This invention relates to evaporative cooling means in a vehicle thermal control subsystem, or the like.

An object of the invention is to adapt a pool boiling principle of heat transfer to the requirements of a vehicle undergoing changing attitudes in use.

Another object of the invention is to provide for cooling as described by reference to a changing condition of the transport fluid and in a manner substantially independent of ambient pressure change as might result from passage of the vehicle through different altitudes.

A further object of the invention is to present a generally new heat transfer system as described, novel in its combination and in its components.

Other objects and structural details of the invention will appear from the following description, when read in connection with the accompanying drawings, wherein:

FIG. 1 is a view in side elevation of evaporative heat transfer means in accordance with the illustrated embodiment of the invention;

FIG. 2 is a view in end elevation of the means of FIG. 1, partly broken away at upper and lower manifold locations.

FIG. 3 is a view in longitudinal section, taken substantially along the line 3--3 of FIG. 2;

FIG. 4 is a fragmentary view in cross-section, taken substantially along the line 4--4 of FIG. 3 and enlarged with respect to FIG. 3;

FIG. 5 is a detail view in longitudinal section of the valve component, taken substantially along the line 5--5 of FIG. 2;

FIG. 6 is a view in cross-section, taken substantially along the line 6--6 of FIG. 5;

FIG. 7 is a view in cross-section taken substantially along the line 7--7 of FIG. 3; and

FIG. 8 is a view in cross-section taken substantially along the line 8--8 of FIG. 5.

Referring to the drawings, heat transfer means in accordance with the illustrated embodiment of the invention comprises a heat exchanger component 9 and a valve component 10 united in a brazing or like operation into a single structural device. The device functions, as noted, to reduce the temperature of a transport fluid circulated in a vehicle thermal control subsystem, the transport fluid having the function of absorbing heat from some heat producing source. The instant device receives the transport fluid in a heated condition, cools it as needed by flowing it in heat transfer relation to an evaporative liquid, and returns it for reuse at the heat producing source.

The heat transfer means provides controls, responsive to the temperature of the transport fluid out of the heat transfer device, to limit the temperature rise thereof to a predetermined high value.

The heat exchanger component 10 is in the illustrated instance of the plate type. It is rectangular in configuration, bounded on two opposing sides by end plates 12 and 13 which may serve as mounting surfaces for the device. In accordance with the concept of a plate type exchanger, between the end plates 12 and 13 are separated flow passes defined by an appropriate arrangement of intermediate plates and spacers. Thus, at opposing side margins of the plate 12, on the underside thereof, are channel shaped spacer members 14. Beneath the spacers 14 is another plate 15 preferably made thinner than the end mounting plates 12 and 13 for better heat conduction. The plate 15 is separated from a like plate 16 by marginal channel shaped spacers 17 which are disposed at ends of the heat exchanger assembly at right angles to the spacer elements 14. The arrangement accordingly is one to provide a space within the heat exchanger assembly between the plates 12 and 15 which is closed along its one side margins by the spacer elements 14 and open at its other side margins or ends, and, further, to define between the plates 15 and 16 a space in the heat exchanger closed at other side margins by the spacer members 17, the arrangement being one to define through passes in adjacent, separated relation to one another. The described arrangement of plates and spacers is continued in superposed alternating relation to define any desired number of flow passes, the plate 13 terminating the series arrangement of flow pass defining plates. The assembly is a fabricated one, with the elements of the heat exchanger being brought to an assembled relation and then joined together in a brazing or like process.

In accordance with the instant inventive concept, the spaces defined by and between spacer elements 14 are utilitarian liquid and gas passages and are each of uniform, intimately contacting relation to the surfaces of adjacent respective plates 12 and 15. The fin strips 23 further define and maintain through the center of the described subassembly a flow pass 24 for the endwise travel of evaporating vapor as will be seen. The side spacer elements 19 hold the subassembly of wicking material and strip in materials in a confined relation. Moreover, they are, as noted, in opposed relation to companion elements 14 and are connected in an abutting relation thereto by the described brazing process. The result is to achieve, between each adjoining pair of spacer elements 14 and 19 a through passage 25.

