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ANTIFREEZE SYSTEM FOR FLUID LINES

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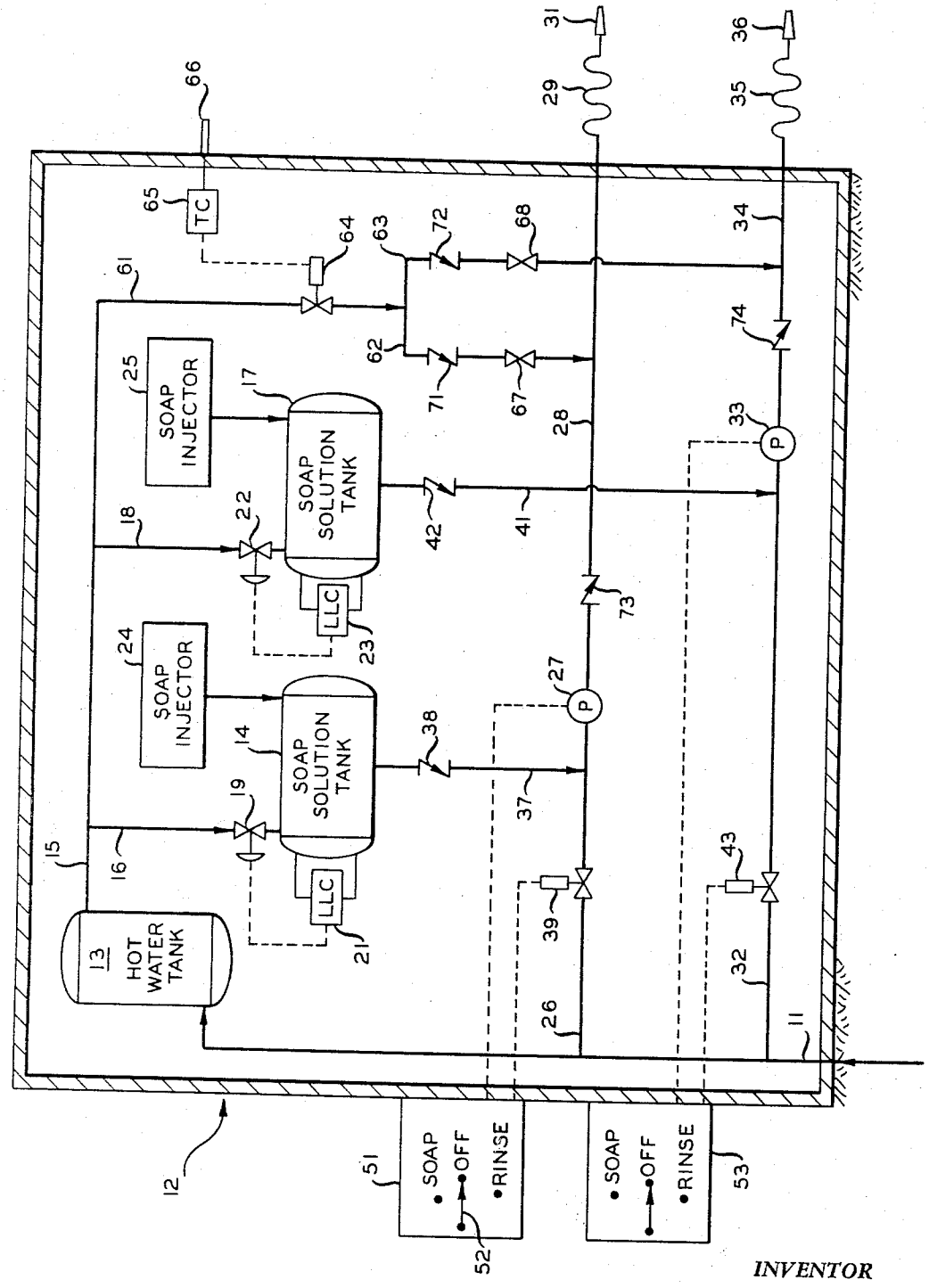

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ANTIFREEZE SYSTEM FOR FLUID LINES

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This invention relates to fluid systems and in particular to means for the prevention of freezing of fluid within pipelines.

