United States Patent [19]

Johnson

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[54] **THERMALLY INSULATED ACTUATOR FOR FIRE SPRINKLER HEADS**

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[21] Appl. No.: **399,852**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 143,394, May 14, 1971, Pat. No. 3,802,510.

[52] **U.S. Cl.** **169/90;** 251/11

[51] **Int. Cl.** **A62c 37/08**

[58] **Field of Search** ..... 169/1 R, 1 B, 2 R, 26, 169/37, 38, 41, 90; 251/11

[56] **References Cited**

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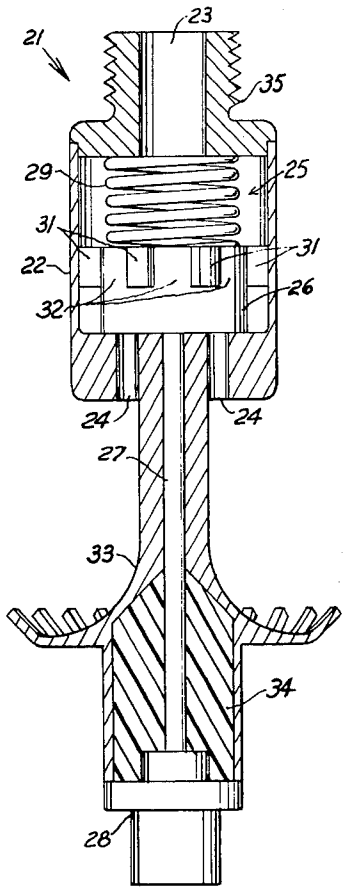
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Assistant Examiner—Michael Mar
Attorney, Agent, or Firm—John E. Toupal

[57] **ABSTRACT**

Disclosed is a mounting system for temperature responsive actuators of automatic fire extinguishing sprinkler heads. Thermal insulation is provided between the temperature responsive actuator and the housing of the sprinkler head.

12 Claims, 7 Drawing Figures



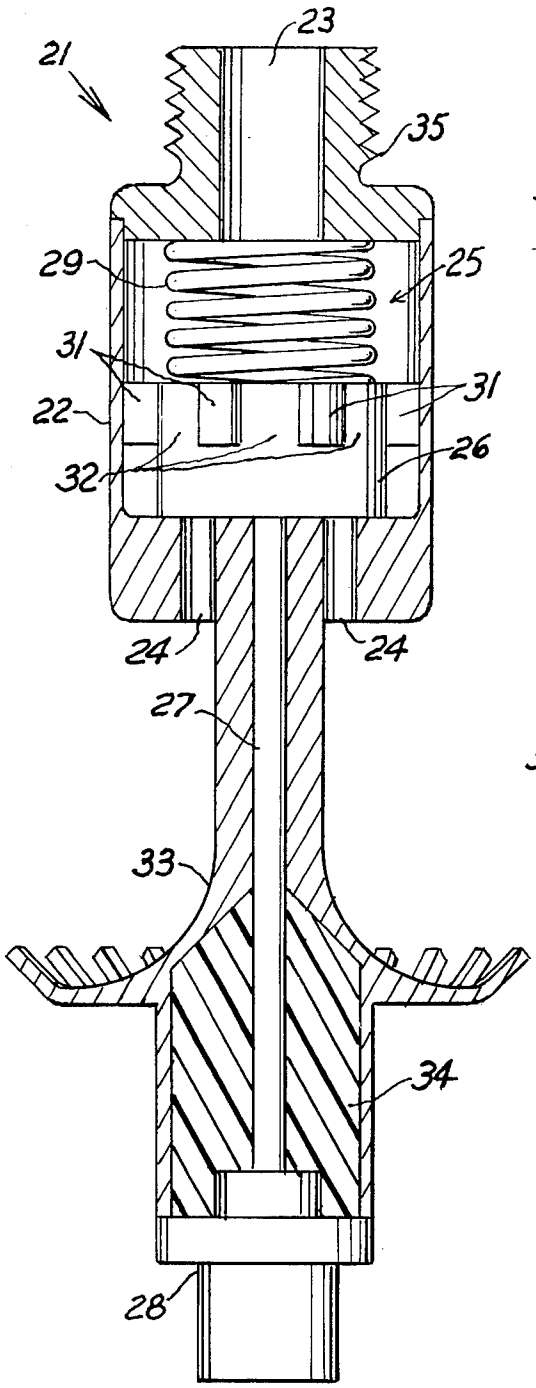


Fig. 1.