The assembled plates, spacers, fins and wicking elements comprise the core of the heat exchanger. Two opposing sides thereof are, as noted, bounded by the relatively heavy end plates 12 and 13. Two other opposing sides are bounded by upper and lower manifold tanks 26 and 27 respectively. Upper manifold tank 26 is a hollow recessed article having margins adapted to rest on the upper edges of end plates 12 and 13 and on approximately planar surfaces as established lengthwise of the heat exchanger by the ends of spacer elements 14 and intermediate plates 15 and 16 and spacers 17. A top planar portion 26 of the manifold tank 26 has a through vertical opening 29 therein. The lower manifold tank 27 is constructed like the upper tank 26 and abuts the opposite ends of the end plates 12 and 13, the manifold tanks being suitable secured as by welding, brazing or the like to the heat exchanger core. The lower manifold tank 27 has spaced apart openings to its exterior registering with bosses 31 and 32. Removable plugs 33 and 34 close the respective bosses which provide fill and drain connections for introducing and removing the evaporative liquid. The manifold tanks are thus in enclosing relation to the end of the passes 24 extending through the heat exchanger core. They comprehend also the defined passes 25, both the passes 24 and the passes 25...
being in continuous communication at their opposite ends with respective manifold tanks.

The remaining two opposing sides of the heat exchanger core have superimposed thereon, again by a welding, brazing or like process, a plurality of individual manifolds 35-39. Thus, while the transport fluid might be put through the heat exchanger core in a single pass it is, in the illustrated instance, directed through successive portions of the core in multiple passes. The several manifolds 35-39 are, in accordance with this concept, constructed and arranged to communicate with selected groups of fluid passes 18 in such manner that the fluid may flow through successive groups of fluid passes, moving in a series relation from one to another of the several manifolds at the sides of the core. Manifold 35 constitutes the inlet and communicates with an upper group of fluid passes 18. Fluid received in the manifold 35 thus is directed through a communicating group of passes 18 to the oppositely disposed manifold 36 which communicates with these passes at their opposite ends and also with a next lower group of fluid passes. The manifold 36 thus redirects the flowing fluid through the heat exchanger core by way of a lower group of fluid passes to opposing manifold 37. This action is repeated as the fluid again reverses itself and flows through a lower group of passes to manifold 38 and after again traversing the core finally reaches the last or exit manifold 39. Inlet manifold 35 and outlet manifold 39 are suitably formed with openings receiving respective tubes 41 and 42 whereby the transport fluid is conducted to and away from the heat exchanger.

The valve component 11 comprises a unitary body 43 formed along its one side with a projecting base portion 44. The latter is adapted to rest on and be secured to the planar portion 28 of the upper tank manifold 26 of the heat exchanger component. A through opening 45 in such base registers with the vertical opening 29 in the tank 26 and so communicates the interior of the upper manifold tank to an intermediate interior chamber 46 of the valve component. At one end of chamber 46 is an internal flange wall 47 integral with the body 43 and having a longitudinal through opening 48 therein. Seated in a counterbore in opening 48 and held therein by a snap ring 49 is a bushing 51 forming part of a thermosstatic device 52. The latter is a device of generally known structural and operating characteristics providing a case 53 containing a pellet 54 composed of a material expansible with considerable force when heated. Through appropriate diaphragm means (not shown) the pellet 54 acts on a plunger 55 extending through and beyond bushing 51 into chamber 46 where it is received in a cup-like adapter 56. The thermosstatic device 52 is held in a substantially free mounted projecting fashion by virtue of the confinement of bushing 51 in opening 48, case 53 thereof being disposed in an intermediate location in a chamber 57 of the valve housing. A removable end closure 58 provides for installation and removal of the thermosstatic device in the valve body.