In recent years automatic car wash installations have become popular throughout the United States. However, one problem encountered with such systems is the freezing of the water in the lines exposed to the atmosphere during periods of cold weather. As many of these installations are operated by the customers and do not have an attendant, it is very difficult, if not impossible, to completely drain such lines after each use. Yet, in order to enhance customer appeal, it is desirable that the installations be available for use twenty-four hours each day. Furthermore, one of the greatest periods of demand is the first warm day following a severe cold spell.

In accordance with the invention it has been discovered that the freezing of the water in the exposed lines can be avoided through the utilization of a simple and inexpensive system comprising a source of hot water, means for determining atmospheric temperature, conduit means connecting the source of hot water to the exposed lines, valve means in said conduit means, and means for actuating the valve means responsive to the output of the temperature determining means. In a presently preferred embodiment utilizing a plurality of exposed pipelines, the conduit means comprises a plurality of branch conduits, each connecting the output of the valve means to the respective exposed pipeline, and each branch conduit containing a check valve means to permit the operation of one or more of the pipelines while connecting the remainder to the antifreeze system.

Accordingly, it is an object of the invention to prevent the freezing of fluid within pipelines or conduits. Another object of the invention is to provide for an automatic antifreeze system. A further object of the invention is to provide a simple and inexpensive means for preventing the freezing of fluid in conduits. Another object of the invention is to provide means for automatically injecting, during freezing conditions, hot water into a pipe when the pipe is not being used and discontinuing such injection when the pipe is being used. A still further object of the invention is to provide a simple and inexpensive system for independently providing antifreeze protection for a plurality of conduits.

Other objects, aspects and advantages of the invention will be apparent to those skilled in the art from a study of the disclosure, the accompanying drawing, and the appended claims.

Referring now to the drawing, there is illustrated a schematic representation of a presently preferred embodiment of the invention. Conduit **11**, which has its inlet connected to a suitable source of fluid such as a city water main, passes through the floor of housing **12** and is connected to the inlet of hot water tank **13**. Tank **13** is provided with any suitable means for heating the water contained therein to the desired temperature, which can be, for example, on the order of 180° F. The hot water outlet of tank **13** is connected to the water inlet of soap solution tank **14** by way of conduits **15** and **16**, and to the water inlet of soap solution tank **17** by way of conduits **15** and **18**. Conduit **16** contains valve means **19** operatively positioned therein. Valve means **19** is actuated by suitable liquid level control means **21** responsive to the liquid level in tank **14** to regulate the flow of hot water

to tank **14** to maintain the liquid level in tank **14** substantially constant. Similarly, conduit **18** contains a valve means **22** which is actuated by liquid level controller **23** responsive to the liquid level in tank **17** to maintain such liquid level substantially constant at a desired value. Controllers **21** and **23** and valves **19** and **22** can be any suitable means known in the art. For example, valves **19** and **22** can be pneumatically actuated diaphragm valves and controllers **21** and **23** can be pneumatic controllers. Valves **19** and **22** can be solenoid valves and controllers **21** and **23** can be liquid level sensors having an electrical output. However, for purposes of simplicity and cost, it is presently preferred that a mechanical float valve be utilized for each combination of liquid level controller and valve. Tanks **14** and **17** are provided with soap injectors **24** and **25**, respectively, for the introduction of concentrated soap into the respective soap solution tank.

Conduit **26** is connected between supply conduit **11** and the inlet of pump **27**. Conduit **28** is connected to the outlet of pump **27** and passes through the wall of housing **12** to connect with the inlet of flexible hose **29** having a spray nozzle **31** on the outlet end thereof. Conduit **32** is connected between supply conduit **11** and the inlet of pump **33**. Conduit **34** is connected to the outlet of pump **33** and passes through the wall of housing **12** to connect with the inlet of flexible hose **35** having a spray nozzle **36** on the outlet end thereof.

Conduit **37** having a check valve **38** operatively positioned therein is connected between soap solution tank **14** and the inlet of pump **27**. Valve **38** passes fluid from tank **14** into conduit **26**, but prevents flow in the opposite direction. Valve **38** is preferably biased to open only on a greater pressure than that produced by the hydraulic pressure due to gravity of the fluid in conduit **37** and tank **14**. Solenoid valve **39** is operatively positioned in conduit **26** upstream of the connection with conduit **37**. Similarly, conduit **41** having a check valve **42** operatively positioned therein connects tank **17** to the inlet of pump **33**. Valve **42** is also preferably biased to require an opening pressure greater than the hydraulic force exerted by the fluid in tank **17** and conduit **41** upstream of valve **42**. Solenoid valve **43** is positioned in conduit **32** upstream of the connection with conduit **41**.

