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Grenier

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[54] **AUTOMATIC ON-OFF SPRINKLER HEAD**

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[52] **U.S. Cl.** **169/37**, 169/22, 251/45

[51] **Int. Cl.** **A62c 37/06**

[58] **Field of Search** 169/19, 20, 22, 23, 169/37; 251/44, 43, 45; 137/413

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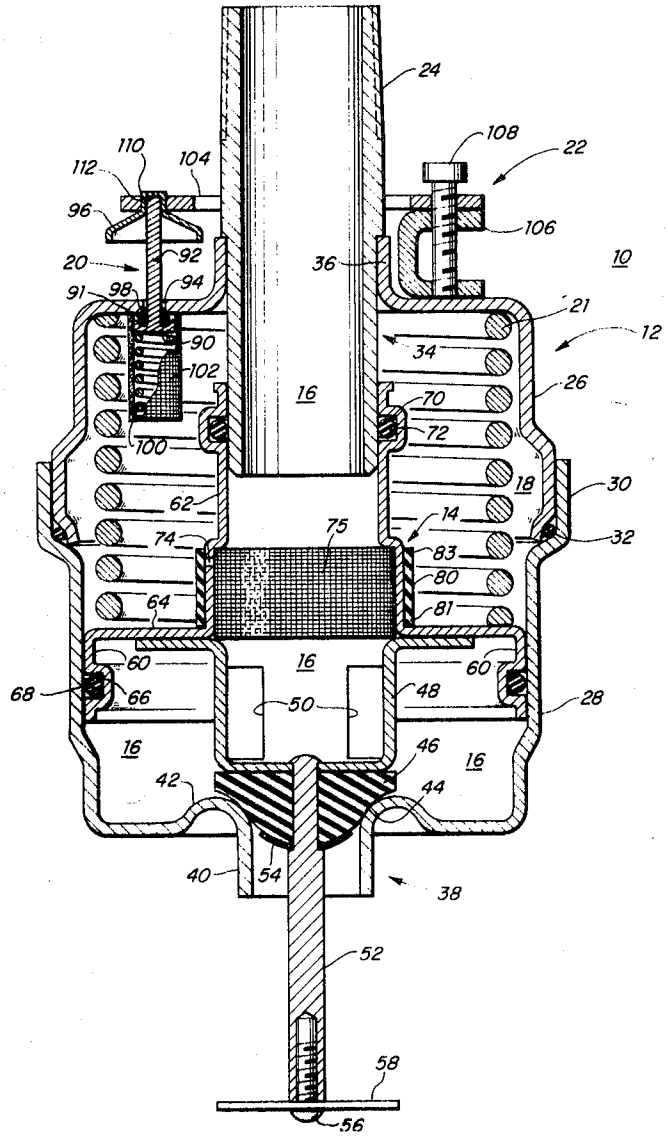
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[57] **ABSTRACT**

An automatic on-off sprinkler head including a housing, a movable partition sealingly engaging the housing for dividing the housing into two chambers: a primary chamber and a control chamber, the housing including an inlet port in the primary chamber adapted for connection with a source of fire quenching fluid and an outlet port in the primary chamber for dispensing fire quenching fluid, a control valve in the control chamber, a heat-responsive device for operating the control valve to turn on the sprinkler head above a predetermined temperature and to turn off the sprinkler head below that temperature, a valve element connected with the partition for closing the outlet port, biasing means for producing a force on the partition to urge the valve element to close the outlet port, and a passage interconnecting the primary and control chambers for enabling equalization of the pressure therein.

