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FOAM-WATER SPRINKLER DEVICE

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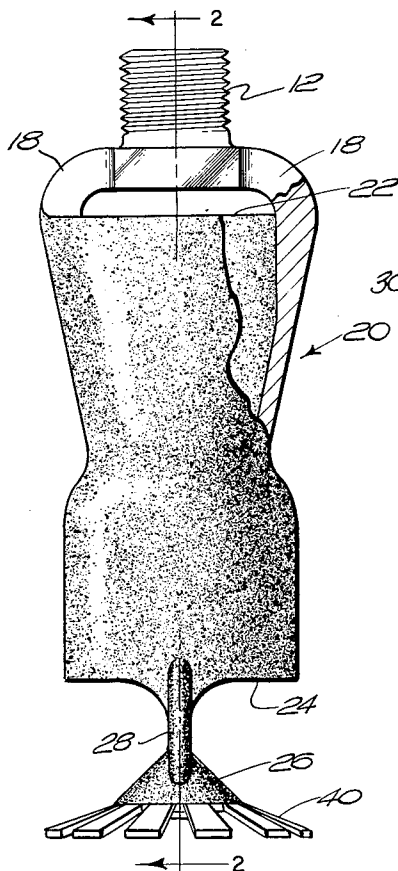


FIG. 1

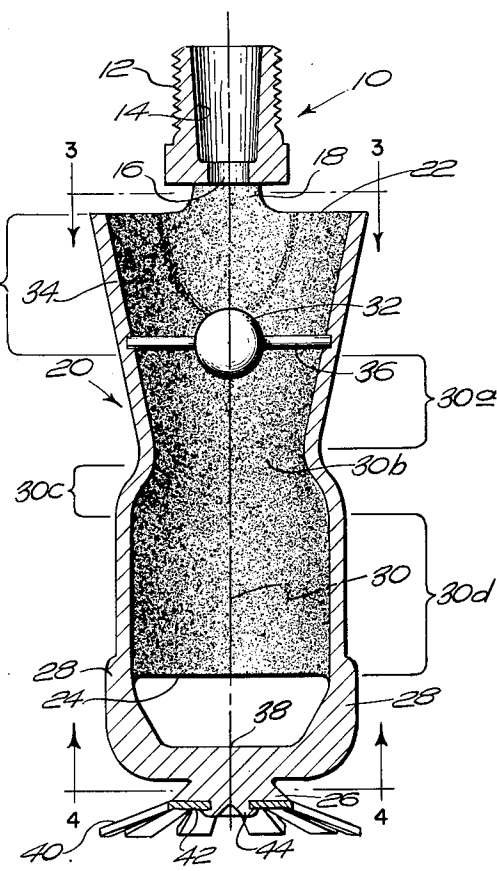


FIG. 2

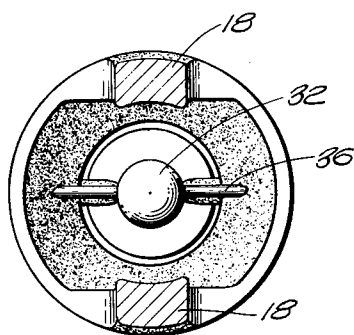


FIG. 3

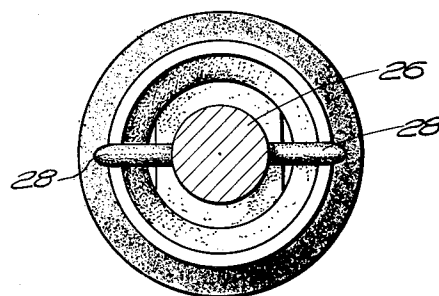


FIG. 4

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FOAM-WATER SPRINKLER DEVICE

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1 Claim. (Cl. 239—432)

This invention relates to improvements in foam-water sprinkler devices for fire extinguishing systems and more particularly has to do with sprinkler heads which form and distribute a mechanical fire-extinguishing foam when a foam agent and water are discharged therethrough from a source of foam agent and water under pressure and which distributes water when water alone is discharged therethrough from a source of water under pressure.