When it is desired to utilize the spray **31**, wash control means **51** is actuated in any suitable manner known in the art. When switch **52** is set to soap, normally closed valve **39** remains unactuated while pump **27** is selectively energized. Pump **27** pulls a suction on the downstream side of valve **38**, overcoming the bias and opening valve **38** to pass the soap solution from tank **14** through conduit **28** and hose **29** to spray **31**. When rinse water is desired, switch **52** is moved to the rinse position, causing valve **39** to be opened. The pressure of the water in supply conduit **11** is sufficient to cause check valve **38** to close. The water from supply conduit **11** passes through conduit **26**, pump **27**, conduit **28**, and hose **29** to spray **31**. Wash control **53** actuates valve **43** and pump **33** in a similar manner.

Conduit **61** is connected between conduit **15** and the inlets of conduits **62** and **63**. The outlet end of conduit **62** is connected to conduit **28** at a point upstream of the portion of conduit **28** which is exposed to freezing conditions. The outlet end of condiut **63** is connected to conduit **34** at a point upstream of the portion of conduit **34** which is exposed to freezing conditions. Solenoid valve **64** is operatively connected in conduit **61** and is actuated by temperature controller **65** responsive to the atmospheric temperature as indicated by temperature sensor **66**. When the temperature drops to freezing, controller **65** opens valve **64** to permit hot water from tank

13 to flow through conduits 28 and 34 and hoses 29 and 35. Set valves 67 and 68 can be operatively positioned in conduits 62 and 63, respectively, to provide a regulation of the flow rate of hot water through the respective conduits. This flow rate of hot water can be any desired value, for example in the range of 0.001 to 10 gallons per hour. In general, the particular flow rate utilized will depend upon the temperature of the water in line 61, the expected atmospheric temperature and the type and size of conduits 28 and 34 and hoses 29 and 35. While valve 64 is preferably an on-off solenoid valve, it is within the contemplation of this invention to utilize a variable position valve to vary the flow rate of hot water through the antifreeze system responsive to variation in atmospheric temperature.

In order to provide for a flow of hot water from conduit 61 through the one of hoses 29 and 35 not being used while the other is in use, check valves 71 and 72 are operatively positioned in conduits 62 and 63, respectively. Check valve 71 permits hot water from conduit 61 to enter conduit 28 when pump 27 is not in operation, but stops this flow of hot water when pump 27 is actuated. Similarly, valve 72 permits hot water from conduit 61 to enter conduit 34 when pump 33 is not in operation and closes upon the actuation of pump 33. Check valves 73 and 74 can be provided in conduits 28 and 34, upstream of the connections with conduits 62 and 63, respectively.

While only two hoses 29 and 35 have been illustrated for purposes of simplicity, any desired number of hoses can be utilized in the system of the present invention. A plurality of branch conduits, such as 62, 63, corresponding in number to the number of hoses, can be employed. While valves 39, 43 and 64 have been illustrated as solenoid valves, it is within the contemplation of the invention to utilize any suitable type of valve means known in the art.

In one particular embodiment of the invention water was supplied to conduit 11 at 75 p.s.i.g. Pumps 27 and 33 were utilized to maintain a hydraulic pressure of 500 p.s.i.g. in conduits 28 and 34, during operation of sprays 31 and 36, respectively. The water in tank 13 was heated to 180° F. Check valves 38 and 42 were spring biased to remain closed when the respective pump was not in operation, and to open under the positive differential caused by the suction when the respective pump was actuated and the respective one of valves 39 and 43 was closed, annd to close when the respective one of valves 39 and 43 was opened. Set valves 67 and 68 were adjusted to provide for flow rates through each of conduits 62 and 63 of approximately two gallons per hour of hot water from tank 13. Controller 65 was set to open 110-volt on-off solenoid valve 64 whenever the temperature indicated by sensor 66 was at or below 32° F. Valves 71, 72, 73 and 74 were swing check valves. This system provided effective anti-freeze protection while being simple and relatively inexpensive.