The adapter member 56 provides a mounting for one end of a compression spring 59, the other end of which is seated on an inwardly projecting web 61 of the valve body immediately located in chamber 46. The spring 59 provides a force for returning plunger 55 inward, re-compressing the pellet 54 upon cooling thereof. Extension of plunger 55, responsive to heating of the pellet 54, is effective through adapter 56 upon one end of a valve shaft 62. The latter projects through and is guided in the rib 61 and extends further through an integral spider formation 63 and into and through a coxial body opening 64. At the opposite end of the shaft 62 there is secured thereto a valve 65 having a conical periphery 66 adapted to seat in and close opening 64. Intermediate spider formation 63 and body opening 64 the valve body 43 is formed with an enlarged portion 67 in which is an annular chamber 68, the arrangement being one to place the chamber 68 in approximate surrounding relation to the opening 64. From enlarged portion 67, the valve body projects as a skirt or shroud a substantial distance beyond opening 64 and terminates in a wide mouthed unobstructed mouth opening 69.

A coil spring 72 is interposed between the rib 61 and a retainer 73 made fast on the valve shaft 62 and serves to maintain the valve shaft in contact with the adapter 56 and thereby with the plunger 55 of thermosstatic device 52. Thus, upon extension of the plunger 55 the shaft 62 is moved slightly to adjust valve 65 to an open position relative to opening 64. Upon cooling of the pellet 54 in device 52 the plunger 55 is retracted under the urging of spring 59. A following motion of valve shaft 62 and valve element 65 is constrained by the spring 72 and valve element 65 thereby returned to a seated, closed position in opening 64. The thermosstatic device 52 is, as noted, freely disposed in the valve body chamber 57. This chamber communicates through an opening 74 with one end of the aforementioned tube 42 extending from the exit manifold 39 of the heat exchanger component. Opening 74 is in a laterally disposed boss on valve body 43. On the opposite side of the body is a like boss providing an internally threaded opening 75 communicating with the chamber 57. Opening 75 is thus adapted for cooperation with connecting means to conduct the transport fluid out of body chamber 57 and away from the heat transfer assembly back to the heat source. As indicated in FIG. 7, the thermosstatic device 52 is interposed between openings 74 and 75 in a manner to directly in the path of flow of the transport fluid as it moves through the valve body. As shown more particularly in FIG. 6, annular body chamber 69 is in communication with oppositely disposed body ports or openings 76 and 77. The former is adapted to receive and to be brazed or otherwise securely connected to one end of the tube 41 leading to inlet manifold 35 of the heat exchanger component. Opening 77 is internally threaded and adapted, like opening 75, to be connected in a system conducting the heated transport fluid from the heat source. The heated fluid accordingly reaches the heat transfer device at opening 77 of the valve body, flows through annular chamber 68 and leaves the valve body by way of opening 76 to be directed by tube 41 to the heat exchanger component. The proximity of the heated fluid to body opening 64 results in a rise of the temperature of the transport fluid. The valve body in the vicinity of opening 64 thus is heated relative to other portions of the body.

In the operation of the system, the transport fluid circulates as described in a closed circuit from the heat source to the heat transfer device and back to the heat source. At the heat transfer device the transport fluid flows first through chamber 68 of the valve component 11, raising the temperature of the valve body in the region of opening 64 therein. From the valve component the transport fluid passes by way of tube 41 to inlet manifold 35 of the heat exchanger component. Here it is controlled and directed in its flow to make a plurality of passes through successive groups of passages 18 by way of intermediate disposed manifolds 36 and 37. Ending its passage through the heat exchanger core at exit manifold 39, the transport fluid is then directed by way of tube 42 to the heat source. There it flows through chamber 57, contacting thermosstatic device 52 in the process, and leaves the heat transfer device by way of opening 75 and returns to the heat source.

