Aug. 25, 1970 TADASHI HATTORI 3,525,402

SPRINKLER HEAD

Filed Jan. 29, 1968 2 Sheets-Sheet 1

Fig. 1.

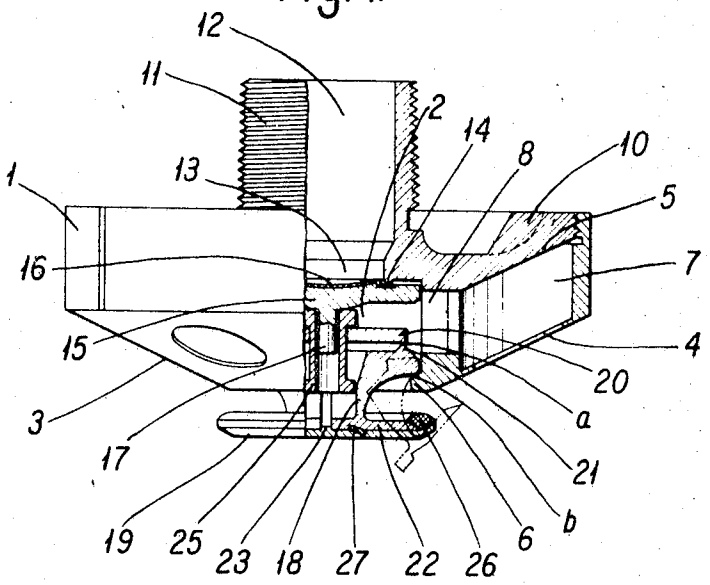
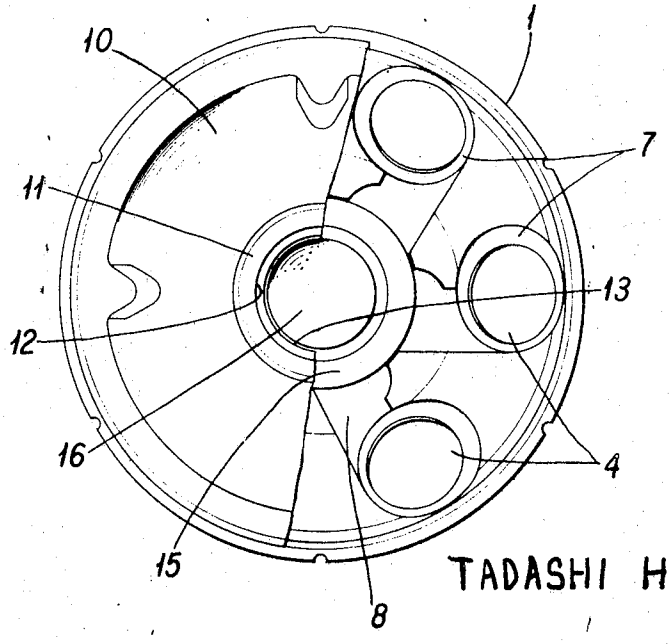


Fig. 2.



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Fig. 3.

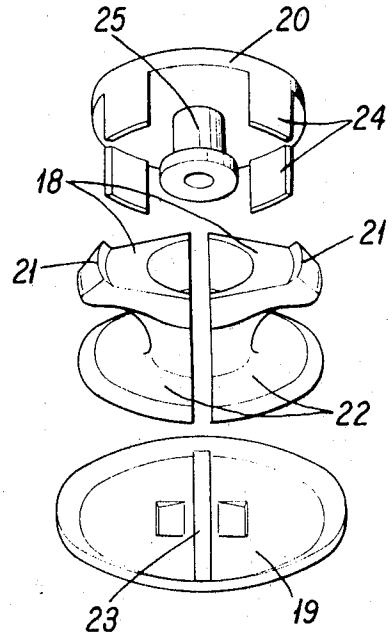


Fig. 4.