20 Claims, 2 Drawing Figures



2 Sheets-Sheet 1

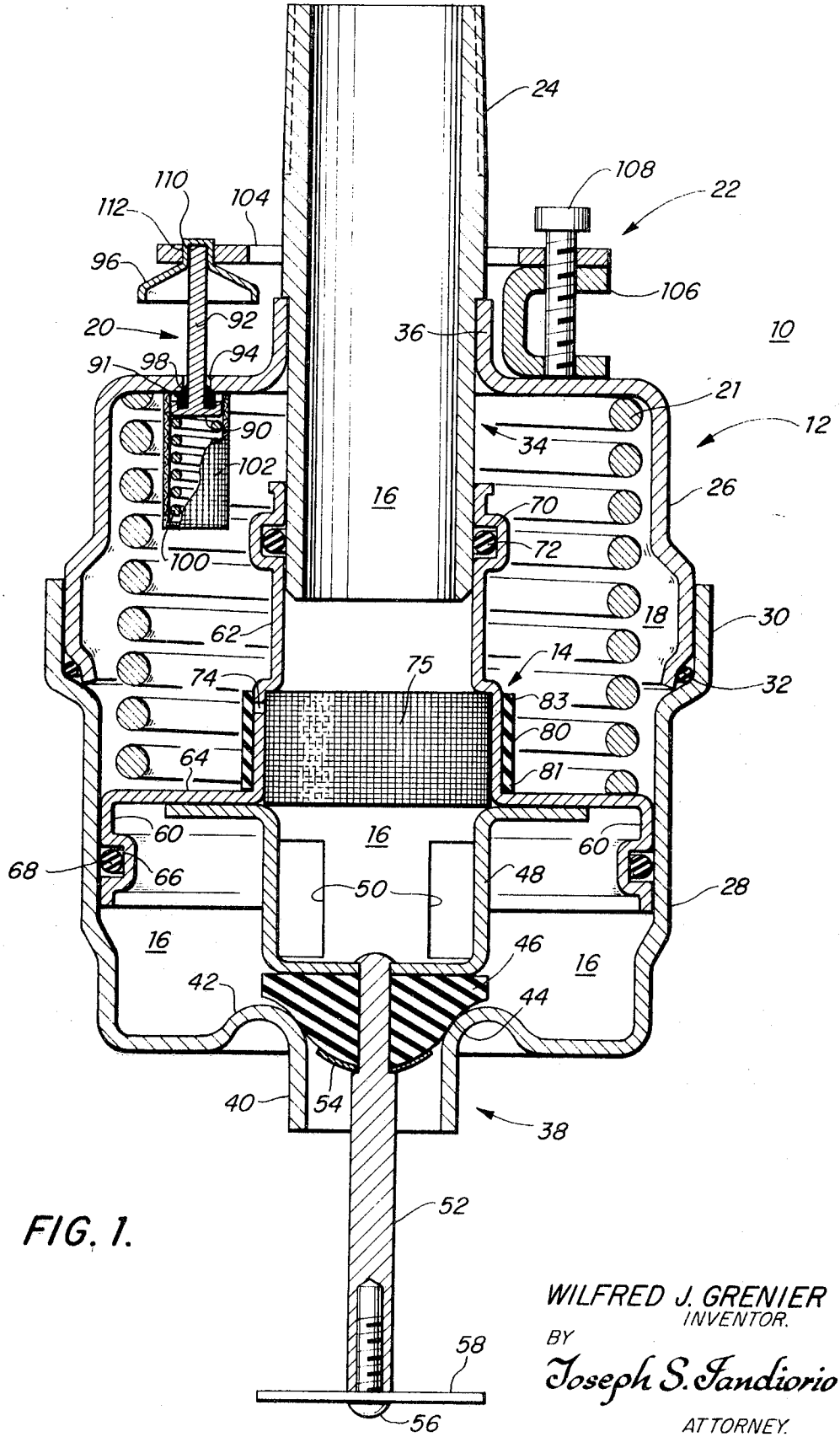


FIG. 1.