Reasonable variations and modifications are possible within the scope of the foregoing disclosure, the drawing and the appended claims to the invention.

I claim:

1. Apparatus for preventing the freezing of a fluid within a wash system comprising a supply conduit having its inlet end in fluid communication with a source of water, water heating means having a fluid inlet in fluid communication with an outlet of said supply conduit, a plurality of pumps, means for selectively actuating said pumps, a plurality of first conduit means connected in fluid communication between said supply conduit and the fluid inlet of the respective pump, a plurality of second conduit means having the downstream portions thereof subject to being exposed to freezing conditions and having the inlet end connected to the fluid outlet of the respective one of said plurality of pumps, a plurality of spray nozzles each of which is connected on the outlet end of a respective one of said second conduit means, a plurality of soap solution tanks, a plurality of third conduit means having the inlet ends thereof connected in fluid communication with a hot fluid outlet of said heating means and the outlet ends connected to the respective soap solution tank, first valve means operatively positioned in each of said third conduit means to regulate the flow rate of water therethrough responsive to the liquid level in the respective soap solution tank, a plurality of fourth conduit means connected in fluid communication between the respective soap solution tank and the fluid inlet of the respective pump, second valve means operatively positioned in each of said first conduit means, means for selectively actuating said second valve means, check valve means connected in each of said fourth conduit means to permit flow of soap solution from the respective tank through the fourth conduit means and to prevent flow of water from the fourth conduit means into the respective tank, each of said check valve means being spring biased to maintain the check valve shut when either the respective pump is off or the respective second valve means is open and to open the check valve when both the respective pump is actuated and the respective second valve means is closed, a fifth conduit means having its inlet end in fluid communication with at hot water outlet of said heating means, a plurality of branch conduit means connected in fluid communication between said fifth conduit means and a respective one of said plurality of second conduit means at a point upstream of the portion subject to exposure to freezing conditions, check valve means located in each of said branch conduit means to permit the flow of hot water from said fifth conduit means into the respective one of said plurality of second conduit means and to prevent fluid flow in the opposite direction, set valve means located in each of said branch conduit means for the adjustment of the flow rate of water therethrough, on-off solenoid valve means located in said fifth conduit means, means for sensing the temperature to which the downstream portions of said second conduit means are subjected, and means connected to said means for sensing and said solenoid valve means for actuating said solenoid valve means responsive to the thus sensed temperature to open said solenoid valve when the sensed temperature drops below a predetermined value and to close said solenoid valve when the sensed temperature is above a predetermined value.

2. Apparatus for preventing the freezing of a fluid within a fluid system comprising a supply conduit having its inlet end in fluid communication with a source of fluid, fluid heating means having a fluid inlet in fluid communication with an outlet of said supply conduit, a plurality of pumps, means for selectively actuating said pumps, a plurality of first conduit means connected in fluid communication between said supply conduit and the fluid inlet of the respective pump, a plurality of second conduit means having the downstream portions thereof subject to being exposed to freezing conditions and having the inlet ends connected to the fluid outlet of the respective one of said plurality of pumps, a plurality of tanks, a plurality of third conduit means having the inlet ends thereof connected in fluid communication with a hot fluid outlet of said fluid heating means and the outlet ends connected to the respective tank, first valve means operatively positioned in each of said third conduit means to regulate the flow rate of fluid therethrough responsive to the liquid level in the respective tank, a plurality of fourth conduit means connected in fluid communication between the respective tank and the fluid inlet of the respective pump, second valve means operatively positioned in each of said first conduit means, means for selectively actuating said second valve means, check valve means connected in each of said fourth conduit means to permit flow of fluid from the respective

tank through the fourth conduit means and to prevent flow of fluid from the fourth conduit means into the respective tank, each of said check valve means being spring biased to maintain the check valve shut when the respective pump is off or the respective second valve means is open and to open the check valve when the respective pump is actuated and the respective second valve means is closed, a fifth conduit means having its inlet end in fluid communication with a hot fluid outlet of said fluid heating means, a plurality of branch conduit means connected in fluid communication between said fifth conduit means and a respective one of said plurality of second conduit means at a point upstream of the portion subject to exposure to freezing conditions, check valve means located in each of said branch conduit means to permit the flow of hot fluid from said fifth conduit means into the respective one of said plurality of second conduit means and to prevent fluid flow in the opposite direction, set valve means located in each of said branch conduit means for the adjustment of the fluid flow rate therethrough, solenoid valve means located in said fifth conduit means, means for sensing the temperature to which the downstream portions of said second conduit means are subjected, and means connected to said means for sensing and said solenoid valve means for actuating said solenoid valve means responsive to the thus sensed temperature.

