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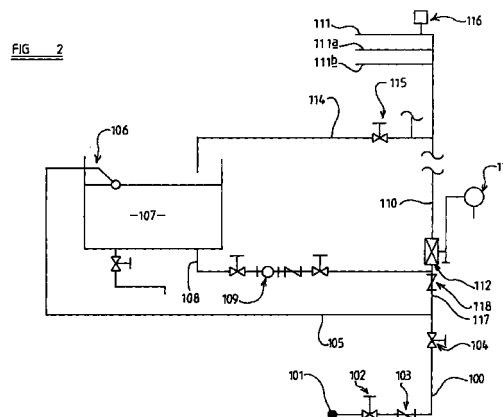
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(54) **Fire sprinkler systems**

(57) A fire sprinkler system comprising at least one sprinkler; break tank means (8; 107), for receiving water from a mains water supply; pump means (11, 12, 13; 109) for supplying water from said break tank means to said at least one sprinkler; means (70; 117) for providing water to said at least one sprinkler from said mains water supply other than by way of said break tank means, and including check valve means (71; 118) for preventing reverse flow of water to said mains water supply; and pressure detection means (20, 21, 22) operable to detect pressure of water supplied to the or one or more of said at least one sprinkler, and operable to cause said pump means to be operated when said pressure is below a predetermined value.



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Description

Description of Invention

[0001] This invention relates to fire sprinkler systems. 5

[0002] Fire sprinkler systems are well known for fire protection. A typical sprinkler system includes a number of suitably positioned sprinklers of a type which is caused to commence operation when an abnormally high temperature is detected. Typically such detection is effected by melting of a fusible element in each sprinkler. The system further comprises the necessary pipe-work for supplying water to the sprinklers. 10

[0003] It is usual to supply a sprinkler system with water from a water main, in which case it is essential that the main should be able to supply water to the system at sufficient pressure and flow rate to supply the sprinklers which have been brought into operation. It will be appreciated that for many fires not all the sprinklers of a system will be brought into operation, as the initial operation of one or more sprinklers will prevent spread of the fire beyond the area protected thereby. 20

[0004] One problem with the supply of water from the water mains to sprinkler systems is that water supply authorities are endeavouring to reduce mains water pressure to the minimum value which they are legally obliged to provide. This is done in order to reduce waste of water by leakage from the water mains. Whilst the ability of most mains is adequate to meet the flow rate requirements of sprinkler systems, in many cases the pressure will no longer be sufficient for satisfactory operation, and this is particularly a problem in respect of the operation of sprinklers on the upper storeys of multi-storey buildings. The standard method of meeting the requirements of a sprinkler system where mains pressure is low is to install a relatively large water storage tank and pumps to supply the sprinklers from such tank. A further method of meeting the requirements is disclosed in our British patent GB-2280368-B, which utilises a break tank for receiving water from the mains and from which pump means supplies water to the sprinkler(s). In this method, the break tank may be of relatively small capacity, although the system as a whole is relatively complex. 35

[0005] Another requirement which has to be borne in mind in the designing of fire sprinkler systems is that any back-flow of water into the mains from the sprinkler system must not occur. In a system such as disclosed in our patent aforesaid, having a break tank, the presence of the break tank ensures that this requirement is met. 40

[0006] It is broadly the object of the present invention to provide an improved sprinkler system which enables any problem of inadequate mains water pressure to be overcome, whilst preventing the possibility of back flow of water from the system into the mains. 45

[0007] According to one aspect of the present invention, we provide a fire sprinkler system comprising:

at least one sprinkler;

break tank means, for receiving water from a mains water supply;

pump means for supplying water from said break tank means to said at least one sprinkler;

means for providing water to said at least one sprinkler from said mains water supply other than by way of said break tank means, and including check valve means for preventing reverse flow of water to said mains water supply;

and pressure detection means operable to detect pressure of water supplied to the or one or more of said at least one sprinkler, and operable to cause said pump means to be operated when said pressure is below a predetermined value. 50

[0008] In a system according to the invention, the means for supplying water to the sprinkler(s) other than by way of the break tank means, which means may be a direct connection between a mains supply pipe and a pipe leading to the sprinkler(s), provides for the supply of water to the sprinkler(s) when the water main is capable of delivering sufficient pressure at a flow rate suitable for satisfactory operation of the number of sprinklers in use. If the pressure falls below the predetermined value, however, for example if a fire is of a size such that a large number of sprinklers are brought into operation, or if mains water pressure is low so that a lesser number of sprinklers will not perform satisfactorily, then the pump means is brought into operation and the sprinklers are supplied by way of the break tank. In this latter condition the pump means will deliver water to the sprinklers under a pressure greater than that available from the water mains, but the check valve means prevents reverse flow of water back into the mains. 55

[0009] Since, in a sprinkler installation including one or more sprinklers at a high level, e.g. on an upper storey or storeys of a multi-storey building, as well as one or more sprinklers at a lower level, it is going to be in respect of the high level sprinkler(s) that low mains water pressure is a problem, the pressure detection means is preferably provided at a high level in the system, and further preferably at the level of one or more highest sprinklers of the system.

