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3,714,964

DOUBLE RATE FLOW CONTROLLER

Original Filed Oct. 24, 1968

Fig. 4.

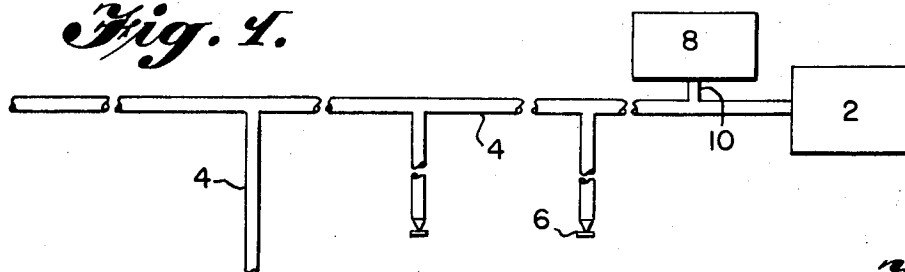


Fig. 2.

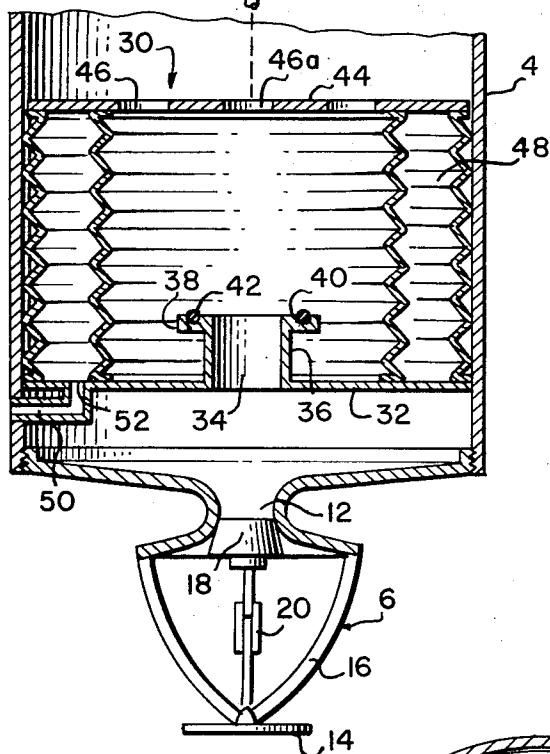
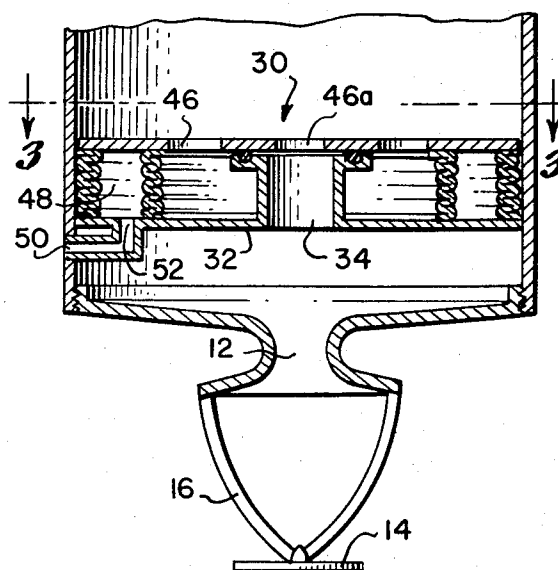
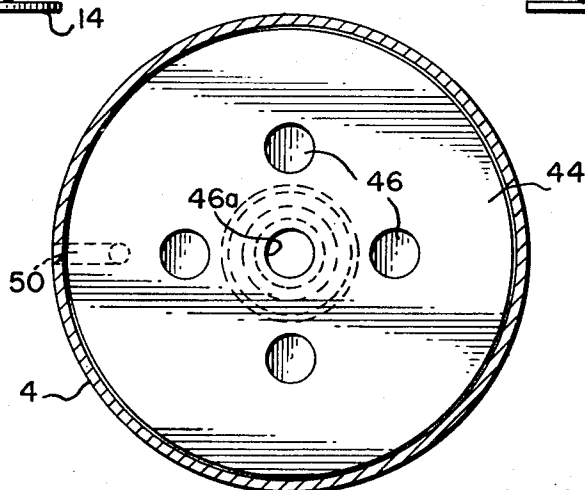


Fig. 3.



