DESCRIPTION

TITLE OF INVENTION

Fire Extinguishing System and Method for Manufacturing Same

TECHNICAL FIELD

[0001] The present invention relates to a fire extinguishing system and a method for manufacturing the same.

BACKGROUND ART

[0002] A conventional wet sprinkler is disclosed in Patent No. 3264939.

CITATION LIST

PATENT LITERATURE

[0003] PTL 1: Patent No. 3264939

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0004] A conventional sprinkler system has a problem that water is discharged from a sprinkler head when the sprinkler head fails.

SOLUTION TO PROBLEM

[0005] A fire extinguishing system according to one aspect is provided in a first area and a second area different from the first area, the fire extinguishing system including a negative pressure sprinkler system provided in the first area, and an atmospheric pressure or pressurized sprinkler system provided in the second area.

[0006] In the fire extinguishing system configured as described above, a sprinkler system of a necessary type can be provided at a necessary place.

[0007] The atmospheric pressure or pressurized sprinkler system in the second area includes a sprinkler head, and the sprinkler head includes a metal inside that melts with heat of a fire to cause water to be discharged from the sprinkler head without a signal from a sensor.

[0008] In the fire extinguishing system configured as described above, the atmospheric pressure or pressurized sprinkler system in the second area is not interlocked with the

sensor, and thus the water in the secondary pipe is discharged from the sprinkler head when the metal of the sprinkler head melts with the heat of the fire. This system eliminates the need for cooperative control of the first area and the second area, and can be achieved at low cost. An introduction cost is reduced.

[0009] A method for manufacturing the fire extinguishing system includes providing an atmospheric pressure or pressurized sprinkler system in the first area, identifying a water leakage spot of a sprinkler pipe of the atmospheric pressure or pressurized sprinkler system, attaching a repair material to an outside of the sprinkler pipe to close the water leakage spot, and then connecting a negative pressure pump to the sprinkler pipe to constitute the negative pressure sprinkler system.

[0010] In the method for manufacturing the fire extinguishing system configured as described above, the negative pressure sprinkler system can be configured by repairing the sprinkler system in the first area. As a result, the negative pressure sprinkler system can be manufactured at low cost.

BRIEF DESCRIPTION OF DRAWINGS

[0011] Fig. 1 is a diagram for describing a method for manufacturing a fire extinguishing system.

Fig. 2 is a schematic diagram of the fire extinguishing system before repair.

Fig. 3 is a schematic diagram of the fire extinguishing system after repair.

Fig. 4 is an enlarged sectional view of a water leakage spot, illustrating a section surrounded by IV in Figs. 3 and 5.

Fig. 5 is a schematic view of a fire extinguishing system according to another aspect.

DESCRIPTION OF EMBODIMENTS

[0012] Hereinafter, an embodiment of the present invention will be described with reference to the drawings.

(Method for manufacturing fire extinguishing system)

Fig. 1 is a diagram for describing a method for manufacturing a fire extinguishing system. As shown in Fig. 1, in the method for manufacturing the fire

extinguishing system, a leakage of fluid from a secondary pipe of a sprinkler system is identified (step S301). The sprinkler system is a sprinkler system in which the secondary pipe does not have a negative pressure. The sprinkler system may be a wet sprinkler system in which the secondary pipe is filled with liquid. The sprinkler system may be a dry sprinkler system in which the secondary pipe is filled with gas.

[0013] Furthermore, this sprinkler system is used for at least two areas, a first area and a second area. For example, the sprinkler system is used for a building having two or more floors. The sprinkler system is provided on a first floor of a building and a second floor above or below the first floor. Note that the two areas do not need to be positioned vertically. The two areas may be provided on the same floor or on the same ground.

[0014] The secondary pipe of the sprinkler system refers to a pipe connected to a sprinkler head. A pipe from a water pump to a valve is referred to as a primary pipe of the sprinkler system.