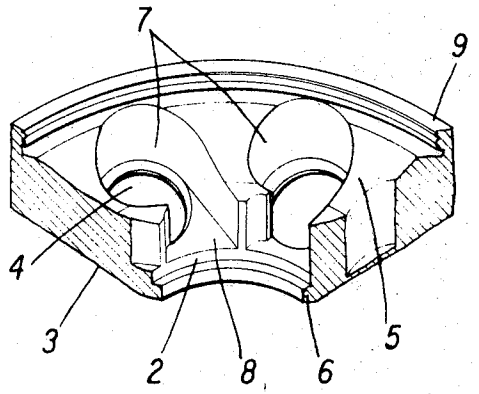
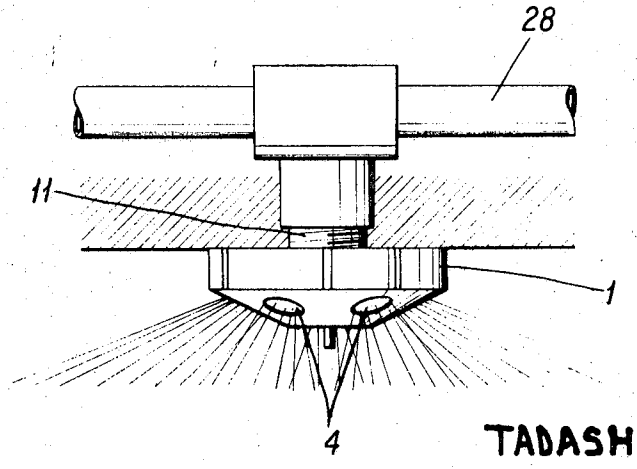


Fig. 5.



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3,525,402

SPRINKLER HEAD

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U.S. Cl. 169—40 3 Claims

ABSTRACT OF THE DISCLOSURE

This invention relates to a sprinkler head which, being installed on the ceiling or the like of a building, spurts water or extinguishing chemicals on the occasion of a fire. The sprinkler head is provided with a plurality of jet holes and characterized by the fact that the greater part of the functioning equipment is concealed inside the main body except the thermo-sensitive plate and the lower part of the lever member which is connected with the said thermo-sensitive plate by means of thermo-sensitive fuse, with the result that in case of emergency the sprinkling covers a very wide range with perfect uniformity without any dead angle. In addition to the foregoing advantage, the sprinkler head has the effects of not spoiling the beauty of any building of the highest quality because of its extremely beautiful appearance prior to its functioning as well as its functioning equipment being free from damage while the body is handled.

The invention relates to a sprinkler head which, installed on the ceiling or the like of a building, spurts water or extinguishing liquid, the valve being automatically opened by the heat on the occasion of a fire.

The known sprinkler head has a single jet hole and since the water spouted from the jet hole is led directly below, a disc-shaped saucer which has radial notches around is provided at the lower edge of a frame formed below the jet hole for the purpose of diffusing the water widely, thereby splashing and dispersing the water in all directions which is spouted from the jet hole directly above. The foregoing device, however, is not free from a dead angle occurring in the water sprinkling range, with the result that there necessarily arise some unsprinklable areas. Moreover, not only uniform sprinkling cannot be obtained even within the sprinkling range, but also the scope of the said dead angle alters according to the pressure of the spouted water, the sprinkling range being remarkably changed as a result. Furthermore, the thermo-sensitive member or the like, mounted between the upper and the lower levers which hold the valve, protrudes further sideways through the frame which projects downward, with the result that there is a risk of the thermo-sensitive member or the like being damaged in course of handling.

The invention makes it possible to solve the foregoing defects of the known sprinkler head, and many aims and advantages of the invention will be clarified by means of the description of the embodiment of the invention with reference to the drawings attached hereto, of which:

FIG. 1 is a vertical section of a part of the sprinkler head of the invention.

FIG. 2 is an upper surface view of the said sprinkler head, showing a part of the upper surface of the body by omitting a part of the upper lid.

FIG. 3 is a dissembled oblique view of the thermo-sensitive member.

FIG. 4 is an oblique view of the body, a part thereof being omitted.

FIG. 5 is a sectional view showing the state of use.

As illustrated by the drawings, the sprinkler head of the invention consists of a body which is provided with

a plurality of jet holes on the lower side thereof, a thermo-sensitive member equipped in the hole in the center of the lower part of the body, an upper lid provided in the upper part of body, and a valve which constantly blocks the water duct provided in the center of the upper lid and opens the water duct as soon as the thermo-sensitive member, having been heated above a certain temperature, starts functioning.