3. Apparatus for preventing the freezing of a fluid within a fluid system comprising a supply conduit having its inlet end in fluid communication with a source of fluid, fluid heating means having a fluid inlet in fluid communication with an outlet of said supply conduit, a plurality of pumps, means for selectively actuating said pumps, a plurality of first conduit means connected in fluid communication between said supply conduit and the fluid inlet of the respective pump, a plurality of second conduit means having the downstream portions thereof subject to being exposed to freezing conditions and having the inlet ends connected to the fluid outlet of the respective one of said plurality of pumps, first valve means operatively positioned in each of said first conduit means, means for selectively actuating said first valve means, a third conduit means having its inlet end in fluid communication with a hot fluid outlet of said fluid heating means, a plurality of branch conduit means connected in fluid communication between said third conduit means and the respective one of said plurality of second conduit means at a point upstream of the portion subject to exposure to freezing conditions, check valve means located in each of said branch conduit means to permit the flow of hot fluid from said third conduit means into the respective one of said plurality of second conduit means and to prevent fluid flow in the opposite direction, set valve means located in each of said branch conduit means for the adjustment of the fluid flow rate therethrough, on-off solenoid valve means located in said third conduit means, means for sensing the temperature to which the downstream portions of said second conduit means are subjected, and means connected to said means for sensing and said solenoid valve means for actuating said solenoid valve means responsive to the thus sensed temperature to open said solenoid valve when the sensed temperature is below a predetermined value and to close said solenoid valve when the sensed temperature is above a predetermined value.

4. Apparatus for preventing the freezing of a fluid within a wash system comprising a supply conduit having its inlet end in fluid communication with a source of water, heating means having a fluid inlet in fluid communication with an outlet of said supply conduit, a plurality of pumps, means for selectively actuating said pumps, a plurality of first conduit means connected in fluid communication between said supply conduit and the fluid inlet of the respective pump, a plurality of second conduit means having the downstream portions thereof subject to being exposed to freezing conditions and having the inlet ends connected to the fluid outlet of the respective one of said plurality of pumps, a plurality of spray nozzles each of which is connected on the outlet end of a respective one of said sensed conduit means, first valve means operatively positioned in each of said first conduit means, means for selectively actuating said first valve means, a third conduit means having its inlet end in fluid communication with a hot fluid outlet of said fluid heating means, a plurality of branch conduit means connected in fluid communication between said third conduit means and the respective one of said plurality of second conduit means at a point upstream of the portion subject to exposure to freezing conditions, check valve means located in each of said branch conduit means to permit the flow of hot water from said third conduit means into the respective one of said plurality of second conduit means and to prevent fluid flow in the opposite direction, set valve means located in each of said branch conduit means for the adjustment of the flow rate of hot water therethrough, on-off solenoid valve means located in said third conduit means, means for sensing the temperature to which the downstream portions of said second conduit means are subjected, and means connected to said means for sensing and said solenoid valve means for actuating said solenoid valve means responsive to the thus sensed temperature to open said solenoid valve when the sensed temperature is below a predetermined value and to close said solenoid valve when the sensed temperature is above a predetermined value.

5. Apparatus for preventing the freezing of a fluid within a fluid system comprising a supply conduit having its inlet end in fluid communication with a source of fluid, fluid heating means having a fluid inlet in fluid communication with an outlet of said supply conduit, a plurality of pumps, means for selectively actuating said pumps, a plurality of first conduit means connected in fluid communication between said supply conduit and the fluid inlet of the respective pump, a plurality of second conduit means having the downstream portions thereof subject to being exposed to freezing conditions and having the inlet ends connected to the fluid outlet of the respective one of said plurality of pumps, third conduit means having its inlet end in fluid communication with a hot fluid outlet of said fluid heating means, a plurality of branch conduit means connected in fluid communication between said third conduit means and the respective one of said plurality of second conduit means at a point upstream of the portion subject to exposure to freezing conditions, check valve means located in each of said branch conduit means to permit the flow of hot fluid from said third conduit means into the respective one of said plurality of second conduit means and to prevent fluid flow in the opposite direction, second valve means located in said third conduit means, means for sensing the temperature to which the downstream portions of said second conduit means are subjected, and means connected to said means for sensing and said second valve means for actuating said second valve means responsive to the thus sensed temperature.