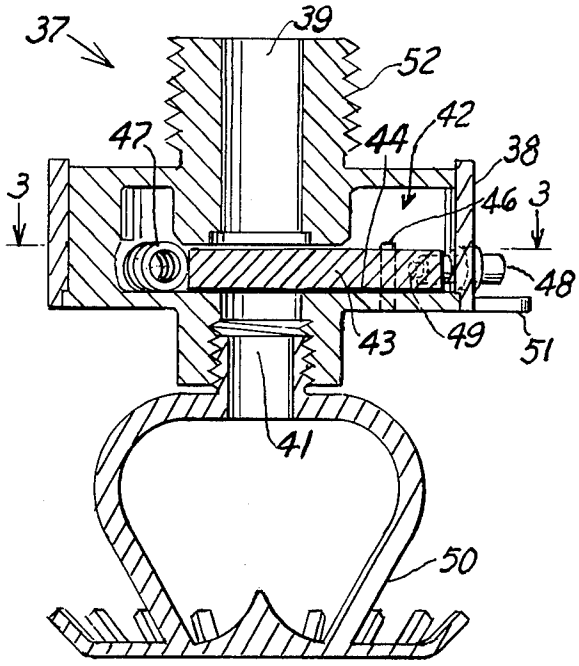


Fig. 2.

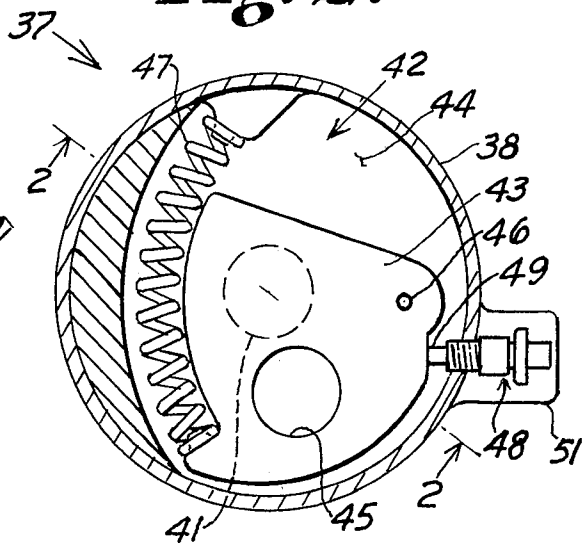


Fig. 3.

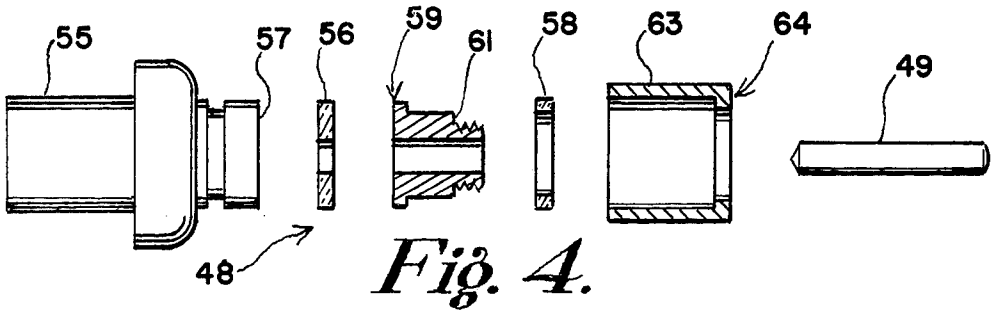


Fig. 4.