[0010] A sprinkler system in accordance with the invention may also be a system as disclosed and/or claimed in our UK patent aforesaid. The invention is also, however, applicable to simpler sprinkler systems as described hereafter.

[0011] The invention will now be described by way of example with reference to the accompanying drawings, of which:-

Figure 1 shows diagrammatically a first embodiment of sprinkler system according to the invention, which is a modification of that described in our patent GB-2280368-B;

Figure 2 shows diagrammatically a further embodi-

ment of sprinkler system in accordance with the invention.

[0012] Referring firstly to Figure 1 of the drawings, this shows a sprinkler system as described in our British patent GB-2280368-B, modified in accordance with the present invention. For a further description of all the components and the method of operation of the sprinkler system, reference should be made to the patent GB-2280368-B.

[0013] A water main bringing water from a water supply authority is indicated at 50. A pipe 51 is branched off the main 50, and contains an isolation valve 1 followed by a non-return valve 2. The pipe extends into an enclosure or equipment cabinet or room indicated generally at 53 which contains the components described hereafter, although it will be appreciated that if desired certain components may be mounted at locations other than in the enclosure 53.

[0014] Within the enclosure, a pipe 54 connected to the pipe 52 has a monitored valve 3, a pressure sensitive device 4, a pressure gauge 5, and leads to a valve assembly for discharge of water into a break tank 8. The valve assembly for such discharge of water may comprise small and large float operated valves 6, 7. The tank 8 is further provided with water level detectors 9 and 9a which are arranged to provide an alarm signal in the event of low or high water level in the tank 8. The tank further has a drain valve 10. The tank may provide for storage of a volume of about 2m³ of water.

[0015] Three pipes 55, 56, 57 lead from the tank 8 to respective booster pumps 11, 12, 13 and thence by respective non-return valves 14, 15, 16, to a manifold 58. From manifold 58 a pipe 59 having a monitored isolating valve 18 and an automatic sprinkler alarm valve 19 extends to an outlet 61 which would be connected to suitable pipework leading to one or more sprinklers. Valve 19 also prevents reverse flow in the pipe 60. Between valve 19 and outlet 61, the pipe 60 has a pressure gauge 30, pressure sensitive electrical switch 20 to provide a "low pressure alarm" signal, pressure responsive switch 21, and pressure responsive switch 22 for recording system pressure. Pressure responsive switch 21 is a switch having a "dead band" between the pressures at which it switches "on" and "off". There is further a flow rate measuring device 23 which may be a device as known by the name "Annubar" and a signal transmitter 24 associated with the flow rate measuring device 23. There is also a monitored drain valve 31. The maximum output of the three booster pumps 11, 12, 13 together is substantially not greater than the sustainable flow rate of water available from the main 50 to replenish the tank 8. Such flow rate may be ascertained by enquiring of the water supply authority.

[0016] From manifold 58 there extends a further pipe 62 having a jockey pump 32 and non-return valve 33. This pipe 62 then rejoins the pipe 60 after the valve 19. A further connection to the manifold 58 is provided

for fire brigade inlets 28, 29, by way of a monitored valve 27. The manifold 58 has a drain valve 17.

[0017] Between outlet 61 and the flow rate measuring device 23 a pipe 63 extends from the pipe 60 and has a motorised valve 25 and solenoid valve 26 connected in parallel with one another, to provide for system testing when required. From these valves, the pipe 63 leads to an outlet 64 to the storage tank 8. The pipe 63 may also have a branch 65 having a monitored valve 37, leading to waste.

[0018] Additionally shown in the drawing is, represented diagrammatically, a control panel 34. There is also an ambient temperature sensor 35 and an electrical heater 36 to warm the vicinity of the equipment above described to prevent freezing in cold weather. The control panel has associated with it suitable electrical and/or electronic circuits and devices for example including data processing means, to detect and control operation of the system components. Suitable indicating devices would be provided as required to indicate the status or condition of the components of the system, the pressures and/or flow rates existing at the different points of the system, and so on.

[0019] In use, provided none of the sprinklers connected to the outlet 61 is in operation and neither of the valves 25, 26 is open, jockey pump 32 operates in accordance with pressure responsive switch 21 to pressurise the pipe 60 leading to the outlet 61. A maximum water level within the storage tank 8 is established by float controlled valves 6, 7, and the system remains in equilibrium.