The body **1** has a circular surface in plane view with a hole **2** in its center penetrating the body **1** from top to bottom, the lower surface being formed into a tapering face **3** with a flat top, a plurality of jet holes **4** being formed on the said tapering face **3**. In the embodiment illustrated by the drawing, 6 jet holes **4** are formed at regular intervals and at equal distances from the center of the body **1**, the said holes **4** being bored at a right angle to the tapering face **3**.

The upper surface of the body **1** is also formed into a tapering face **5** more or less parallel with the tapering face **3**, though the central part thereof constitutes a level. An internal flange **6** is integrally formed at the lower edge of the said hole **2**.

From the tapering face **5** of the upper surface of the body **1** toward each jet hole **4**, a circular hollow larger than the jet hole **4** in diameter is formed as a water circuling part **7**, a water inductive route **8** being formed from one side of the circling duct toward the hole **2**, the said inductive route **8** being formed in a tangential direction to the circumference of the circling part **7**.

The upper lid **10** is linked with the body **1** by fitting the male screw on the external periphery of the said upper lid **10** into the female screw formed on the internal periphery of the circumferential wall **9** which is formed on the upper side of the external periphery of the body **1**.

A cylinder **11** threaded outside thereof is integrally formed in the upper part in the center of the upper lid **10**, the inside of the said cylinder **11** constituting a water duct **12**. The lower surface of the upper lid **10** is so formed as fits the tapering face **5** on the upper part of the body **1**, and when the upper lid **10** is linked with the body **1** the lower surface of the upper lid **10** closes the upper part of the circling duct as well as the water inductive route **8** of the body **1**. The lower end of the water duct **12** of the upper lid **10** opens as a valvular mouth **13** under the lower surface of the upper lid **10**, a valve seat **14** which consists of a blade-shaped circular flange being integrally formed around the valvular mouth **13**.

The numeral **15** designates the valve, packing **16** which is in contact with the valve seat **14** being fitted on the upper surface of the valve **15**, a pin **17** being erected in the center at the lower end.

As shown by FIG. 3, the thermo-sensitive part consists of a pair of lever members **18**, a thermo-sensitive plate **19** and a pressure plate **20**. The lever member **18** comprises a projection **21** formed on the terminal end of the arm stretching outward from the upper part and a semicircular fitting plate **22** formed outward at the lower end. The thermo-sensitive plate **19** is in the shape of a disc, the external periphery of which is slightly bent upward, a protruding ridge **23** which passes the center being formed on the upper surface in the middle.

The pressure plate **20** has a diameter which is smaller than the hole **2**, four downward pieces **24** being integrally formed at equal intervals on the periphery of the lower surface, a tube **25** being provided in the center. This tube **25** may be formed either integrally with the pressure plate **20**, or independently of the pressure plate **20** and fitted into the central hole thereof. In either case, however, it is necessary that the pressure plate **20** and the tube **25** should be kept unseparable at all times.

The foregoing pair of lever members **18** are placed on the thermo-sensitive plate **19** so that the linear edge of

the fitting plate **22** at the lower end may hold the protruding ridge from both sides thereof, the thermo-sensitive plate **19** and the fitting plate **22** being jointed together by means of thermo-sensitive fuse **26**, such as a metal of a low melting point and the like. In this case, a skidproof piece **27** is interposed between a pair of hollows on the thermo-sensitive plate **19** and the hollow provided on the lower surface of each fitting plate **22**, respectively. This arrangement serves to prevent the lever member **18** from separating from the thermo-sensitive plate **19**, and the protruding ridge **23** on the thermo-sensitive plate **19** is useful to maintain a precise interval between the right and left lever members **18**.

As described above, the upper part of each lever member which is fixedly mounted on the thermo-sensitive plate **19** is fitted into the hole **2** in the center from the bottom of the body **1**, the external end of the member **18** being hooked on the internal flange **6**.

Then, from the top of the body **1** from which the upper lid **10** has been removed, the pressure plate **20** is loosely fitted into the hole **2**, the downward pieces **24** thereof being placed on both sides of the upper external edge of each lever member **18**, the lower end of each downward piece **24** being located inside the internal flange **6**, the tube **25** being positioned between the lever members **18**, the part adjacent the external periphery of the lower surface of the pressure plate **20** being placed on the projection **21** of each lever member **18**.