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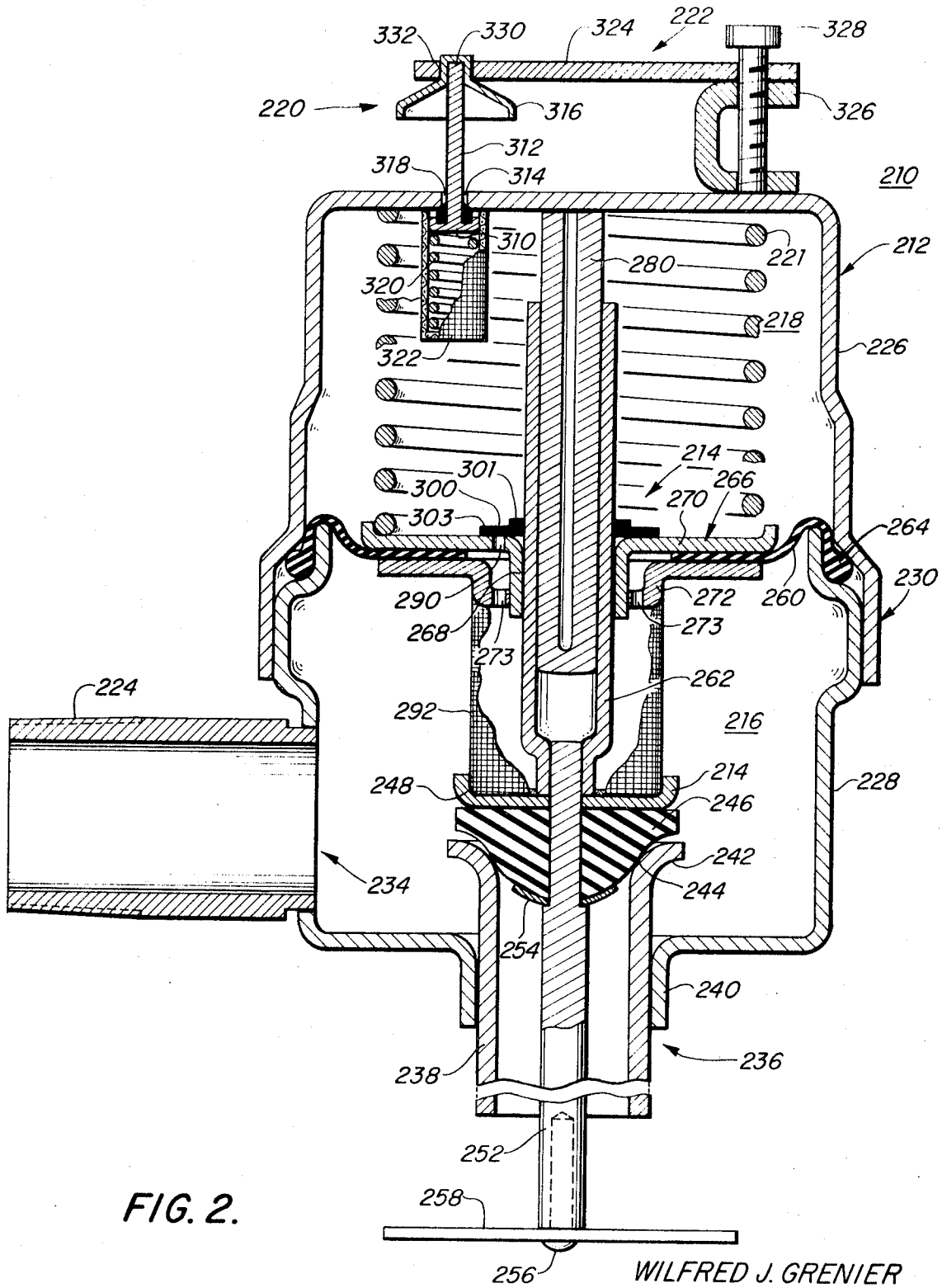


FIG. 2.

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AUTOMATIC ON-OFF SPRINKLER HEAD

FIELD OF INVENTION

This invention relates to an improved sprinkler head which automatically turns on when the temperature increases to a predetermined level and turns off when the temperature decreases below that level.

BACKGROUND OF INVENTION

Conventional fire sprinkler heads generally contain a plug of fusible material which, when subjected to temperatures above a predetermined level, melts and opens the head permitting water or other fire quenching fluid to escape and douse the fire. Since by operation of the head the plug is destroyed, the head remains on and continues to spue forth the fluid even after the temperature has subsided. Attempts to advance the art by using a sprinkler head that automatically turns on and off have met with indifferent success perhaps because the heads have lacked a clean, quick opening and closing action and positive sealing in the off condition.

SUMMARY OF INVENTION

It is therefore an object of this invention to provide a new and improved automatic on-off sprinkler head having quick, sure opening and closing action and positive sealing in the off condition.