In certain commercial areas where the fire hazard is great because materials located there are highly flammable the putting out of fires by water alone is not regarded as sufficiently certain or rapid, and fire extinguishing equipment is employed which forms and distributes mechanical foam from a mixture of foam agent and water. The supply of water in such a system is normally still plentiful even after the supply of foam agent is exhausted, and although generous amounts of foam agent are provided, prolonged discharge will eventually exhaust this agent. At such time it is expected that the fire will be extinguished, but for the rare case when it has not been completely put out and for the prevention of reignition when the fire has been put out continued discharge of water alone to further control the fire or prevent such reignition is desirable.

Accordingly, efforts have been made in this field to provide sprinkler devices which not only properly form and distribute the foam but also properly distribute water alone after the foam agent is exhausted. Such devices have had some success, but the difficulty has been that they have not combined all of the desirable features for equipment of this kind.

Thus, for a foam-water sprinkler system it is desirable to keep the size of the sprinkler device as small as possible, to provide a strong sprinkler device which is not easily damaged by rough handling during installation and in service and which resists heat, to provide a sprinkler device which can be used either in an upright or pendant position with a minimum of modification, to provide a sprinkler device which forms a good quality foam of such quality that the blanket of foam which accumulates on the surfaces in the protected area is not washed away or greatly damaged by the subsequent discharge of water alone, to provide a sprinkler device which widely and evenly distributes this foam, and to provide a sprinkler device which widely and evenly distributes water alone.

I have discovered a novel sprinkler device structure which achieves each of these desirable objects to a surprising degree. More particularly, I have discovered that unexpectedly good results are obtained when the sprinkler device is in the form of a nozzle presented to one open end of a short barrel which has a tapered first passageway portion tapering to a throat, and in which the throat is followed by an expansion second passageway portion larger than the throat and extending therebeyond, there being a splitter in the path of the nozzle and ahead of the first passageway portion, and there being a deflector spaced beyond the open end of the second passageway portion.

With this structural arrangement I have found that the stream of water and foam agent issuing from the nozzle and impinging on the splitter is directed against tapering walls which constrict the fluids toward the throat. This provides a desirably abrupt change in fluid direction and

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simultaneously compacts and intimately mixes the fluids as they approach the throat. Beyond the throat in the expansion passageway portion the fluids are further mixed and their direction of movement is oriented for final discharge against the deflector.

At the same time with this structural arrangement discharge of water alone from the nozzle provides a water distribution in the protected area comparable in pattern and volume to the foam distribution, and this is a particularly fortunate feature because of the great difference in the properties of foam and water.

Accordingly, it is an object of the present invention to provide an improved foam-water sprinkler device of the kind above described.

I have also discovered that the splitter is unusually effective if it presents to the nozzle orifice a convexed substantially hemispherical surface and even more effective if an axial projection of the nozzle orifice falls entirely on such surface.

Accordingly it is another object of the invention to provide a foam-water sprinkler device of the kind described in which the splitter has its stream-receiving surface substantially hemispherically convexed, and it is another object to have such a splitter surface sufficiently extensive to engage substantially the entire liquid stream from the nozzle.

I have further discovered that manufacture of a device in accordance with this invention is greatly eased if the splitter is in the form of a substantially complete sphere because problems of orientation of the splitter to present the desired surface to the liquid stream are thus avoided. Regardless of how such a ball splitter is turned or twisted during manufacture it still presents the desired hemispherical surface to the liquid stream.

Accordingly, it is another object to provide a foam-water sprinkler device of the kind first above described in which the splitter is a substantially complete sphere.

I have also discovered that by extending the tapered first passageway portion upstream to the end of the barrel into which the nozzle is directed the increase on diameter at such end due to the continuation of taper thereto results in a large air intake opening when such end is left open for an intake. This in turn permits the nozzle to be located close to the barrel end without unduly restricting the ingress of air, and a device of conveniently short overall length results. By having the taper smooth from air-intake end to throat a gradual constriction of fluids takes place.