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3,714,964

DOUBLE RATE FLOW CONTROLLER

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Original application Oct. 24, 1968, Ser. No. 770,248, now Patent No. 3,592,270. Divided and this application Aug. 6, 1970, Ser. No. 61,801

Int. Cl. F16k 13/04

U.S. Cl. 137—513.3

4 Claims

ABSTRACT OF THE DISCLOSURE

A double rate flow controller including a means for permitting fluid flow at a first high flow rate, a means for reducing the first flow rate to a second lower flow rate and a means for regulating the volume of water passing through the flow controller during the high flow condition before the high flow rate is terminated and the low flow rate begins.

CROSS-REFERENCE TO RELATED APPLICATION

This application is a division of copending application Ser. No. 770,248, filed Oct. 24, 1968, now Pat. No. 3,592,270.

BACKGROUND OF THE INVENTION

The present invention relates to a fluid flow control device and more particularly to a fluid flow control device for use in a fire extinguishing system.

In a copending application entitled "Method of Controlling Fire," Ser. No. 766,475 filed Oct. 10, 1968, by the inventors William L. Livingston and Russell W. Pierce and assigned to the assignee of the present invention, and now Pat. No. 3,605,900, a fixed fire extinguishing system is disclosed wherein fluid ablative material is formed by the addition of a water swellable polymer powder to water when the system is activated, which combines with the water and forms an ablative gel which is dispensed from sprinkler heads located over the fire. The gel material is substantially more viscous than plain water and tends to cling to the surfaces on which it is sprayed and therefore, its heat absorbing capabilities are substantially greater than plain water. An automatic fire extinguishing system using this ablative material is therefore effective at lower flow rates and with a lower overall volume of water than with conventional plain water systems. However, when the fluid ablative material is used in a conventional sprinkler system, health codes do not allow the ablative material to be maintained in the sprinkler system where the system is in fluid communication with the potable water supply. Since this is generally the situation with the majority of sprinkler systems presently in use, the gel forming material must be added to the water supply after the sprinkler system has been placed in operation. In a conventional wet pipe fire sprinkler system, initially the flow through the sprinkler head nozzles is pure water. The gelling powder which is subsequently added after the system commences operation, changes the pure water to the fluid ablative material. In fire extinguishing systems of this type it is desirable that the water and gel material mixture be built-up to the maximum concentration level as fast as possible to be the most effective. A feature equally important, is to build up an accumulation of ablative material at the fire exposure location in the shortest possible time to maximize the fire extinguishing capabilities of the system.

To accomplish both of these ends, it is desirable that the system provide an initial high rate of flow from the sprinkler head nozzles. Subsequently, when the fluid ablative material is accumulated, the sprinkler flow may

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be reduced to a lower level sufficient to sustain the fire extinguishing capabilities of the system.

It is known to use various types of fluid flow control devices to regulate the rate of fluid flow, however, conventional flow control devices are not adequate for use in a fire extinguishing system of the type described above, where an initial high flow rate at a high pressure is needed and where it is important to regulate the volume and duration of the high rate fluid flow.

SUMMARY OF THE INVENTION

The present invention is directed to a double rate flow control device adapted for use in a sprinkler type fire extinguishing system and which permits an initial high flow rate and a subsequent lower flow rate. This is accomplished by a flow regulating means including a pressure operated dash pot to restrict the volume of fluid ablative material passing through the sprinkler system after a predetermined volume has been passed through the flow control device.

Among the objects of the invention are the provision of a fluid flow control device adapted for use with fire extinguishing systems using fluid ablative material to initially maximize the build-up of the ablative material at a fire location, and subsequently to maintain it at a sustaining level after the build-up of the material has been maximized, and the provision of a fluid flow control device for permitting a first flow of fluid therethrough at a high flow rate and a subsequent second lower flow rate after a predetermined volume has been passed through the device at the first flow rate.