This invention features an automatic on-off sprinkler head including a housing and a movable partition sealingly engaging the housing for dividing the housing into two chambers: a primary chamber and a control chamber. The housing includes an inlet port in the primary chamber adapted for connection with a source of fire quenching fluid and an outlet port in the primary chamber for dispensing fire quenching fluid. There is a control valve in the control chamber and a heat-responsive device for operating the control valve to turn on the sprinkler head above a predetermined temperature and turn off the sprinkler head below that temperature. There is a valve element connected with the partition for closing the outlet port and biasing means for producing a force on the partition to urge the valve element to close the outlet port. A passage interconnecting the primary and control chambers enables the equalization of pressure therein.

DISCLOSURE OF PREFERRED EMBODIMENTS

Other objects, features and advantages will occur from the following description of preferred embodiments and the accompanying drawings, in which:

FIG. 1 is a cross-sectional elevational view of an automatic on-off sprinkler head according to this invention.

FIG. 2 is a cross-sectional elevational view of an alternative automatic on-off sprinkler head according to this invention.

The sprinkler head of this invention may be constructed using a housing and a movable partition which sealingly engages with the housing to provide a primary chamber and a control chamber. The housing includes an inlet port and an outlet port in the primary chamber; the inlet port is adapted for connection with a source of fire quenching fluid which is distributed through the outlet port. A passage between the two chambers, preferably located in the partition, permits the fluid provided at the inlet port to fill the control chamber as well as the primary chamber. Thus the pressure in the two

chambers equalizes and the resultant force on the partition is balanced. A valve element connected to the partition is provided to close the outlet port. A biasing device, such as a spring, is used to apply a positive force to the partition in this balanced condition to insure proper seating of the valve element with the outlet port. The outlet port may include a valve seat and the valve element may be made of resilient material to improve the valving action. A control valve in the control chamber is opened by a heat responsive device when a predetermined temperature is reached. Upon the opening of this control valve the fluid in the control chamber is vented to a lower pressure, usually atmospheric pressure, so that the pressure in the control chamber is substantially reduced relative to that in the primary chamber. The difference in pressure between the two chambers produces a resultant force on the partition sufficient to move it and so also move the valve element away from the outlet port. The sprinkler head is now on and discharges the fire quenching fluid. After the fire subsides and the temperature decreases the heat responsive device permits the control valve, usually spring loaded, to return to the closed position. The fluid entering through the inlet port enters through the passage interconnecting the chambers and fills the control chamber and enables the pressures in the two chambers to once again equalize. When the pressures are equalized the spring force moves the partition to position the valve element to close the outlet port and shut off the sprinkler head.

In one embodiment, FIG. 1, sprinkler head **10** includes a housing **12** with a partition **14** that creates two chambers, primary chamber **16** and control chamber **18**, a control valve **20**, spring **21** and heat responsive device **22**.

Housing **12** includes nipple **24**, upper section **26** and lower section **28** joined together at seam **30** where there may be located an O-ring **32** for additional sealing. Inlet port **34** is formed by nipple **24** fitted in collar **36** and outlet port **38** is formed at collar **40**. Nipple **24** extends through control chamber **18** into primary chamber **16**. Raised shoulder **42** provides a valve seat **44** for valve element **46** connected to partition **14** by spider bracket **48** which is formed with large holes **50** to permit free flow of fluid therethrough. Valve element **46** is preferably formed of resilient material such as rubber and fastened in place by stem **52**. A rigid cap **54** may be used to prevent distortion of valve element **46**. At the lower end of stem **52** there is, secured by screw **56**, distributor plate **58** for distributing the fire quenching fluid.

Partition **14** includes cylindrical base **60**, cylindrical neck **62** and intermediate annular member **64**. Base **60** slidingly engages section **28** of housing **12** and has a channel **66** for retaining O-ring **68**. Neck **62** slidingly engages nipple **24** and includes a channel **70** for retaining O-ring **72**. Passage **74** interconnects chambers **16** and **18** to permit chamber **18** to fill from chamber **16** and to permit the pressures in the chambers to equalize. A screen **75** may be used to prevent dust particles from reaching passage **74**.