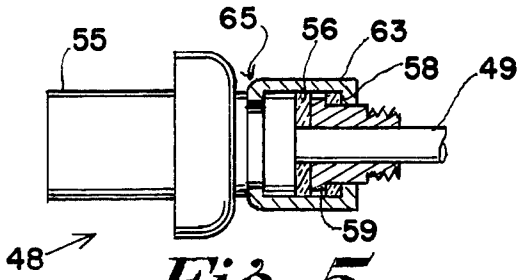


Fig. 5.

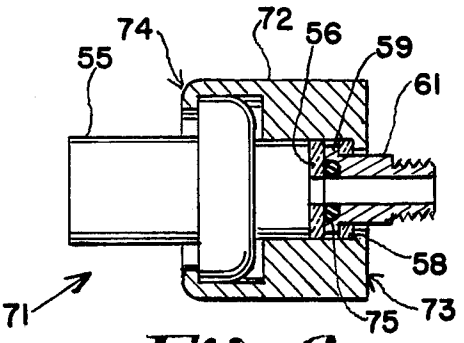


Fig. 6.

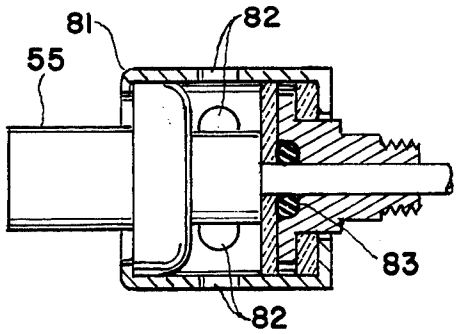


Fig. 7.

THERMALLY INSULATED ACTUATOR FOR FIRE SPRINKLER HEADS

BACKGROUND OF THE INVENTION

This invention is a continuation-in-part of my copending U.S. application Ser. No. 143,394, filed May 14, 1971 now U.S. Pat. No. 3,802,510 and entitled Automatic Fire Sprinkler Head.

This invention relates to fire extinguishing systems and, more particularly, to a mounting system for mounting a temperature responsive actuator to the housing of a fire extinguisher sprinkler head while maintaining thermal isolation therebetween.

The many advantages of automatic fire extinguishing systems have long been known. Furthermore, renewed interest in automatically resetable heads for fire sprinkling systems is evident. Examples of that interest are several recently issued U.s. Pats. such as Nos. 3,698,483; 3,702,160 and 3,734,191.

A problem found in conjunction with resettable heads that did not occur with use of the more conventional "one shot" heads is the danger of premature closing. This can occur if the fire is substantially extinguished and the ambient temperature drops. In such an event, the fire intensity is sure to increase after the cessation of water flow. Extinguishing action can also be terminated prematurely if cooling action around the head due to the flow of the extinguishing medium reaches the thermally responsive control device. Clearly, premature termination of water flow can lead to catastrophic results.

An object of this invention, therefore, is to provide a resettable sprinkler head this is reliable and resists premature termination of flow.

SUMMARY OF THE INVENTION

This invention is characterized by a valve assembly for automatic fire extinguishing systems and includes a housing that defines a fluid passage therethrough. A valve member is within the fluid passage and is coupled to a temperature responsive actuator. Temperature insulation is utilized in the mounting to secure the actuator to the valve housing and restrict thermal communication therebetween. Consequently, many of the aforementioned problems associated with fire extinguishing sprinkler heads are prevented. For example, the flow of cool fire extinguishing medium through the housing cannot effectively cool the temperature responsive sensor and thus prematurely close the valve. In addition, the sensor is more responsive to increases in ambient temperature in that heat loss to the valve housing is minimized.

One embodiment disclosed herein includes a large heat sink in thermal contact with the temperature responsive sensor. The heat sink is heated while a fire persists and, upon extinguishment of the fire or a reduction in the intensity thereof, maintains the temperature responsive sensor at an elevated temperature and thus retains the valve open for a delay period. Consequently the chance of a sprinkler head prematurely closing due to near extinguishment of a fire is reduced.