Accordingly it is another object of the invention to provide a foam-water sprinkler device of the kind first above described in which the end of the barrel into which the nozzle is directed has a diameter greater than the diameter of the upstream end of the tapered first passageway portion. Another object is to provide a device in which the barrel portion between the tapered first passageway portion and the inlet end is also tapered in the same direction of taper as that of the first passageway portion. Another object is to provide a device in which the barrel portion between the tapered first passageway portion and the inlet end has a taper which is a smooth continuation of the taper of the first passageway portion, and another object is to provide a device in which the barrel portion between the tapered first passageway portion and the inlet end has a constant taper which is the same as a constant taper of the first passageway portion and is a smooth continuation of such first passageway portion.

Another object of the present invention is to provide an improved foam-water sprinkler device of the kind described which is compact in size, strong in construction and superior in operation and which is easy and inexpensive to manufacture.

Other objects will appear from the following description:

The best mode in which it has been contemplated applying the principles of the present invention are shown in the accompanying drawings, but the latter are to be deemed merely illustrative because it is intended that the patent shall cover by suitable expression in the appended claims whatever of patentable novelty exists in the invention disclosed.

In the drawings:

FIGURE 1 is a partly sectioned side elevation view of a foam-water sprinkler device in accordance with the present invention;

FIGURE 2 is a cross-sectioned side elevation view taken on line 2—2 of FIG. 1; and

FIGURES 3 and 4 are views taken on lines 3—3 and 4—4, respectively, of FIG. 2.

Referring now to the drawings the foam-water sprinkler device shown comprises a nozzle 10 externally threaded at 12 for connection to a source of water and foam agent under pressure, for example, a piping system (not shown) conducting such materials to the area to be protected from fire.

The nozzle passage 14 is slightly restricted at the discharge orifice 16 by a decrease in diameter, as shown. Secured to the nozzle 10 by short legs 18 is a hollow tubular barrel 20 axially aligned with the axis 30 of the nozzle and open at both its inlet end 22 and its discharge end 24. The end 22 is spaced somewhat from the discharge orifice 16 of the nozzle, and similarly an axially located cone deflector 26 is spaced from the open discharge end 24 of the barrel by short supporting struts 28.

When fluid under pressure, for example, a mixture of foam agent and water, issues from the discharge orifice 16 of the nozzle 10 it is in the form of a solid stream which enters the open inlet end 22 of the barrel along the barrel axis 30 and strikes a ball-shaped splitter 32 supported within the barrel passageway 34 on the barrel axis by a pair of rods 36. This impact fans the stream out against the barrel wall downstream of the splitter. In the embodiment shown the ball splitter 32 has a diameter slightly greater than that of the orifice 16 so that substantially the entire stream impinges on the splitter even if the stream expands somewhat between the nozzle orifice and splitter.

The ball splitter is located at the upstream end of a first barrel passageway portion 30a which is defined by straight-sided walls of the barrel having a converging taper between the upstream end of this first portion and a throat 30b. The cross section of this first passageway portion is substantially circular.

Just beyond the throat 30b in the direction of flow the barrel passageway 30 opens out along a short portion 30c with a taper much more abrupt than the taper in portion 30a to join a final expansion portion 30d having in this embodiment substantially the same diameter as the upstream end first portion.

In the first portion 30a the stream fanned out by the splitter strikes the tapered barrel walls, and the movement of the thus agitated liquid along the barrel passageway entrains air from the open barrel inlet end 22 so that a mixture of air and liquid progresses along the barrel. This mixture is the beginning of the foam which this sprinkler device is intended to form and the further interaction of the liquid and air along the remainder of the barrel and against the deflector completes and distributes this foam mixture.