A unidirectional check valve, rubber cuff **80** may be provided at passage **74** to help prevent surges in line pressure in chamber **16** from accidentally turning on head **10**. Cuff **80** is a flap of resilient material, such as rubber, whose lower periphery **81** tightly grips the base of cylindrical neck **62** and whose upper periphery **83** is

free to flap against neck 62 to seal the end of passage 74 in chamber 18. Cuff 80 permits flow through passage 74 from chamber 16 to chamber 18 when line pressure increases but prevents back-flow from chamber 18 to chamber 16 when line pressure decreases. A drop in line pressure in chamber 16 does not immediately cause a drop in pressure in chamber 18. If such a drop in pressure were communicated to chamber 18 a subsequent sudden surge or increase in line pressure might provide a sufficient pressure imbalance relative to the decreased pressure in chamber 18 to cause head 10 to turn on. Cuff 80 helps prevent this set of conditions from accidentally turning on head 10 by preventing back-flow from chamber 18 to chamber 16.

Control valve 20 includes a valve element 90 on valve stem 92 which passes through vent hole 94 and supports hood 96. Valve element 90 including resilient portion 91 is urged closed against seat 98 by spring 100 in screened enclosure 102.

Heat responsive device 22 includes a bimetallic element 104 mounted on bracket 106 fastened to section 26 of housing 12. Screw 108 threadably engages with holes in bimetallic element 104 and the top and bottom of bracket 106 to provide adjustment of bimetallic element 104. The neck 110 of hood 96 is engaged in hole 112 in bimetallic element 104.

In operation, at normal temperatures, control valve 20 is held closed by spring 100, the pressure in chamber 18 is equal to that in chamber 16 so that the force exerted by spring 21 on partition 14 holds valve element 46 against seat 44 closing outlet port 38 and maintaining head 10 in the off condition. When the surrounding temperature increases to a predetermined level bimetallic element 104 reacts by moving downward at its free end thereby moving valve element 90 off its seat 98 and opening control valve 20. The fluid in chamber 18 is thus vented to the atmosphere through vent hole 94 thereby reducing the pressure in chamber 18. The difference in pressure thus created between chambers 16 and 18 produces a force on partition 14 sufficient to overcome that executed by spring 21 and partition 14 is moved upward. Valve element 46 fixed to partition 14 is likewise moved upward off of seat 44 and outlet port 38 is opened. Head 10 is now in the on condition and fire quenching fluid is discharged from outlet port 38 and distributed by distributor plate 58.

After the fire is out and the temperature decreases, the free end of bimetallic element 104 moves upwardly and permits hood 96, stem 92 and valve element 90 to move upward under the urging of spring 100 until valve element 90 is once again closed on seat 98. When control valve 20 is closed, fluid entering through passage 74 begins to accumulate in chamber 18 and the pressure in chamber 18 approaches that in chamber 16. When the pressures in the two chambers are substantially equal the force of spring 21 moves partition 14 downwardly and valve element 46 closes outlet port 38 restoring head 10 to the off condition.

In an alternative embodiment, FIG. 2, sprinkler head 210 includes a housing 212 with a partition 214 that creates two chambers, primary chamber 216 and control chamber 218, a control valve 220, the spring 221 and heat responsive device 222.

Housing 212 may include a nipple 224, upper section 226 and lower section 228 joined together at seam 230. Housing 212 includes an inlet port 234 and an outlet port 236 in primary chamber 216. Outlet port 236 may include outlet tube 238 fitted in collar 240. Tube 238 may be formed with a flared end 242 to provide valve seat 244 for valve element 246 connected to partition 214 by bracket 248. Valve element 246 is preferably formed of resilient material such as rubber and fastened in place by stem 252. A rigid cap 254 may be used to prevent distortion of valve element 246. At the lower end of stem 252 there is, secured by screw 256, distributor plate 258 for distributing the fire quenching fluid.