Other objects and further applicability of the present invention will become more apparent when taken from the detailed description given below in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a schematic diagram of a fire extinguishing system including a cross-section of the flow control device of the present invention shown in the high flow rate position;

FIG. 2 is a cross-section of the flow control device of FIG. 1 shown in the low flow rate position and

FIG. 3 is a view of the system taken along line 3—3 of FIG. 2.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

As shown in FIG. 1, a fire extinguishing system of the fluid ablative material type includes a water supply source 2 which is coupled by means of a pipe line 4 to a plurality of sprinkler heads 6 (only one of which is shown in detail in the drawing). A supply 8 of gelling powder material, upstream of the sprinkler heads 6, is connected to the system pipe line 4 by an auxiliary line 10. Each sprinkler head 6 is a conventional type and includes a nozzle 12 and a water deflector 14 which is attached to the nozzle by means of a yoke 16. In the non-operative condition, the nozzle 12 is closed by means of a cap 18 maintained in position by means of a fusible link 20. The nozzle portion of the sprinkler head assembly is threaded into the open end of the sprinkler head pipe line 4. The fire extinguishing system is preferably a wet pipe type, that is it contains water; although the invention is not restricted to such a system.

The dual rate flow control device of the present invention is generally designated by the reference numeral 30 in the drawings. It is normally positioned upstream of the sprinkler head nozzle 12 in the sprinkler head pipe line 4. The flow control device 30 is formed of a circular mounting base 32 made of a noncorrosive metallic plate, placed in sealing engagement with the inside of the

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sprinkler head pipeline 4. This is accomplished such as, for example, by spot welding prior to the assembly of the sprinkler system or by means of a threaded connection. The base 32 of the flow control device 30 includes a high flow orifice 34 through which water is adapted to flow at a high rate when the system is activated. The orifice 34 is formed by a tubular stand pipe 36, the lower end of which is attached integrally with the base 32. The upper portion of the stand pipe 36 extends vertically above the base 32 and includes a circular flange 38 having an annular recess 40 to receive a soft rubber O-ring seal 42.

The upstream end of the flow control device 30 is provided with a circular plate 44, the outside perimeter of which generally corresponds to and is slidable within the interior of the sprinkler head pipeline 4. The plate 44 includes a plurality of small fluid flow apertures 46 equally spaced apart in a radial direction in the plate 44, as shown in FIG. 3. One of the apertures 46a is positioned in the center of the plate 44 so as to be directly over the high flow orifice 34. Although four apertures 46, in addition to the center aperture 46a, are illustrated, it will be appreciated that the number, size and location of these apertures on the plate 44 may be altered depending upon the flow conditions desired.

The plate 44 is supported above the base 32 by means of an air-filled dashpot comprising a bellows 48, the lower end of which is secured to the base plate 32 and the upper end of which is secured to the plate 44. The bellows 48, is filled with air when the system is in the non-operative condition. The bellows 48 is vented to the atmosphere by means of a vent 50 which communicates with the bellows interior through an opening 52 in the base 32. The rate of venting of the air from within the bellows 48 may be regulated in part by the size of the vent 50.

The operation of the flow controlled device will now be described. In the static or no flow condition of the fire extinguishing system, water is present in the pipeline 4. As shown in FIG. 1, the plate 44 of the flow control device 30 is maintained in the upstream position by means of the dashpot bellows 48. Since water is present in a static condition on either side of the plate 44 there is no pressure differential acting upon the plate 44 and air is not vented within the bellows 48.

During a fire condition, temperatures of the surrounding area are raised and the fusible link 20 melts to release the cap 18 and open the nozzle 12. Water then begins to flow through the sprinkler 6 from the head pipe line 4 at a fairly rapid flow rate and is discharged onto the fire location. Further upstream, the gelling powder material from the supply 8 is mixed with the plain water from the supply 2 to form the fluid ablative material. With the plate 44 in the upstream position, the initial high flow rate is maintained since the fluid ablative material flows through all of the small apertures 46 and on through the high flow orifice 34. This permits the gelling material to be completely mixed with the plain water in a minimum amount of time and maximizes the build up of the fluid ablative material at the fire location. As the fluid ablative material continues to flow in the pipeline 4 and through the flow control device 30, the line pressure gradually builds up upon the upstream side of the plate 44 forcing it downwardly against the resistance of the air-filled bellows 48. This causes the air to be gradually vented from the interior of the bellows 48 through the vent 50, which in turn allows the plate 44 to gradually move downwardly toward the base plate 32 and the high flow orifice 34.