[0015] As a method for identifying a leakage from the secondary pipe, for example, in a case where the secondary pipe is filled with water, the water leaks to form a stain on the building. Thus, by investigating the secondary pipe near the stain, the leakage spot can be identified. In a case where the secondary pipe is filled with gas, a pressure sensor is provided in the secondary pipe. By investigating the secondary pipe in consideration that there is a leak when the amount of decrease in pressure per unit time is large, the leakage spot can be identified.

[0016] In general, leakage is likely to occur from a thin part of the secondary pipe. For example, an end of the secondary pipe is often threaded and connected to a joint. The threaded part tends to be thin, from which leakage may occur.

[0017] After the leakage is identified, the liquid in the secondary pipe is removed. When the inside of the secondary pipe is filled with gas, the gas need not be removed.

[0018] A water leakage from a pipe of a general pressurized or non-pressurized sprinkler system advances by the following mechanism. When a long period of time elapses after the sprinkler system is installed, corrosion progresses from the inside of

the pipe toward the outside of the pipe due to moisture in the pipe, and finally a hole penetrating from the inside of the pipe to the outside is formed.

[0019] The leakage is repaired from the outside of the secondary pipe (step S302). As a method for repairing the leakage, a tape made of an organic or inorganic material is attached from the outside of the secondary pipe, the leakage spot is welded from the outside of the secondary pipe, a gel or sol substance is injected from the outside of the secondary pipe into the leakage spot, or a highly viscous fluid is injected from the outside of the secondary pipe into the leakage spot before the fluid is cured. The reasons why the leakage spot is repaired from the outside of the secondary pipe are as follows. When the leakage spot is repaired from the outside of the secondary pipe in order to make the inside of the secondary pipe have a negative pressure in the subsequent process, a repair material receives a force drawing to the inside and is hardly detached. The secondary pipe cannot be repaired from the inside substantially. Repairing the secondary pipe from the outside is less costly than replacing the secondary pipe.

[0020] The leakage is repaired in one of the first area or the second area where the leakage has occurred, and the secondary pipe is not repaired in the other area.

[0021] It is preferable to repair after cleaning the outside of the secondary pipe such that the repair material easily adheres to the outside of the secondary pipe. Examples of a method for cleaning include cleaning using a surfactant, cleaning with an acid or an alkali, and cleaning of surface grinding with a grindstone.

[0022] A water leakage spot is identified, and the hole is repaired from the outside of the secondary pipe. Although it is conceivable to remove the pipe including the water leakage spot, the removal of the pipe will be a large-scale modification, and the time and effort for curing the inside of a protection zone will increase. Furthermore, the construction cost will increase. Thus, the water leakage is stopped by repairing the hole with the repairing material from the outside. In order to construct the negative pressure sprinkler system later, the repair material is not pressurized outward from the hole even though the repair material may be sucked toward the hole by a negative

pressure. Therefore, the repair material is not peeled off.

[0023] A negative pressure pump is connected to the repaired secondary pipe (step S303). By connecting the negative pressure pump to the secondary pipe, the inside of the secondary pipe can be made to have a negative pressure. When the secondary pipe has a negative pressure, the repair material provided outside the secondary pipe is drawn into the secondary pipe, and the repair material is fixed to the leakage spot.

[0024] In an area where the negative pressure pump is connected to the secondary pipe, a control system is changed such that the secondary pipe functions as a negative pressure sprinkler. The inside of the secondary pipe has a negative pressure and need not be filled with liquid, or may be filled with liquid. When the secondary pipe has a negative pressure and is filled with liquid, the area functions as a wet negative pressure sprinkler. The other area serves as a non-negative pressure sprinkler. When the secondary pipe has a negative pressure and is not filled with liquid, the area functions as a dry negative pressure sprinkler. The other area serves as a non-negative pressure sprinkler.