Partition 214 includes diaphragm 260 and slide 262 connected therewith. Diaphragm 260 may be a resilient material such as rubber and may include a peripheral bead 264 which when gripped between sections 226 and 228 at seam 230 serves to support diaphragm 260 and slide 262, and improve the seal between sections 226 and 228. Slide 262 may be interconnected with diaphragm 260 by means of support member 266 having a collar 268 fixed to slide 262 and an annular area 270 engaged with diaphragm 260 and a second support member 272 fixed to slide 262 and also engaged with diaphragm 260. Diaphragm 260 is held between members 266 and 272 by any suitable means such as a friction fit, adhesive material or the like.

Slide 262 is a hollow tubular form which is adapted to slide on and sealingly engage guide 280 fixed to section 226.

Passage 290 interconnects chambers 216 and 218 to permit chamber 218 to fill from chamber 216 and to permit the pressures in the chambers to equalize. Member 272 has a plurality of holes 273 in it to provide free flow of fluid therethrough and to insure communication between passage 290 and the rest of chamber 216. A screen 292 may be used to prevent dirt particles from reaching passage 290.

A unidirectional check valve, flat rubber ring 300 may be provided at passage 290 to help prevent surges in line pressure from accidentally turning on head 210 in the same manner as cuff 80, FIG. 1. Ring 300 may be a flap of resilient material, such as rubber, whose inner periphery 301 tightly grips slide 262 and whose outer periphery 303 is free to flap against member 266 to seal the end of passage 290 in chamber 218. Ring 300 permits flow through passage 290 from chamber 216 to chamber 218 when line pressure increases but prevents back-flow from chamber 218 to chamber 216 when line pressure decreases. A drop in line pressure in chamber 216 does not immediately cause a drop in pressure in chamber 218; if such a drop in pressure were communicated to chamber 218 a subsequent sudden surge or increase in line pressure might provide a sufficient pressure imbalance relative to the decreased pressure in chamber 218 to cause head 210 to turn on. Ring 300 helps prevent this set of conditions from accidentally turning on head 210 by preventing back-flow from chamber 218 to chamber 216.

Control valve 220 includes a valve element 310 on valve stem 312 which passes through vent hole 314 and supports hood 316. Valve element 310 including resilient portion 311 is urged closed against seat 318 by spring 320 in screened enclosure 322.

Heat responsive device 222 includes a bimetallic element 324 mounted on bracket 326 fastened to section 226 of housing 212. Screw 328 is threadably engaged in holes in bimetallic element 324 and the top and bottom of bracket 326 to provide adjustment of bimetallic

element **324**. The neck **330** of hood **316** is engaged in hole **332** in bimetallic element **334**.

In operation, at normal temperatures, control valve **220** is held closed by spring **320**, the pressure in chamber **218** is equal to that in chamber **216** so that the force exerted by spring **221** on partition **214** holds valve element **246** against seat **244** closing outlet port **236** and maintaining head **210** in the off condition. When the surrounding temperature increases to a predetermined level bimetallic element **324** reacts by moving downward at its free end thereby moving valve element **310** off its seat **318** and opening control valve **220**. The fluid in chamber **218** is thus vented to the atmosphere through vent hole **314** thereby reducing the pressure in chamber **218**. The difference in pressure thus created between chambers **216** and **218** produces a force on partition **214** sufficient to overcome that exerted by spring **221** and partition **214** is moved upward. Valve element **246** fixed to partition **214** is likewise moved upward off of seat **244** and outlet port **236** is opened. Head **210** is now in the on condition and fire quenching fluid is discharged from outlet port **236** and distributed by distributor plate **258**.

After the fire is out and the temperature decreases, the free end of bimetallic element **324** moves upwardly and permits hood **316**, stem **312** and valve element **310** to move upward under the urging of spring **320** until valve element **310** is once again closed on seat **318**. When control valve **220** is closed, fluid entering through passage **290** begins to accumulate in chamber **218** and the pressure in chamber **218** approaches that in chamber **216**. When the pressures in the two chambers are substantially equal the force of spring **221** moves partition **214** downwardly and valve element **246** closes outlet port **238** restoring head **210** to the off condition.