DESCRIPTION OF THE DRAWINGS

These and other features and objects of the present invention will become more apparent upon a perusal of the following description taken in conjunction with the accompanying drawings wherein:

FIG. **1** is a sectional elevation view of a fire sprinkler head apparatus;

FIG. **2** is a sectional elevation view of another fire sprinkler head embodying the subject insulated mounting system;

FIG. **3** is a sectional plan view of the head depicted in FIG. **2**;

FIG. **4** is an exploded sectional view of the insulated mounting system utilized in the head shown in FIGS. **2** and **3**;

FIG. **5** is a sectional detail view of the mounting system utilized in the head shown in FIGS. **2** and **3**;

FIG. **6** is a sectional view of an alternate insulated mounting system; and

FIG. **7** is a sectional view of another alternate mounting system.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. **1** there is shown a sectional view of an embodiment **21** of the invention including a housing **22** that defines an inlet opening **23** and a plurality of outlet openings **24.** Enclosed in a cavity **25** within the housing **22** is a valve member **26** that is connected by a reciprocating actuator **27** to a temperature responsive control mechanism **28.** Contained within the control mechanism **28** is a body of expansible material that exhibits a substantial volume change during the liquid to solid transition. The melting point can be selected accurately from a wide temperature range by varying the composition of the material. Suitable mechanisms of this type are disclosed, for example, in U.S. pats. Nos. 2,815,174; 2,938,384; and 3,092,322. Changes in volume of the material within housing **28** produce reciprocating mechanical motion of the operatively coupled actuator **27.** Also disposed within the cavity **25,** and positioned between the top thereof and the vavle member **26** is a bias spring **29** that presses the valve member toward the bottom of the cavity, thereby covering and closing the outlets **24.** Projecting from the annular surface of the valve member **26** are a plurality of guides **31** that keep the valve member transversely centered within the cavity **25.** When the valve member **26** is forced upward by the actuator **27,** thereby opening the outlets **24,** water freely flows from the inlet **23** to the outlets **24** through a plurality of gaps **32** disposed between and defined by the guides **31.** Disposed below the outlets **24** and in the path of discharge is a deflector **33** to disperse the flow of water. Between the deflector **33** and the actuator **28** is a large body **34** of thermal insulation material that prevents the flow of water around the deflector **33** from influencing the temperature sensed by the control mechanism **28.** An upper portion **35** of the housing **22** is threaded so that the embodiment **21** may be installed in existing fire extinguishing systems by simply changing valves.

During operation of embodiment **21** valve member **26** is normally in the closed position as shown in FIG. **1,** and held in place by bias spring **29.** In the event of a fire, heat raises the ambient temperature and the temperature of the control mechanism **28** quickly reaches

the melting point of the expansible material. The melting point is sharply defined, and therefore the entire body of expansible material quickly melts and the resultant increase in volume forces the piston actuator **27** in an upward direction. The force of the spring **29** is overcome and the valve member **26** is moved to the open position, uncovering the outlets **24**. Water then flows through the inlet **23**, the gaps **32** and the outlets **24** over the deflector **33** thereby spraying the surrounding area. When the fire is extinguished, as evidenced by a decrease in ambient temperature, the temperature of the control mechanism falls to below the melting point of the expansible material, and the body of expansible material then solidifies and contracts. As the contraction takes place the spring **29** pushes the valve member **26** back to the closed position thereby stopping the flow of water automatically. Typically, the actuator mechanism **28** would be selected to have a reponse in a temperature range between 140°–220°F.