[0025] In the wet negative pressure sprinkler, the secondary pipe is filled with liquid, and the inside of the secondary pipe has a negative pressure, and thus the liquid evaporates from the inside of the secondary pipe. In order to compensate for the evaporated liquid, a valve provided at a boundary between the secondary pipe and the primary pipe is opened to allow the liquid to flow from the primary pipe into the secondary pipe. In order to enable such control, it is necessary to newly provide a sensor that detects the amount of the liquid in the secondary pipe and a control device that opens the valve for supplying the liquid from the primary pipe to the secondary pipe as necessary on the basis of the sensor. When a fire occurs, suction by the negative pressure pump is stopped or a suction force is weakened. Then, the liquid in the secondary pipe does not flow toward the negative pressure pump, and the water in the secondary pipe can be discharged only from the sprinkler.

[0026] In the dry negative pressure sprinkler, it is not necessary to consider a reduction of the liquid in the secondary pipe as described above, and thus, it is not necessary to

control the valve for preventing the reduction of the liquid in the secondary pipe. However, when a fire occurs, the suction by the negative pressure pump is stopped or the suction force is weakened. Then, the liquid in the secondary pipe does not flow toward the negative pressure pump, and the water in the secondary pipe can be discharged only from the sprinkler.

[0027] The advantage of adopting the negative pressure sprinkler system for only a specific area in this manner is that the cost for modification is reduced as compared with the case where the negative pressure sprinkler system is used for all the areas.

[0028] Next, by adopting the negative pressure sprinkler system, repair work can be performed from the outside of the secondary pipe, and the construction cost is reduced.

[0029] The repaired pipe is left, and members used only in the pressurized or non-pressurized sprinkler system are removed. Many components are different between the pressurized or non-pressurized sprinkler system and the negative pressure sprinkler system. Therefore, devices used only in the pressurized or non-pressurized sprinkler system are removed.

[0030] (Description of negative pressure sprinkler system)

The negative pressure sprinkler system is used, for example, in an environment that dislikes moisture, such as a medical facility, a nuclear power plant, or a lithium battery plant. The negative pressure sprinkler system is provided in a building. The building has a first zone which is on a lower floor and a second zone which is on an upper floor. The negative pressure sprinkler system does not need to be used in an environment that dislikes moisture, and may be used in an environment where a pressurized or non-pressurized sprinkler system is used.

[0031] The negative pressure sprinkler system includes the primary pipe, the secondary pipe connected to the primary pipe, the sprinkler head provided in the secondary pipe, the valve provided at the boundary between the primary pipe and the secondary pipe, and the water pump for sending water to the primary pipe.

[0032] The primary pipe is filled with water. This water is pressurized by the water pump. Water is supplied to the water pump from an extinguishing water tank.

Water may be supplied to the water pump from an elevated water tank on a top floor of the building. The primary pipe rises vertically from the water pump to a top of the building and branches at each floor. The number of the floors of the building need not be two floors. The water in the primary pipe is stopped by the valve, and the water in the primary pipe is sent to the secondary pipe by opening the valve. The opening and closing of the valve is controlled by a computer.

[0033] The secondary pipe is connected to the valve. The secondary pipe is disposed in a zone for extinguishing a fire. The secondary pipe is disposed on a ceiling of the zone. The secondary pipe is provided with a plurality of sprinkler heads. The number of sprinkler heads is determined by a size of the zone.

[0034] The sprinkler head is a closed sprinkler head, and is provided with a plurality of holes for discharging water. The sprinkler head has a heat-sensitive mechanism (soluble metal piece). In a normal state, a space between the hole through which water is discharged and the secondary pipe is shielded in the sprinkler head. When the heat-sensitive mechanism melts due to flame in a fire, the shield is opened, and water is discharged from the hole of the sprinkler head via the primary pipe.

[0035] A negative pressure system includes a negative pressure pipe connected to the secondary pipe, and the negative pressure pump that makes the inside of the negative pressure pipe have a negative pressure. The negative pressure sprinkler system can be achieved only by connecting the negative pressure pipe and the secondary pipe to each other.