With respect to the other side or circuit of the heat exchange process, as effected in the heat exchanger component, this circuit is conditioned for operation by admitting a suitable evaporative liquid, such as water, to the heat exchanger core by way of one of the bosses 31 and 32. Liquid is admitted to fill or substantially to fill the manifold tank 27 and communicating areas, these
being, as heretofore seen passes 24 and communicating spaces between the separated pairs of plates 15 and 16. The layers 21 and 22 of wicking material absorb the liquid, being comprised of felt or the like and are saturated thereby. When the layers 21 and 22 have in this manner uniformly been wetted, flow of liquid to the heat exchanger is cut off and the other one of the bosses 31 and 32 opened for an interval to drain off excess liquid.

The layers of wicking material are, as noted, held in intimately contacting relation to adjacent plates defining the flow passageways 18 for the transport fluid. The heat of the flowing transport fluid is conducted through the plates to the wicking material on the opposite sides thereof. Under appropriate temperature and pressure conditions the plate surfaces presented to the wicking material induce boiling of liquid held in the manifold with a consequent release of vapor and cooling of the plate surface. The released vapor may flow endwise through respective layers 21 and 22 of wicking material to the manifolds 26 or 27. The strip fins 23, however, provide an open passageway between adjacent working layers whereby the vapor need travel only through the thickness of the relatively thin layers to reach space 24 whence it may pass without obstruction to either manifold tank 26 or 27. As heretofore seen, the spacer elements 14 and 19 define longitudinal through passageways 25 at the sides of the heat exchanger core interconnecting and intercommunicating the manifold tanks 26 and 27. Hence vapors flowing to lower tank 27 may reverse themselves and return via the open passages 25 to the upper manifold tank 26.

All of the released vapor accordingly collects in manifold tank 26. There it may flow by way of opening 45 in valve body 43 into chamber 46 of the valve body. In the event of valve 65 opening, the vapor then is free to escape from the system by way of opening 64 which thus defines the vapor outlet. Skirt 69 conducts the escaping vapors outwardly, the expansion of the gases being directed to atmosphere or to another location adjacent to the interior of the heat transfer device.

The system is made responsive to the temperature of exiting transport fluid with the view of returning the transport fluid to the heat source at a temperature not exceeding a predetermined high value. The transport fluid reaches the heat transfer device under varying temperature and boiling point conditions, at which time there is no need for cooling. Control of the variable thermal load is accomplished through adjustment of the valve 65 to achieve a modulated vapor pressure control. Thus, cooling is accomplished as described by evaporating liquid at the surfaces of plates 15 and 16. The vapor pressure at the boiling surfaces dictates when boiling, and thus cooling, may occur. Valve 65 obviates a reduction in pressure within the system, due to decreasing ambient pressures, to avoid boiling at temperatures beneath that showing a need for cooling. Should the temperature of the transport fluid show cooling to be not required, valve 65 remains closed and no opportunity for the vapor pressure at the boiling surfaces to drop to a value low enough to permit boiling is afforded. As the temperature of the transport fluid increases, however, the thermostatic device 52 may respond by opening valve 65. An escape route for released vapor accordingly is provided and boiling at boiling point 60 continues under varying thermal conditions, at which time there is no need for cooling. Control of the variable thermal load is accomplished through adjustment of the valve 65 to achieve a modulated vapor pressure control.

Thus, cooling is accomplished as described by evaporating liquid at the surfaces of plates 15 and 16. The vapor pressure at the boiling surfaces dictates when boiling, and thus cooling, may occur. Valve 65 obviates a reduction in pressure within the system, due to decreasing ambient pressures, to avoid boiling at temperatures beneath that showing a need for cooling. Should the temperature of the transport fluid show cooling to be not required, valve 65 remains closed and no opportunity for the vapor pressure at the boiling surfaces to drop to a value low enough to permit boiling is afforded. As the temperature of the transport fluid increases, however, the thermostatic device 52 may respond by opening valve 65. An escape route for released vapor accordingly is provided and boiling at boiling point 60 continues under varying thermal conditions, at which time there is no need for cooling. Control of the variable thermal load is accomplished through adjustment of the valve 65 to achieve a modulated vapor pressure control.
a fluid passageway, means for flowing a heated fluid through said passageways, said material being external to said fluid passageways, liquid saturable wicking material interposed between separated pairs of plates and occupying less than the full space thereof, a fluid passageway for vapor from said interposed saturable material, the vapor flowing through open area between adjacent passageways to either manifold, means for conducting vapor from one of said manifolds to the other, and a valve communicating with and controlling the escape of vapor from said other manifold.