Then, the valve **15** is placed on the upper end of the tube **25** by loosely fitting the pin **17** of the valve **15** into the tube **25**, the upper lid **10**, after the packing **16** is turned upward, being screwed into the upper part of the body **1**, thus the valve seat **14** in the center of the lower surface of the lid **10** being pressed against the packing **16**, the mouth of the valve **13** being in the state of air-tight closure by means of the valve **15**.

When the pressure of the valve **15** by means of screwing of the aforementioned upper lid **10** into the body **1** reaches an appropriate degree, a knock pin for the arrest of revolution is knocked into the hole which is appropriately provided across both the upper lid **10** and the body **1**, thereby completing the sprinkler head of the invention.

The sprinkler head of the invention which is assembled as per the foregoing description is linked to the water pipe **28** taking advantage of a screw cylinder **11** as shown by FIG. 5 and the body **1** is fitted directly or adjacently to the ceiling or the like of a building.

In this state, water leak is prevented by means of the valve **15** being pressed against valve seat **14**. Further, a downward force is constantly at work upon the valve **15** by means of the water pressure applied to the valve **15** from the water duct **12**, the said force being transmitted to the pressure plate **20**, which in turn applies pressure to each projection **21** on the pair of lever members **18**.

In the foregoing state, the contact point *a* between the projection **21** and the pressure plate **20** is slightly nearer the center of the body than the contact point *b* between the flange **6** and the lever member **18**, with the result that the force applied to the pressure plate **20** is turned into a revolving force centering on the point *b*.

However, at normal temperature each lever member **18** and the thermo-sensitive plate **19** are fixedly combined with thermo-sensitive fuse **26**, as a result of which the valve **15** is maintained in the closed position, each lever member **18** being hooked to the internal flange **6** and supporting the pressure plate **20**.

In the foregoing state, in case the room temperature abnormally rises or a fire breaks out owing to overheat or the like of the heating apparatus in the room which is equipped with a sprinkler head of the invention, the temperature of the thermo-sensitive plate **19** rises at once and the thermo-sensitive fuse **26** begins to melt when the temperature reaches about 70° C.

As soon as the fuse **26** melts and the combination between the thermo-sensitive plate **19** and the fitting plate **22** is lost, each lever member **18** which is pressed by the pressure plate **20** revolves centering on the contact point *b* between the lower surface of the upper external edge of the member **18** and the internal flange **6** as shown by the dotted line in FIG. 1, as a result of which the fitting plate **22** and the thermo-sensitive plate **19** are completely separated and the thermo-sensitive plate **19** and each lever member **18** are disconnected from the body **1**.

When the lever member **18** and the thermo-sensitive plate **19** are disconnected, the pressure plate **20** is simultaneously disconnected through the hole **2**, with the result that the valve **15** which has been supported by the pressure plate **20** is instantly sent down by the water pressure, the peripheral edge thereof settling on the flange **6** and blocking the lower part of the hole **2**, the valvular mouth **13** being simultaneously opened to the full, the water from the water pipe **28** entering the hole **2** by way of the water duct **12** and the valvular mouth **13** and then flowing into each water circling part **7** through each inductive route **8**, thus starting a circling movement and spouting from each jet hole **4**.

The sprinkler head of the invention performs the foregoing function, and since the inductive route **8** is provided in the tangential direction to the water circling part **7**, the water which flows into the water circling part **7** from the inductive route **8** circles at high speed in a spiral inside the circling part **7** and spurts whirling sidewise from the jet bore **4**.

Since the water coming from each jet hole **4** is in the state of vortex, the water is sidewise spurted dispersing spirally with each jet hole **4** as the center, as a result of which the water stream from each jet hole **4**, colliding and mixing with each other and obtaining uniform granularity, disperses in a wide-angled conic form centering on the body **1** as per FIG. 5, within the range of which sprinkling of nearly uniform density can be effected, burning object within the scope of sprinkling being speedily extinguished and cooled.