To assist in the proper entrainment of air from the open inlet end 22 the barrel passageway has another portion 30e upstream of portion 30a. At the inlet end 22 this portion has a diameter substantially greater than the diameter of the upstream end of passageway portion 30a so that air can be freely drawn into the barrel even though the nozzle is located across the inlet end 22 and

to some extent blocks it. This enables the nozzle 10 to be located close to the barrel to keep at a minimum the overall length of the device.

In the embodiment shown the enlarged diameter of passageway portion 30e at the inlet end 22 is achieved by a continuation upstream along portion 30e of the constant taper of portion 30a. This is a preferred arrangement because of its simplicity and smooth flow characteristics.

The splitter 32 preferably presents to the steam a splitting surface on which an axial projection of the discharge nozzle orifice 16 substantially entirely falls so that substantially the entire stream issuing from the nozzle strikes the splitter and is fanned out thereby. This surface is preferably substantially a hemisphere, as is the case, for example, when the splitter 32 is a complete ball having a diameter larger than the diameter of the nozzle opening 16.

One advantage of a hemispherical surface is that it has a large central portion of its surface area which is suitably blunt to agitate the liquid striking this portion and at the same time has a large peripheral portion of its surface area which is suitably angled to redirect and fan out the liquid striking there without greatly retarding the velocity of that liquid.

Another advantage is that by using a ball for a splitter manufacture is greatly simplified because the splitting surface need not be carefully orientated with respect to the nozzle. It is enough to locate the ball in the path of the stream from the nozzle and twisting or turning of the ball does not change the orientation of the splitting surface.

The throat 30b is preferably substantially larger in area than the axially projected area of the splitter.

Beyond the throat 30b, the passageway 30 preferably opens outwardly abruptly to the expansion portion which is preferably cylindrical and has a diameter substantially equal to the diameter of the upstream end of first tapered portion 30a.

The deflector 26 is in the form of a cone axially aligned with the barrel axis 30 and having its apex 38 presented to the open barrel end 24. On issuing from this end the frothy mixture of liquid and air is further agitated by impingement on this cone and is redirected thereby outwardly against suitable tines 40 which extend beyond the cone edge and create the distribution pattern of the final foam on the area to be protected from fire. In the drawings these tines 40 are formed on a separate plate 42 secured to the base of the deflector cone 26 by a rivet 44 integral with the deflector 26, and these tines are disposed to distribute the foam to the floor of the protected area when the device is in the pendent position shown. Other tine shapes (not shown) can be used in a well known manner to distribute the foam to the floor when the device is used in another position, for example, an upright position.

I claim:

A foam-water sprinkler device comprising:

- (I) a hollow tubular member having:
 - (A) an open upstream inlet end,
 - (B) an open downstream discharge end,
 - (C) an axis,
 - (D) a passageway which:
 - (1) is of substantially circular cross section,
 - (2) extends:
 - (i) through said tubular member,
 - (ii) between said ends,
 - (iii) along said axis,
 - (3) has a first portion which is defined by tubular member walls tapering downstream gradually inwardly toward said axis with a substantially constant first taper,
 - (4) has a second portion which:
 - (i) is defined by tubular member walls extending upstream abruptly inwardly

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toward said axis with a second taper substantially greater than said first taper,

(ii) has its upstream end joining the downstream end of the first portion to form a throat, 5

(iii) has a length along said axis substantially shorter than the length of said first passageway portion,

(5) has a third portion which: 10

(i) is between said second portion and said tubular member discharge end,

(ii) is defined by tubular member walls extending parallel to said axis,

(iii) has a cross sectional area greater than a cross sectional area of said throat, 15

(II) a liquid nozzle which:

(A) is connected to said tubular member at said inlet end, 20

(B) has a single discharge orifice directed into said tubular member inlet end along said tubular member axis,

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(III) a ball splitter which:

(A) is located on the upstream side of said first passageway portion,

(B) has a diameter greater than the diameter of said nozzle orifice,

(IV) at least one strut connecting said ball splitter to said tubular member,

(V) a cone deflector which:

(A) is connected to said tubular member across the open discharge end thereof,

(B) has a cone apex presented to said open discharge end on said axis.

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