[0036] The negative pressure pump generates a negative pressure. The negative pressure pump may include a main machine and a backup machine. In this case, the usage of the entire facility can be covered at the time of failure and maintenance. When used in a medical facility, sucked bacteria and air containing bacteria are collected by a suction filter so as not to contaminate the atmosphere.

[0037] The negative pressure pipe connected to the negative pressure pump rises vertically from the negative pressure pump to the top of the building and branches at each floor. The negative pressure pipe is branched at each floor, and the negative

pressure pipe is stretched around each room. A negative pressure pump is connected to the negative pressure pipe.

[0038] The negative pressure pipe and the secondary pipe are connected at a connection point. As a result, in the normal state, the inside of the secondary pipe has a negative pressure.

[0039] When the negative pressure sprinkler system is a wet negative pressure sprinkler system, the inside of the secondary pipe has a negative pressure and there is water in the secondary pipe in the normal state. The negative pressure prevents water from being discharged from the sprinkler head even if the sprinkler head is damaged. In order to prevent water from moving from the secondary pipe to the negative pressure pipe, a film that allows water vapor to pass but does not allow water to pass, a gas-liquid separator, or the like may be provided near the connection point. Since the inside of the secondary pipe has a negative pressure, the water evaporates. To replenish the water, the valve may be opened to replenish the secondary pipe with water when the water is reduced.

[0040] When the negative pressure sprinkler system is a dry negative pressure sprinkler system, the inside of the secondary pipe has a negative pressure and there is no water in the secondary pipe.

[0041] A detection system has a fire detector and a computer. When a fire occurs in the protective zone, the fire detector detects heat or smoke of the fire. The computer and the valve are connected to each other by a signal line. The computer and the water pump are connected to each other by a signal line.

[0042] The fire extinguishing system includes a negative pressure sprinkler system including a sprinkler head and a secondary pipe as a sprinkler pipe for supplying water to the sprinkler head, the secondary pipe being maintained in a negative pressure state in a normal state, a negative pressure pipe, and a negative pressure pump as a negative pressure device for supplying a negative pressure to the secondary pipe and the negative pressure pipe.

[0043] Fig. 2 is a schematic diagram of the fire extinguishing system before repair.

As shown in Fig. 2, a sprinkler system 1 serving as the fire extinguishing system before repair is provided on a first floor 100 serving as a first area (first protection zone) and a second floor 200 serving as a second area (second protection zone). First floor 100 is provided with a pressurized sprinkler system 100a. Second floor 200 is provided with a pressurized sprinkler system 200a. Pressurized sprinkler systems 100a and 200a may be replaced with other sprinkler systems that are not pressurized sprinkler systems.

[0044] A primary pipe 4 is connected to a water pump 2. An output of water pump 2 is controlled by a control device 3. The output of water pump 2 can be changed continuously. Water is supplied to water pump 2 from a water tank (not shown). Impurities need not be added to the water, and rust prevention or the like may be added to the water.

[0045] A primary pipe 101 for first floor 100 is branched from primary pipe 4. Primary pipe 101 is connected to a valve 105 located at a boundary between primary pipe 101 and secondary pipe 102. Opening and closing of valve 105 is controlled by control device 3.

[0046] Secondary pipe 102 is provided with a plurality of sprinkler heads 103. Sprinkler heads 103 are provided on first floor 100. Each sprinkler head 103 has a part that melts with heat in a fire. In an event of a fire, this part melts and a liquid (water) as an extinguishing agent is supplied from secondary pipe 102 to first floor 100 via sprinkler heads 103.

[0047] Secondary pipe 102 may be filled with water or need not be filled with water.

On first floor 100, a sensor 104 for sensing heat is provided. When sensor 104 senses heat, a signal is sent to control device 3. Control device 3 instructs water pump 2 to increase the output of water pump 2. Control device 3 opens valve 105. When secondary pipe 102 is not filled with water, valve 105 is opened to fill secondary pipe 102 with water. However, air in secondary pipe 102 is compressed and accumulated in secondary pipe 102. When secondary pipe 102 is filled with water in advance, valve 105 is opened to increase water pressure in secondary pipe 102.