3. In a system for controlled pool boiling in a thermal control system, including means presenting a heat transfer surface, means for flowing a heated fluid over said surface, a saturable material contacting said heat transfer surface in separate relation to said heated fluid, said surface when heated to a boiling temperature by said heated fluid effecting a release of vapor from said saturable material, manifold means for collecting vapor released from said manifold means, for controlling escape of vapor from said manifold means including a body having an outlet opening through which said vapor escapes upon escape from said manifold means, and a passageway for conducting the heated fluid to said heat transfer surface by way of said body including a chamber in said body in surrounding relation to said outlet opening therein to heat the area of the body adjacent to said outlet opening.

4. A method according to claim 3, characterized by a passageway for conducting the heated fluid away from said heat transfer surface by way of said body, and, further, by a thermostat in said body sensing the temperature of said fluid in said last mentioned passageway and by a valve controlling vapor flow through said outlet opening and adjusted by and under control of said thermostat to opened and closed positions.

5. A heat exchanger for use in pool boiling in a thermal control system, including means presenting a heat transfer surface, a heated fluid being brought to the heat exchanger and conducted over said heat transfer surface, a layer of liquid saturable wicking material in contact with said heat transfer surface in separate relation to said fluid, vapor being released from said saturable material when the temperature of said heat transfer surface rises to a boiling point, manifold means for collecting released vapor, and separate means holding said saturable material to said heat transfer surface and defining a relatively open passageway for released vapor to said manifold means.

6. A plate type heat exchanger for use in pool boiling in a thermal control system, including separated pairs of plates, the space between each pair of plates providing a fluid passageway from one side to another of the heat exchanger, an assembly between adjacent plates of including first and second layers of liquid saturable wicking material and an intermediate corrugated strip fin, said fin holding said layers of material against respective adjoining plate surfaces and defining a passageway through said heat exchanger in transverse relation to said fluid passageway for flow of vapor released from said saturable material by heat transfer through said plates, and side mounted manifold means collecting the released vapor.

7. A plate type heat exchanger for use in pool boiling in a thermal control system, including an assembly of superposed separated rectangular plates, first and second marginal spacer means in alternating relation between said plates and in transverse relation to one another to define alternating fluid passageways through said assembly of plates in relatively transverse disposed sets, means for flowing a heated fluid through one set of said fluid passageways, a saturable material disposed in the flow passes of the other set, and manifold means on opposing sides of said assembly of plates receiving vapor released from said saturable material, one of said first and second marginal spacer means being constructed as tubular conduits to conduct released vapor from manifold means on one side of the assembly to manifold means on the opposing side.

8. A plate type heat exchanger according to claim 7, characterized in that at least some of the flow passes of said other set have an assembly therein comprising layers of liquid saturable material in contact with respective opposing plate surfaces and further comprising a corrugated fin strip of non-saturable material interposed between said layers and defining an intermediate passage way for flow of the released vapor to said manifold means.

9. In a pool boiling thermal control system adapted for the cooling of a circulated transport fluid, said system including evaporative heat transfer means, valve means comprising a body having a first passage therethrough for the heated fluid as it flows to said heat transfer means, a second passage therethrough for the same said fluid as it flows from said heat transfer means and a third passage therethrough for vapor released from said heat transfer means said third passage terminating in an outlet opening through which the vapor expands to the exterior of the system, said first passage passing through said body in such proximate relation to said outlet opening as to add heat to the body at the location of said outlet opening, and a thermostat in said second passageway connected to said valve for adjustment thereof in accordance with the temperature of the fluid upon leaving said heat transfer means.