[0020] If one or more of the sprinklers connected to outlet 61 should be brought into operation, e.g. by melting a fusible element in such sprinkler or sprinklers if a fire breaks out, the pressure at the outlet 61 will drop and this and the resulting flow of water to such sprinkler or sprinklers, initially provided by the jockey pump 32, will be detected by flow rate measurement device 23 and pressure switch 20. Firstly in response to such detection the effect is to bring the first pump 11 into operation, and if sufficient sprinklers are operating such that the pump 11 is not able to sustain the required flow rate and pressure at the outlet 61 the further pumps 12 and 13 are brought successively into operation. As water is drawn from the tank 8 to be thus supplied to the sprinklers, the tank is replenished from the water main supply under the control of valves 6, 7.

[0021] In accordance with the present invention, a pipe 70 is branched off the pipe 54 and connected to the pipe 60. The pipe 70 incorporates a check valve 71 for preventing reverse flow of water in the pipe 70, in the direction from the pipe 60 back towards the water main 50. Thus water is capable of reaching the outlet 61 and thence the sprinklers other than by way of the break tank 8, and if the main is capable of providing water at a sufficient flow rate and pressure to ensure operation in satisfactory manner of the number of sprinklers which might be brought into operation, the pumps 11 to 13 will

not be brought into operation. If the pumps are brought into operation, however, which will establish a pressure in the pipe 60 greater than that in the main 50, the check valve 71 prevents reverse flow in the pipe 70.

[0022] Referring now to Figure 2 of the drawings, this shows a somewhat simpler sprinkler system in accordance with the invention. Figure 2 shows, diagrammatically, a pipe 100 which is connected to a water main 101 by way of a stop valve and non-return valve 102, 103 respectively. An isolating valve 104 is provided upstream of a pipe 105 leading to the inlet control valve 106 of a break tank 107. An outlet 108 from the break tank leads by way of a booster pump 109 with associated valves to a pipe 110 which leads to an outlet 111 for connection to pipework of a network of sprinklers. In the pipe 110 there is shown a sprinkler alarm valve 112 which, when water flows in the pipe 110 due to the coming into operation of one or more sprinklers, provides for the supply of water to a water-operated gong 113. Branching from the pipe 110 is a pump-proving line 114 incorporating a test valve 115; this leads back to the break tank 107 and enables operation of one or more sprinklers to be simulated to test operation of the pump 109 as required. A pressure detector 116 detects the pressure supplied to the sprinklers by way of the outlet 111, and causes the pump 109 to operate when the pressure falls below a predetermined level.

[0023] The sprinkler system may include sprinklers on a number of storeys of a multi-storey building, and Figure 2 shows further outlets 111a, 111b leading to sprinklers on lower storeys than an upper storey fed by the outlet 111. In this case the present detector 116 is preferably provided at the level of one or more of the highest sprinklers of the system, as illustrated, since it is such high sprinklers whose operation will suffer most from any lack of mains water supply capability.

[0024] In accordance with the invention, a connection 117 is provided between the pipe 100 and the pipe 110, enabling water to be delivered to the outlet 111 directly from the mains, i.e. not by way of the break tank 107. The connection incorporates a check valve (non-return valve) 118. If the mains is capable of maintaining the required pressure at the outlet 111, the pump 109 is not brought into operation and water reaches the outlet 111 leading to the sprinklers directly and not by way of the break tank. When the pump 109 is in operation, in response to falling of the sprinkler pressure below a predetermined value, the check valve 118 prevents reverse flow of water from the pipe 110 back to the water mains.

[0025] The features disclosed in the foregoing description, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately, or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

Claims

1. A fire sprinkler system comprising:
 - at least one sprinkler;
 - break tank means (8; 107), for receiving water from a mains water supply (50; 101);
 - pump means (11, 12, 13; 109) for supplying water from said break tank means to said at least one sprinkler; characterised by means (70; 117) for providing water to said at least one sprinkler from said mains water supply other than by way of said break tank means, and including check valve means (71; 118) for preventing reverse flow of water to said mains water supply;
 - and pressure detection means (20, 21, 22; 116) operable to detect pressure of water supplied to the or one or more of said at least one sprinkler, and operable to cause said pump means to be operated when said pressure is below a predetermined value.
2. A fire sprinkler system according to Claim 1, further characterised in that the means for supplying water to the sprinkler(s) other than by way of the break tank means comprises a connecting pipe (70; 117) between a mains supply pipe and a pipe leading to the sprinkler(s).
3. A fire sprinkler system according to Claim 1 or Claim 2, further characterised by including one or more sprinklers at a high level and one or more sprinklers at a lower level and wherein said pressure detection means is provided at a high level in the system.
4. A fire sprinkler system according to Claim 3, further characterised in that said pressure detection means (116) is provided at the level of one or more highest sprinklers of the system.
5. A system according to any one of the preceding claims, further characterised in that said pump means is arranged to be operated so as to provide for supply of water to said at least one sprinkler at a flow rate substantially not greater than a predetermined flow rate which is the sustainable flow rate of water available from the water main.
6. A system according to Claim 5, further characterised by means for measuring the pressure and/or flow rate of water in a pipe leading to said at least one sprinkler, and means for controlling operation of the pump means in accordance with the flow rate and/or pressure thus measured.
7. A system according to Claim 5 or Claim 6, further