[0048] When a fusible part of sprinkler heads 103 is melted by heat, the water in

secondary pipe 102 is discharged to first floor 100 via sprinkler heads 103.

[0049] Primary pipe 4 is connected to a valve 205 located at a boundary between primary pipe 4 and a secondary pipe 202. Opening and closing of valve 205 is controlled by control device 3. Primary pipe 4 is connected to other primary pipes 101 and 201.

[0050] Secondary pipe 202 is provided with a plurality of sprinkler heads 203. Sprinkler heads 203 are provided on second floor 200. Each sprinkler head 203 has a part that melts with heat in a fire. In an event of a fire, this part melts and water as an extinguishing agent is supplied from secondary pipe 202 to ~~first~~ second floor ~~100~~ 200 via sprinkler heads 203. Secondary pipe 202 may be filled with water or need not be filled with water.

[0051] On second floor 200, a sensor 204 for sensing heat is provided. When sensor 204 senses heat, a signal is sent to control device 3. Control device 3 instructs water pump 2 to increase the output of water pump 2. Control device 3 opens valve 205. When secondary pipe 202 is not filled with water, valve 205 is opened to fill secondary pipe 202 with water. However, air in secondary pipe 202 is compressed and accumulated in secondary pipe 202. When secondary pipe 202 is filled with water in advance, valve 205 is opened to increase water pressure in secondary pipe 202.

[0052] Sensor 104 is reused, if reusable, in a non-negative pressure sprinkler system and a negative pressure sprinkler system 100b.

[0053] When a fusible part of sprinkler heads 203 is melted by heat, the water in secondary pipe 202 is discharged to second floor 200 via sprinkler heads 203.

[0054] Fig. 3 is a schematic diagram of the fire extinguishing system after repair. As illustrated in Fig. 3, it is assumed that a water leakage spot 110 occurs in secondary pipe 102. In that case, water leakage spot 110 is repaired from the outside. Further, secondary pipe 102 is connected to a negative pressure pump 5. A negative pressure pipe 109 is interposed between secondary pipe 102 and negative pressure pump 5. This can make the inside of secondary pipe 102 have a negative pressure.

[0055] Fig. 4 is a sectional view of a water leakage spot. As illustrated in Fig. 4, a

hole 1020 is formed in secondary pipe 102 at water leakage spot 110. The hole is closed by a repair material 111 from the outside of secondary pipe 102.

[0056] In this example, water leakage spot 110 is generated on first floor 100, but a water leak spot may be generated in secondary pipe 202 on second floor 200. In that case, secondary pipe 202 is connected to negative pressure pump 5 while secondary pipe 202 is repaired from the outside.

[0057] While secondary pipe 102 on first floor 100 has a negative pressure, secondary pipe 102 may be filled with water or need not be filled with water. When secondary pipe 102 is filled with water, the water is likely to evaporate due to the negative pressure of secondary pipe 102. When the water in secondary pipe 102 evaporates and a water level decreases, valve 105 is opened to replenish the water in secondary pipe 102.

[0058] When secondary pipe 202 is not filled with water, the secondary pipe operates as a dry negative pressure sprinkler.

[0059] In sprinkler system 1, a negative pressure sprinkler system is provided on first floor 100, and a non-negative pressure sprinkler system is provided on second floor 200. The non-negative pressure sprinkler system may be provided on first floor 100, and the negative pressure sprinkler system may be provided on the second floor.

[0060] When a water leakage spot occurs not only in secondary pipe 102 on first floor 100 but also in secondary pipe ~~202~~ 102 on second floor 200, the water leakage spot is repaired from the outside of secondary pipe 202, and secondary pipe 202 is connected to negative pressure pump 5. Thus, a negative pressure sprinkler system can be also configured in second floor 200.

[0061] Hole 1020 as a pinhole is formed by oxygen or the like contained in water in the pipe. Due to the presence of hole 1020, water flows out from hole 1020. After a position of hole 1020 is identified, hole 1020 can be prevented by repair material 111 from the outside.