Referring not to FIGS. **2** and **3** there is shown another embodiment **37** of the invention including a housing **38** defining an inlet opening **39** and an outlet opening **41**. Within the housing **38** is a cavity **42** with an eccentric cam **43** resting on a lower surface **44** thereof. The eccentric cam **43** defines a valve opening **45** and is pivotally mounted by a pin **46**. A bias spring **47** holds the cam **43** in a closed position, that is, with the valve opening **45** horizontally displaced from the outlet **41**. Mounted on the housing **38** is a temperature responsive control mechanism **48** that is operatively coupled to the cam **43** by a reciprocating actuator **49**. The control mechanism **48** comprises a sensor similar to that denoted by number **28** is embodiment **21**. The cam **43** mechanically couples the spring **47** to the actuator **49** as a lever, thereby amplifying the force exerted by the spring **47** on the actuator **49**. Disposed below the control mechanism **48** is a deflector **51** to prevent the cooling of the control mechanism by splashing water discharged against a dispensing deflector **50** located below the outlet **41**. An upper portion **52** of housing **38** is threaded so that the unit **37** may be easily substituted for conventional fusible type nozzles in existing fire extinguishing systems.

During operation of embodiment **37** the bias spring **47** normally holds the eccentric cam **43** in the closed position. Heat, caused by a fire, raises the ambient temperature and therefore the temperature of the control mechanism **48** until the melting point of the expansible material is reached. The body of the expansible material then melts quickly, and the associated increase of volume forces the actuator **49** to the left as viewed in FIG. **3**. The eccentric cam **43** is thereby rotated clockwise to the open positions, that is, with the valve opening **45** disposed between the inlet **39** and the outlet **41**. Water then flows through the valve **37**. When the fire is extinguished and the ambient temperature drops, the body of expansible material solidifies, with an associated decrease in volume. As the decrease in volume occurs, the bias spring **47**, through the lever action of the cam **43**, forces the actuator **49** to the right as viewed in FIG. **3**. The valve **37** is then closed, and ready to be recycled. The mechanical leverage furnished by the cam **43** amplifies the force provided by the spring **47** to insure full retraction of the actuator **49** and thereby full closure of the valve. This is an important feature in that actuator mechanisms of this type offer a substantial resistance to full retraction because of the elastic nature of internal gaskets (not shown) that are generally employed. Thus, the lever motion of cam **43** permits use of the full stroke of the actuator **49** while minimizing the bias requirements of the spring **47**. Another important feature of embodiment **37** is that the reciprocating movement of the actuator **49** is transverse to the direction of fluid discharge from the outlet **41**. Because of this relationship and the use of a slide valve, the control mechanism can be mounted out of the path of fluid flow to provide an extremely compact unit.

Referring now to FIGS. **4** and **5** there is shown in detail the thermally responsive control mechanism **48**. An insulated mounting system couples the housing of a thermally responsive sensor actuator **55** to the housing **38** (FIG. **3**). A first insulating washer **56** with a passage therethrough fits against the inner face **57** of the sensor housing. A second insulating washer **58** forms, together with the first insulating washer **56**, an insulating sheath. Retained by the sheath is an annular coupling ring **59** on a threaded rigid mounting member **61**. A tubular cover **63** with an inwardly turned collar **64** on the outer end fits over the sheath and the mounting member **61**. Passing through openings in each of the aforementioned components is the actuator rod **49**.

FIG. **5** shows the components depicted in FIG. **4** in an assembled juxtaposition. It will be appreciated that during assembly the inner end of the tubular cover **63** is crimped to form an inner collar **65** and thus secure the various components together. The tubular cover **63** is in thermal contact with the housing of the actuator **55**. However, it is not in thermal contact with the rigid threaded mounting member **61**. Structural coupling therebetween is supplied through the annular washers **56** and **58**. Thus, the threaded mounting member **61** is effectively thermally isolated from the housing of the thermal actuator **55**. Mounting of the apparatus **48** includes screwing the member **61** into a threaded opening in the side of the housing **38** and tightening the assembly with a wrench accommodated by the exposed outer body surface of the member **61**. Preferably, once assembled, the spacing between the wrench receiving body portion of member **61** and the housing **38** is small, for example 3/16 inches, so as to require a specially sized wrench for disengagement. In this way once assembled the unit is rendered less subject to tampering.