characterised in that the pump means includes a number of pumps of which one or more are arranged to be brought into operation according to the number of sprinklers operating.

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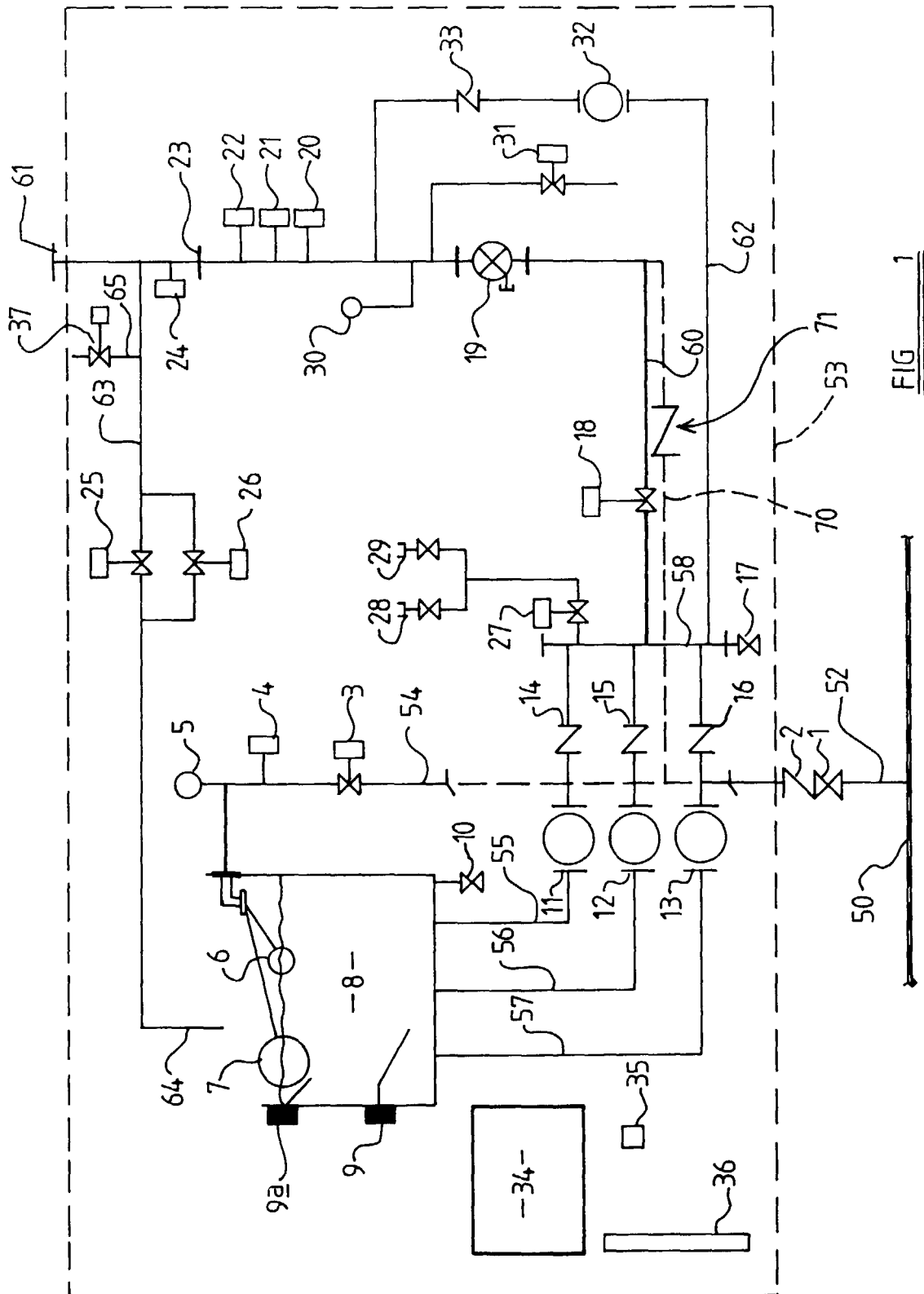


FIG. 1

FIG 2