[0062] Examples of repair material 111 include an aluminum tape, a tape of a glass fiber cloth containing a resin, and a packing tape. It is also possible to form repair

material 111 by welding a metal plate to secondary pipe 102.

[0063] Negative pressure sprinkler system 100b is originally a pressurized or non-pressurized sprinkler system, and is modified to be a negative pressure sprinkler system by closing hole 1020 after hole 1020 is formed.

[0064] Sprinkler system 1 includes negative pressure sprinkler system 100b having sprinkler head 103 and secondary pipe 102 that supplies water to sprinkler head 103 and has a negative pressure inside, and negative pressure pump 5 that maintains negative pressure sprinkler system 100b in a negative pressure state in a normal state, in which secondary pipe 102 has hole 1020 that penetrates secondary pipe 102 in a thickness direction of secondary pipe 102, and sprinkler system 1 further includes repair material 111 that seals an opening of hole 1020 from outside of the secondary pipe.

[0065] Operation of negative pressure sprinkler system 100b will be described. When a fire occurs on first floor 100 as a part of a protection zone, sensor 104 senses heat or smoke from the fire. Sensed information is transmitted from sensor 104 to control device 3 as a computer. Control device 3 gives a signal to valve 105 to open valve 105. Control device 3 drives water pump 2 or increases a driving force of water pump 2. Accordingly, there is no water in dry negative pressure sprinkler system 100b in the normal state, and secondary pipe 102 in a negative pressure state is filled with water. In wet negative pressure sprinkler system 100b, the inside of secondary pipe 102 is filled with water in a negative pressure state in the normal state. At this time, the driving force of negative pressure pump 5 may be made weaker than in a steady state.

[0066] The heat from the fire melts a heat-sensitive mechanism of sprinkler heads 103. As a result, a water discharge hole of sprinkler head 103 and secondary pipe 102 are connected to each other. When valve 105 is opened, water is discharged from the water discharge hole of sprinkler head 103 to extinguish the fire.

[0067] In comparison with a dry sprinkler system (pre-actuated sprinkler system) in which the secondary pipe has atmospheric pressure in the normal state, negative

pressure sprinkler system 100b according to the embodiment has the following effects. In an atmospheric pressure dry sprinkler system, in an event of a fire, the pump is operated to fill the secondary pipe with water, but at this time, the air in the secondary pipe is compressed by the water, and thus the secondary pipe is not filled with water smoothly (in a short time). On the other hand, in wet negative pressure sprinkler system 100b, since the inside of secondary pipe 102 has a negative pressure and is filled with water, it is possible to sprinkle water from sprinkler heads 103 at an early stage. It is therefore possible to solve a problem that sprinkling of water from a sprinkler head is delayed, which is a disadvantage of a conventional dry sprinkler (pre-actuated sprinkler). In dry negative pressure sprinkler system 100b, since the inside of secondary pipe 102 has a negative pressure, the inside of secondary pipe 102 is filled with water immediately. Thus, it is possible to sprinkle water from sprinkler heads 103 at an early stage.

[0068] Since secondary pipe 102 is used in a pressurized or non-pressurized sprinkler system, manufacturing costs can be reduced as compared with a newly installed secondary pipe. Further, repair material 111 is attached to the outside of secondary pipe 102, but water does not leak from hole 1020 again since the inside of secondary pipe 102 has a negative pressure in the normal state.

[0069] Sprinkler system 1 as a fire extinguishing system is a fire extinguishing system provided on first floor 100 as the first area and on second floor 200 as the second area different from the first area, and includes negative pressure sprinkler system 100b provided on first floor 100 and atmospheric pressure or pressurized sprinkler system 200a provided on second floor 200. First floor 100 may be the second area, and second floor 200 may be the first area.