Other embodiments will occur to those who are skilled in the art and are within the following claims:

What is claimed is:

1. An automatic on-off sprinkler head comprising:

a housing;

a movable partition sealingly engaging said housing for dividing said housing into two chambers, a primary chamber and a control chamber; said housing including an inlet port in said primary chamber adapted for connection with a source of fire quenching fluid, and an outlet port in said primary chamber for dispensing fire quenching fluid;

a control valve in said control chamber;

a heat responsive device for operating said control valve to turn on the sprinkler head above a predetermined temperature and turn off the sprinkler head below that temperature;

a valve element connected with said partition for closing said outlet port;

biasing means for producing a force on said partition to urge said valve element to close said outlet port; and

a passage interconnecting said primary and control chambers for enabling equalization of pressure therein.

2. The sprinkler head of claim **1** in which said movable partition includes a base for sealingly, slidingly engaging said housing and a neck for sealingly, slidingly engaging said inlet port and an intermediate member interconnecting said base and said neck.

3. The sprinkler head of claim **2** in which said base and said neck are generally cylindrical and said intermediate member is generally annular.

4. The sprinkler head of claim **2** in which said inlet port includes an inlet tube, extending through said control chamber into said primary chamber, for sealingly slidingly engaging said neck.

5. The sprinkler head of claim **1** in which said passage extends through said partition.

6. The sprinkler head of claim **1** in which said outlet port includes a valve seat for sealing engagement with said valve element.

7. The sprinkler head of claim **1** in which said valve element includes a resilient material.

8. The sprinkler head of claim **1** in which said biasing means includes a spring member located in said control chamber.

9. The sprinkler head of claim **1** further including a distributor device for distributing the fluid discharged from said outlet port.

10. The sprinkler head of claim **1** in which said partition includes a diaphragm sealingly engaged with said housing.

11. The sprinkler head of claim **10** in which said partition further includes a slide member connected with said diaphragm.

12. The sprinkler head of claim **11** in which said slide member includes an intermediate member for interconnecting said slide member and said diaphragm.

13. The sprinkler head of claim **11** further including a guide member mounted within said housing for slidingly engaging said slide member.

14. The sprinkler head of claim **11** in which said passage extends through said partition.

15. The sprinkler head of claim **11** in which said outlet port includes an elongated outlet tube.

16. The sprinkler head of claim **11** in which said outlet port includes a valve seat for sealing engagement with said valve element.

17. The sprinkler head of claim **11** in which said biasing means includes a spring member located in said control chamber.

18. The sprinkler head of claim **11** further including a distributor device for distributing the fluid discharged from said outlet port.

19. An automatic on-off sprinkler head including a housing, a movable partition sealingly engaging said housing for dividing said housing into two chambers; a primary chamber and a control chamber, said housing including an inlet port in said primary chamber adapted for connection with a source of fire quenching fluid, and an outlet port in said primary chamber for dispensing fire quenching fluid, said movable partition including a base for sealingly slidingly engaging said housing and a neck for sealingly slidingly engaging said inlet port, and an intermediate member interconnecting said base and said neck, a control valve in said control chamber, a heat responsive device for operating said control valve to turn on said sprinkler head above a predetermined temperature, and turn off said sprinkler head below that temperature, a valve element connected with said partition for closing said outlet port; biasing means for producing a force on said partition to urge said valve element to close said outlet port, and a passage interconnecting said primary and control chambers for enabling equalization of pressure therein.

20. An automatic on-off sprinkler head, including a housing, a movable partition sealingly engaging said housing for dividing said housing into two chambers: a primary chamber and a control chamber, said partition including a diaphragm sealingly engaged with said housing and a slide member connected with said diaphragm, said housing including an inlet port in said primary chamber adapted for connection with a source of fire quenching fluid and an outlet port in said primary chamber for dispensing fire quenching fluid and a guide member for slidingly, sealingly engaging said slide member, a control valve in said control chamber, a heat responsive device for operating said control valve to turn on said sprinkler head above a predetermined temperature, and turn off said sprinkler head below that temperature, a valve element connected with said partition for closing said outlet port, biasing means for producing a force on said partition to urge said valve element to close said outlet port, and a passage interconnecting said primary and control chambers for equalization of pressure therein.

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