As described above, as the sprinkler head of the invention has the effect of giving water fine granularity and wide dispersion by means of making water spurt in a whirlpool through a large number of slanting jet holes **4**, the density of water which is dispersed in fine granularity necessarily changes according as the water pressure change. However, since the scope of sprinkle is scarcely affected and the sprinkling uniformity is constantly maintained, it is comparatively easy to determine the sprinkling scope with considerable precision according to the dimension of the body **1**, the size and the number of the jet holes and the height of fitting, with the result that distribution of the sprinkler heads in the building can be arranged effectively.

Moreover, as the thermo-sensitive plate **19** and the lower part of the lever member **18** are exposed below, there is an advantage of the thermo-sensitive plate **19** being speedily heated when the room temperature rises, reacting sensitively to prevent a fire from becoming disastrous. Another advantage is that the sprinkler head of the invention is not only beautiful in its appearance but free from damage to the functioning parts thereof by an impact with other hard object during storage prior to fitting to the building, during the fitting work to the building, or in the fitted state in the building, because the body **1** conceals all the functioning parts thereof, such as the contact point *b* which works as a fulcrum of the lever member **18**, the contact point *a* which is a point of gravity applying a downward force to the lever member **18**, the valve **15**, and the pressure plate **20** which transmits to the lever member **18** the pressure applied to the valve **15**.

There is a still further advantage that the sprinkler head of the invention is easy to manufacture in large quantities because not only the structure thereof is simple but each part is of a simple shape as well.

The foregoing is a particular description with reference to the attached drawings concerning an embodiment desirable for the invention, and it goes without saying that the invention is not confined to the foregoing embodiment, various modifications being applicable to the structure thereof.

I claim:

1. A sprinkler head consisting of a duct for fire-extingushing liquid, a body having a plurality of jet holes which lead to the said duct, a valve which closes the said duct, a lever member which, being hooked to a part of a hole in the center of said body, receives water pressure applied to said valve, and a thermo-sensitive plate which, being fixed to the part of said lever member protruding outside said body by means of thermo-sensitive fuse, maintains hooking between said lever member and said body at normal temperature under the pressure applied to said lever member, and dissolves the valve-supporting state of said lever member by separation and falling down therefrom when said thermo-sensitive fuse melts at an abnormal rise of temperature, the lower surface of said body being made into a tapering face rising toward the center, said plurality of jet holes being provided on the said tapering face at regular intervals, thereby making each jet hole face obliquely outward.

2. A sprinkler head consisting of a duct for fire-extinguishing liquid, a body having a plurality of jet holes which lead to the said duct, a valve which closes the said duct, a lever member which, being hooked to a part of a hole in the center of said body, receives water pressure applied to said valve, a thermo-sensitive plate which, being fixed to the part of said lever member protruding outside said body by means of thermo-sensitive fuse, maintains hooking between said lever member and said body at normal temperature under the pressure applied to said lever member, and dissolves the valve-supporting state of said lever member by separation and falling down therefrom when said thermo-sensitive fuse melts at an abnormal rise of temperautre, said body having a water circling part formed therein for each jet

hole and an indcuctive route leads to said circling part, said inductive route being provided in a tangential direction to said water circling part, thereby giving the water which flows into said circling part from said inductive route a whirling motion in said circling part and making the water spurt from said jet holes in a whirl.

3. A sprinkler head consisting of a duct for fire-extinguishing liquid, a body having a plurality of jet holes which lead to the said duct, a valve which closes the said duct, a pair of levers the upper external ends of which are hooked to an internal flange formed at the lower end of a hole in the center of said body a projection at the upper external end of each said lever being pressed down with a pressure plate which receives water pressure applied to said valve, thereby giving a revolving force to said levers, and a thermo-sensitive plate which, being fixed to the part of said levers protruding outside said body by means of thermo-sensitive fuse, maintains hooking between said levers and said body at normal temperature under the pressure applied to said levers through said pressure plate, and dissolves the value-supporting state of said levers by separation and falling down therefrom when said thermo-sensitive fuse melts at an abnormal rise of temperature, said thermo-sensitive plate having a protruding ridge provided on the upper surface thereof, said levers being fitted to said protruding edge, thereby maintaining the space between both levers with precision.

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U.S. Cl. X.R.

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