[0070] In the fire extinguishing system configured as described above, a sprinkler system of a necessary type can be provided at a necessary place. Although the method for repairing hole 1020 with repair material 111 has been described as a manufacturing method, hole 1020 need not be provided. In a case where hole 1020 is not provided, repair material 111 is not provided.

[0071] Fig. 5 is a schematic diagram of a fire extinguishing system according to another aspect. As shown in Fig. 5, fire extinguishing system 1 according to another aspect is different from fire extinguishing system 1 shown in Figs. 3 and 4 in that no sensor is provided on second floor 200. Atmospheric pressure or pressurized sprinkler system 200a on second floor 200 includes sprinkler head 203 and discharges water from sprinkler head 203 without a signal from the sensor as the metal in sprinkler head 203 melts with the heat of the fire. That is, sprinkler head 203 is not connected to control device 3. In this embodiment, as in the embodiment in Figs. 3 and 4, first floor 100 may be the second area, and second floor 200 may be the first area. Secondary pipe 102 may be manufactured by a method in which hole 1020 of secondary pipe 102 is provided and repaired with repair material 111. Hole 1020 of secondary pipe 102 need not be provided. In a case where hole 1020 is not provided, repair material 111 is not provided.

[0072] When sprinkler head 203 discharges water without signals from the sensor and control device 3, only a melting temperature of the metal in sprinkler head 203 on second floor 200 determines a discharge condition of water from sprinkler head 203, which simplifies the control of the discharge condition. Accordingly, sprinkler system 1 can be introduced at low cost.

[0073] A fire extinguishing system according to one aspect is a fire extinguishing system provided in at least one of a first area or a second area different from the first area, the fire extinguishing system including a negative pressure sprinkler system including a sprinkler head and a secondary pipe that supplies water to the sprinkler head and has a negative pressure inside, and a negative pressure pump that maintains the negative pressure sprinkler system in a negative pressure state in a normal state, in which the secondary pipe has a hole penetrating the secondary pipe in a thickness direction of the secondary pipe, and the fire extinguishing system further includes a repair material that seals an opening of the hole from an outside of the secondary pipe.

[0074] Since the fire extinguishing system configured as described above includes the repair material that seals the opening of the hole from the outside of the secondary pipe,

outside air is not introduced from the hole even when the inside of the secondary pipe has a negative pressure.

[0075] A method for manufacturing a fire extinguishing system according to one aspect includes providing a sprinkler system including a sprinkler pipe in which water is stored in a normal state on a first floor of a building and on a second floor above or below the first floor, identifying a water leakage spot of the sprinkler pipe on either the first floor or the second floor, attaching a repair material to an outside of the sprinkler pipe to close the water leakage spot, and then connecting a negative pressure pump to the sprinkler pipe to constitute a negative pressure sprinkler system.

[0076] In the method for manufacturing the fire extinguishing system configured as described above, the negative pressure sprinkler system can be configured by repairing the sprinkler system in which water is stored in a normal state. As a result, the negative pressure sprinkler system can be manufactured at low cost.

[0077] A method for manufacturing a fire extinguishing system according to another aspect includes providing a sprinkler system including a sprinkler pipe in which water is not stored in a normal state on a first floor of a building and on a second floor above or below the first floor, identifying a leakage spot from the sprinkler pipe on either the first floor or the second floor, attaching a repair material to an outside of the sprinkler pipe to close the leakage spot, and then connecting a negative pressure pump to the sprinkler pipe to constitute a negative pressure sprinkler system.

[0078] In the method for manufacturing the fire extinguishing system configured as described above, the negative pressure sprinkler system can be configured by repairing the sprinkler system in which water is not stored in a normal state. As a result, the negative pressure sprinkler system can be manufactured at low cost.

[0079] Example 1 is a fire extinguishing system provided in at least one of a first area or a second area different from the first area, the fire extinguishing system including a negative pressure sprinkler system including a sprinkler head and a secondary pipe that supplies water to the sprinkler head and has a negative pressure inside, and a negative pressure pump that maintains the negative pressure sprinkler system in a negative

pressure state in a normal state, in which the secondary pipe has a hole penetrating the secondary pipe in a thickness direction of the secondary pipe, and the fire extinguishing system further includes a repair material that seals an opening of the hole from an outside of the secondary pipe.