10. In a pool boiling thermal control system adapted for the cooling of a circulated transport fluid, said system including an evaporative heat transfer means; valve means comprising a body having an inlet and an outlet for heated fluid to flow therethrough to said heat transfer means and said body further having an inlet for receiving vapor released from said heat transfer means and an outlet opening through which the released vapor may escape to the exterior of the system, a passageway in said body conducting the heated fluid from the said first mentioned inlet to the said first mentioned outlet in such proximate relation to said outlet opening as to add heat to the body at the location of said last mentioned outlet opening whereby to heat the body at the location of said last mentioned outlet opening, and a valve controlling escape of the released vapor through said outlet opening.

11. In a pool boiling thermal control system adapted for the cooling of a circulated transport fluid, said system including an evaporative heat transfer means; valve means comprising a body having an inlet for receiving vapor released from said heat transfer means and having an outlet opening through which the released vapor expands to the exterior of the system, a valve controlling escape of the vapor through said outlet opening, and a passageway through said valve body for conducting heated fluid to said heat transfer means, said passageway being arranged relative to said outlet opening to heat the body at the location of such opening.

12. Valve means according to claim 11, characterized in that said passageway comprises an annular chamber in surrounding adjacent relation to said outlet opening.

13. In a pool boiling thermal control system adapted for the cooling of a circulated transport fluid, said system including an evaporative heat transfer means; valve means comprising a body having an inlet in closed communication with the vapor side of said heat transfer means and having further an outlet opening through which released vapor may expand to the exterior of the system for closing said outlet opening and which when closed substantially obviates boiling in said heat transfer means, said body providing a through flow passage for transport fluid leaving said heat transfer means, and a thermostat in said passage for opening said valve upon a predetermined rise in temperature of the fluid in said passage.
9. A valve means according to claim 14, characterized by a small diameter opening in said valve obviating distortion or misoperation of the system due to excessive pressure differences.

10. In a system for controlled pool boiling in a thermal control system, said system operating in variable pressure ambient conditions, a heat exchanger including separated closed circuits in which liquid is evaporated on boiling surfaces exposed to a flowing transport fluid, means for continuously wetting said boiling surfaces with a liquid, manifold means enclosing the evaporating liquid circuit and defining an outlet for the restricted escape of released liquid vapor, and means for controlling flow through said outlet to initiate and discontinue boiling at said boiling surfaces as a function of vapor pressure at said surfaces.

11. A system according to claim 16, characterized by means responding to the temperature of said transport fluid for operating said last named control means to inhibit opening of said outlet at temperature values under a predetermined value.

12. In a system for controlled pool boiling in a thermal control system, said system operating in variable pressure ambient conditions, including a heat exchanger having separated closed circuits in which liquid is evaporated on boiling surfaces exposed to a flowing transport fluid, means for continuously wetting said boiling surfaces with a liquid, manifold means enclosing the evaporating liquid circuit and defining an outlet for the restricted escape of released liquid vapor, and means achieving a modulated control of flow through said outlet by reference to the temperature of said transport fluid whereby to utilize the vapor pressure at the boiling surfaces as a means suppressing boiling at said boiling surfaces at temperatures of said transport fluid below a predetermined value.

13. A system evaporating liquid to low ambient pressures, including a heat exchanger providing separated circuits in which liquid is evaporated on boiling surfaces exposed to a flowing heated transport fluid, manifold means collecting the released liquid vapor, a valve unit having an inlet communicating with said manifold means to receive the released liquid vapor therefrom, said unit having an outlet for restricted escape to ambient surroundings of the released vapor, a valve for controlling flow through said outlet to initiate and discontinue boiling at said boiling surfaces as a function of vapor pressure at said surfaces, and means bringing the transport fluid to said heat exchanger by way of said valve unit and in such proximate relation to said outlet wherein to heat the unit at the location of said outlet.