6. Apparatus for preventing the freezing of a fluid within a fluid system comprising a supply conduit having its inlet end in fluid communication with a source of fluid, fluid heating means having a fluid inlet in fluid communication with an outlet of said supply conduit, a pump, means for actuating said pump, a first conduit means connected in fluid communication between said supply conduit and the fluid inlet of said pump, a second conduit means having the downstream portion thereof subject to being exposed to freezing conditions and having the inlet end connected to the fluid outlet of said pump, third conduit means having its inlet end in fluid communication with a hot fluid outlet of said fluid heating means and its outlet end connected in fluid communi-

cation with said second conduit means at a point upstream of the portion subject to exposure to freezing conditions, valve means located in said third conduit means, means for sensing the temperature to which the downstream portions of said second conduit means are subjected, and means connected to said means for sensing and said valve means for actuating said valve means responsive to the thus sensed temperature.

7. Apparatus for preventing the freezing of a fluid within a fluid system comprising a supply conduit having its inlet end in fluid communication with a source of fluid, fluid heating means having a fluid inlet in fluid communication with an outlet of said supply conduit, a plurality of pumps, means for actuating said pumps, a plurality of first conduit means connected in fluid communication between said supply conduit and the fluid inlet of the respective pump, a plurality of second conduit means having the downstream portions thereof subject to being exposed to freezing conditions and having the inlet ends connected to the fluid outlet of the respective one of said plurality of pumps, a plurality of tanks, a plurality of third conduit means having the inlet ends thereof connected in fluid communication with a hot fluid outlet of said fluid heating means and the outlet ends connected to the respective tank, a plurality of forth conduit means connected in fluid communication between the respective tank and the fluid inlet of the respective pump, first valve means operatively positioned in each of said first conduit means, means for actuating said first valve means, second valve means connected in each of said fourth conduit means to permit flow of fluid from the respective tank through the fourth conduit means and to prevent flow of fluid from the fourth conduit means into the respective tank, a fifth conduit means having its inlet end in fluid communication with a hot fluid outlet of said fluid heating means, a plurality of branch conduit means connected in fluid communication between said fifth conduit means and a respective one of said plurality of second conduit means at a point upstream of the portion subject to exposure to freezing conditions, third valve means located in each of said branch conduit means to permit the flow of hot fluid, fourth valve means located in said fifth conduit means, means for sensing the temperature to which the downstream portions of said second conduit means are subjected, and means connected to said means for sensing and said fourth valve means for actuating said fourth valve means responsive to the thus sensed temperature.

8. Apparatus for preventing the freezing of a fluid within a fluid system comprising a supply conduit having its inlet end in fluid communication with a source of fluid, fluid heating means having a fluid inlet in fluid communication with an outlet of said supply conduit, a pump, means for actuating said pump, a first conduit means connected in fluid communication between said supply conduit and the fluid inlet of said pump, a second conduit means having the downstream portion thereof subject to being exposed to freezing conditions and having the inlet end connected to the fluid outlet of said pump, a tank, a third conduit means having the inlet end thereof connected in fluid communication with a hot fluid outlet of said fluid heating means and the outlet end connected to said tank, a fourth conduit means connected in fluid communication between said tank and the fluid inlet of said pump, first valve means operatively positioned in said first conduit means, means for actuating said first valve means, second valve means connected in said fourth conduit means to permit flow of fluid from said tank through the fourth conduit means and to prevent flow of fluid from the fourth conduit means into said tank, a fifth conduit means having its inlet end in fluid communication with a hot fluid outlet of said fluid heating means and its outlet end connected in fluid communication with said second conduit means at a point upstream of the portion subject to exposure to freezing conditions, third valve means located in said fifth conduit means, means for sensing the temperature to which the downstream portion of said second conduit means is subjected, and means connected to said means for sensing and said third valve means for actuating said third valve means responsive to the thus sensed temperature.

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