[0080] Example 2 is a method for manufacturing a fire extinguishing system, the method including providing a sprinkler system including a sprinkler pipe in which water is stored in a normal state in a first area and a second area different from the first area, identifying a water leakage spot of the sprinkler pipe in either the first area or the second area, attaching a repair material to an outside of the sprinkler pipe to close the water leakage spot, and then connecting a negative pressure pump to the sprinkler pipe to constitute a negative pressure sprinkler system.

[0081] Example 3 is a method for manufacturing a fire extinguishing system, the method including providing a sprinkler system including a sprinkler pipe in which water is not stored in a normal state in a first area and a second area different from the first area, identifying a leakage spot from the sprinkler pipe in either the first area or the second area, attaching a repair material to an outside of the sprinkler pipe to close the leakage spot, and then connecting a negative pressure pump to the sprinkler pipe to constitute a negative pressure sprinkler system.

[0082] It should be understood that the embodiments disclosed herein are illustrative in all respects and not restrictive. The scope of the present invention is defined not by the above embodiments but by the claims, and is intended to include meanings equivalent to the claims and all modifications within the scope.

REFERENCE SIGNS LIST

[0083] 1: sprinkler system, 2: water pump, 3: control device, 4, 101, 201: primary pipe, 5: negative pressure pump, 100: first floor, 100a, 200a: pressurized sprinkler system, 100b: negative pressure sprinkler system, 102, 202: secondary pipe, 103, 203: sprinkler head, 104, 204: sensor, 105, 205: valve, 109: negative pressure pipe, 110: water leakage spot, 111: repair material, 200: second floor, 1020: hole, S301, S302, S303: step

CLAIMS

~~1. A fire extinguishing system provided in a first area and a second area different from the first area, the fire extinguishing system comprising:~~

~~a negative pressure sprinkler system provided in the first area; and~~

~~an atmospheric pressure or pressurized sprinkler system provided in the second area.~~

~~2. The fire extinguishing system according to claim 1, wherein~~

~~the atmospheric pressure or pressurized sprinkler system in the second area includes a sprinkler head, and~~

~~the sprinkler head includes a metal inside that melts with heat of a fire to cause water to be discharged from the sprinkler head without a signal from a sensor.~~

~~3~~1. A method for manufacturing a fire extinguishing system provided in a first area and a second area different from the first area, the fire extinguishing system comprising:

a negative pressure sprinkler system provided in the first area; and

an atmospheric pressure or pressurized sprinkler system provided in the second area;

~~the fire extinguishing system according to claim 1 or 2,~~ the method comprising:

providing an atmospheric pressure or pressurized sprinkler system in the first area;

identifying a water leakage spot of a sprinkler pipe of the atmospheric pressure or pressurized sprinkler system;

attaching a repair material to an outside of the sprinkler pipe to close the water leakage spot; and then

connecting a negative pressure pump to the sprinkler pipe to constitute the negative pressure sprinkler system.

2. A method for manufacturing a fire extinguishing system provided in a first area and a second area different from the first area, the fire extinguishing system comprising:

a negative pressure sprinkler system provided in the first area; and

an atmospheric pressure or pressurized sprinkler system provided in the second area;

wherein the atmospheric pressure or pressurized sprinkler system in the second area includes a sprinkler head, and

the sprinkler head includes a metal inside that melts with heat of a fire to cause water to be discharged from the sprinkler head without a signal from a sensor;

the method comprising:

providing an atmospheric pressure or pressurized sprinkler system in the first area;

identifying a water leakage spot of a sprinkler pipe of the atmospheric pressure or pressurized sprinkler system;

attaching a repair material to an outside of the sprinkler pipe to close the water leakage spot; and then

connecting a negative pressure pump to the sprinkler pipe to constitute the negative pressure sprinkler system.