14. A system evaporating liquid to low ambient pressures, including a heat exchanger providing separated circuits in which liquid is evaporated on boiling surfaces exposed to a flowing heated transport fluid, a valve unit having a restricted outlet, means for bringing vapor released from the liquid circuit to said valve unit for escape to ambient surroundings through said outlet, and means bringing the transport fluid to said heat exchanger by way of said valve unit and in such proximate relation to said outlet wherein to heat the unit at the location of said outlet.

15. A system evaporating liquid to low ambient pressures, including a heat exchanger providing at least a pair of separated flow passages for a heated fluid, a liquid saturated wicking material occupying part of the space between said pair of flow passages, separate means in the balance of such open flow path means for escape of released vapor, a manifold communicating with said flow path means and collecting released vapor, and means for controlling escape of released vapor from said manifold by reference to the temperatures of said heated fluid.

16. A system according to claim 21, characterized by a flow passage arranged to utilize the heat of said heated fluid to inhibit icing at the location of said last named means as released vapor expands to the low pressure ambient surroundings.

17. A plate-type heat exchanger for use in controlled liquid boiling in a thermal control system, including separated pairs of plates, the space between each pair of plates providing a fluid passageway from one side to another of the heat exchanger, an assembly between adjacent pairs of plates including first and second layers of saturable wicking material and an intermediate corrugated strip fin, said fin holding said layers of material against respective adjoining plate surfaces and defining a passageway through said heat exchanger in transverse relation to said fluid passageway for flow of vapor released from said saturable material by heat transfer through said plates, the released vapor being free to flow in either direction through said transversely defined passageway, manifold means on each side of the heat exchanger receiving the released vapor, means interconnecting said manifold means, one of said manifold means being closed, and means effecting a controlled communication of the other manifold means with ambient surroundings.

18. A heat exchanger according to claim 23, characterized by means for admitting liquid to the said manifold means for saturating said wicking material.

19. In a thermal control system as described, a heat exchanger including means for defining spaced vapor passages for heated fluid, a layer of saturable wicking material disposed between said flow paths in heat transfer relation thereto, the space between said paths receiving said wicking material being open at opposite ends, said manifold at each of said opposite ends in closing relation to said space, means for admitting liquid to one of said manifolds for wetting said saturable material, said layer of saturable material having one edge continuously exposed to liquid in said one manifold, said manifold material by capillary action from said one edge, the other manifold collecting vapor released from said material by heat absorbed from said fluid, and means for controlling escape of released vapor from said other manifold.

20. A system for controlled pool boiling in a thermal control system, including means presenting heat transfer surface, means for flowing a heated fluid over said surface, a liquid saturated wicking material contacting said heat transfer surface in separated relation to said heated fluid, said surface being continuously wetted by said material, closed manifold means in enclosing relation to said material, the interior of said manifold means being unconnected to any pressure source but having restricting communication with ambient surroundings, said manifold means collecting vapor released from said material, and means for suppressing boiling of the liquid in said manifold means as boiling vapor expands to the low pressure ambient surroundings.
material on said surface which is a function of decreasing ambient pressure.

29. A system evaporating liquid to ambient surroundings, including a heat transfer surface, means for flowing a heated fluid over said surface on one side thereof, a liquid saturated wicking material contacting said heat transfer surface on the other side thereof, said other side of said surface being continuously wetted by said material, liquid in said material boiling on said surface under the influence of conducted heat, and means for suppressing boiling of the liquid in said material on said surface which is a function of decreasing ambient pressure rather than of rising temperature.

30. A system evaporating liquid on a heat transfer surface, including a heat exchanger providing a passage for fluid being cooled on one side of said surface and a place in adjacent non-communicating relation to said passage for storing a liquid, said place occupying a through space in said heat exchanger, a flat pad of saturable wicking material in said space having one side thereof in a covering contacting relation to said heat transfer surface, said pad having a thickness less than the width of said space, and corrugated fin material in a portion of said space outwardly of said pad holding said pad to said heat transfer surface and defining escape passages into which vapor is released over the entire surface of the other side of said pad, said passages extending from said space to conduct released vapors out of the heat exchanger.

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