After a sufficient amount of air has been expelled from the bellows 48 due to the pressure of the flowing fluid ablative material against the plate 44, the low flow position, as illustrated in FIG. 2, is reached. At this point the plate 44 is clamped against the flange 38 and the O-ring seal 42 of the stand pipe 36 by the fluid pressure in such a way so that only the center aperture 46a on the plate

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44 remains in flow communication with the high flow orifice 34. A seal is maintained at this point by the line pressure and only the fire ablative material flowing through the center aperture 46a is permitted to pass through the high flow orifice 34. It will be appreciated since the center aperture 46a is smaller than the opening of the high flow orifice 34, the amount of fluid ablative material passing through the nozzle 12 and onto the fire location is substantially reduced.

Rate of flow is proportional to pressure and time and by determining the constants of the system, the sprinkler system can be adapted to permit a predetermined volume of fluid ablative material through each sprinkler head 6 at the high flow rate before the flow control device 30 acts to reduce the flow rate to the lower sustaining level. It will be appreciated that bellows will vent faster at higher pressures and as such the flow control device 30 becomes a flow integrator to maintain a substantially constant volume of high rate fluid flow.

Thus with the fluid flow control device of the present invention, an initial high fluid flow rate is provided to allow the gel material to build up to a maximum at the fire location. For example, it has been found that the volume of fluid ablative material which accumulates after approximately 15 minutes at the high flow rate is sufficient under normal sprinkler system pressures to insure the maximum fire extinguishing capabilities of the system. By calculating the venting rate of the bellows 48, the size of the vent 50 may be established to insure the desired duration of flows at the high fluid flow rate. After the high rate fluid flow, the flow of fire ablative material is continued at a lower flow rate sufficient to sustain the fire extinguishing capabilities of the system and maintained at this rate until the fire is extinguished and the system shut off.

Generally, the fire extinguishing system is not used more than once, however, the fluid flow control device of the present invention may be reused by reinflating the dashpot-bellows to reset the upper plate to its static flow position.

It will be appreciated that the above description of the double-rate flow control device is illustrative only and numerous modifications and variations may be made in light of the above teachings. It is therefore to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described herein.

I claim:

1. A fluid flow controller comprising a housing having an inlet for connection to a source of fluid and an outlet for discharging said fluid; and means defining a first and second fluid passage in said housing to respectively pass fluid at a first and second flow rate between said inlet and outlet, said means including a dashpot assembly having a base defining a high-flow orifice and a plate defining a plurality of low-flow orifices for fluid in said housing, said plate being movable with respect to said base in response to a predetermined fluid pressure in said housing and being adapted to attain a first operational mode in which said high-flow orifice is in fluid communication with a plurality of said low-flow orifices to establish said first fluid passage, and a second operational mode in which said high-flow orifice is in fluid communication with one of said low-flow orifices to establish said second fluid passage, said dashpot assembly defining a chamber adapted to be filled with air, said chamber in its filled condition maintaining said plate in said first operational mode whereby said plurality of low-flow orifices are spaced from and in flow communication with said high-flow orifice, said chamber in its empty condition maintaining said plate in said second operational mode whereby all but one of said plurality of low-flow orifices are positioned out of fluid communication with said high-flow orifice.

2. The controller of claim 1 wherein said chamber is defined by a bellows attached between said base and

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said plate and adapted to be filled with air, said bellows being filled with air in said first operational mode of said dashpot assembly, said bellows being emptied of air in said second operational mode of said dashpot assembly.

3. The controller of claim 2 wherein said dashpot assembly further includes means for venting said chamber in response to a predetermined movement of said plate with respect to said base.

4. A device for regulating fluid flow through a conduit comprising movable means for creating a restriction in said conduit, said movable means being movable in said conduit from a first position to a second position in response to fluid flow through said conduit, and means cooperating with said movable means to maintain a substantially constant rate of fluid flow through said conduit during said movement and to change the fluid flow rate through said conduit in response to said movable means attaining said second position, said movable means being adapted to stay in said second position despite a later reduction of said fluid flow rate.

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U.S. Cl. X.R.

137—72, 504, 514, 517, 613; 138—31, 45