Referring now to FIG. **6** there is shown an alternate mounting system **71** including a thermally responsive sensor **55** and two washers **56** and **58** that form a sheath around an annular ring **59** of a rigid mounting member **61**. A tubular cover **72** includes an enlarged heat sink portion **73**. The actuator rod **49** is not shown to preserve clarity. Observation of FIG. **6** will show that the mounting system **71** is substantially similar to the mounting system **48** except for the inclusion of the heat sink in thermal contact with the housing of the actuator **55** and that an inner collar **74** is formed around a different portion of the housing **55**. Also, the member **61** is provided with an annular recess that accommodates an O-ring **75** that prevents flow of extinguishant fluid out of the valve and into the actuator along the path between the surfaces of the actuator rod and the member **61**. The inner collar **74** is formed in the different location to insure thermal communication between the heat sink and the housing of the sensor **55**. Mounting is, of course, performed similarly by screwing the threaded mounting member **61** into the housing **38**.

FIG. 7 illustrates a slightly modified version of the sensor shown in FIG. 6. In this case the heat sink 73 is replaced by a thin walled tubular cover 81 that renders the unit more sensitive to changes in ambient temperature. Again, an O-ring 83 isolates the actuator from extinguishing fluid. Still further temperature sensitivity is established by a plurality of apertures 82 in the tube 81 that permit air to flow across that portion of the sensor 55 enclosed by the tube 81.

Obviously, many modifications and variations of the present invention are possible in light of the above teachings. It is to be understood, therefore, that the invention can be practiced otherwise than as specifically described.

What is claimed is:

1. A valve assembly for use in automatic fire extinguishing systems and comprising:

a housing defining a fluid passage therethrough;

a valve member in said passage for controlling the flow of fluids therethrough;

temperature responsive actuator means for operating said valve member in response to ambient temperature changes, said actuator means further comprising an actuator housing and a recyclable actuator means for repeatedly operating said valve member in response to repeated ambient temperature changes; and

temperature insulation means for securing said actuator housing to said housing and for restricting thermal communication therebetween.

2. A valve assembly according to claim 1 comprising fluid dispersion means disposed near one end of said fluid passage for dispersing fluid emerging therefrom.

3. A valve assembly according to claim 1 wherein said actuator means comprises a body of material that exhibits a substantial volume increase during the solid to liquid transition and a corresponding volume decrease during the liquid to solid transition and wherein said volume increase is utilized to actuate said valve member.

4. A valve assembly according to claim 1 wherein said temperature insulation means is annular and is coupled to said housing at one end and to said actuator housing at the end of said insulation means opposite said one end.

5. A valve assembly according to claim 4 wherein said actuator means comprises an actuator rod emerging from said actuator housing and operatively coupled to said valve member and wherein said actuator rod passes through said insulation means.

6. A valve assembly according to claim 1 wherein said temperature insulation means comprises insulated mounting means for attaching to said housing and further comprises coupling means for coupling said actuator housing to said insulated mounting means so as to provide thermal insulation in all direct heat transfer paths between said housing and said actuator housing.

7. A valve assembly according to claim 6 wherein said insulated mounting means comprises a rigid mounting member for coupling to said housing and further comprises insulating sheath means for covering said rigid member.

8. A valve assembly according to claim 7 wherein said rigid mounting member comprises an annular portion spaced apart from said housing and said coupling means comprises a tube with an inward collar at each end thereof, and wherein one of said collars is in operative engagement with said annular member and the other one of said collars is in operative engagement with said actuator housing so as to secure said actuator housing to said annular member but wherein a portion of said sheath is disposed between said annular portion and said actuator housing.

9. A valve assembly according to claim 8 wherein another portion of said sheath is disposed between said annular member and said one of said collars.

10. A valve assembly according to claim 8 wherein said tube comprises an enlarged heat sink portion.

11. A valve assembly according to claim 8 wherein said tube comprises openings providing air flow paths to said actuator housing.

12. A valve assembly according to claim 8 including seal means providing a fluid tight seal between said actuator rod and said insulation means.

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