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(54) **Nozzle for a low-pressure fire extinguishing system, low-pressure fire extinguishing system and method for extinguishing fire**

(57) The invention relates to a nozzle for a low-pressure fire extinguishing system using an extinguishing liquid. The nozzle has a first end and a second end, the first end comprising means for attaching the nozzle to a fire extinguishing system. Further, the nozzle has adjacent to the first end a first spraying level comprising at least one first nozzle head having a liquid channel for the extinguishing liquid with a slot-like opening, the diameter of the channel decreasing towards the opening. Furthermore, the nozzle has a second spraying level comprising at least one second nozzle head having a liquid channel for the extinguishing liquid and at least two guide wings arranged into the liquid channel for bringing the extinguishing liquid into a rotary motion. The invention relates also to a fire extinguishing system and to a method for extinguishing fire.

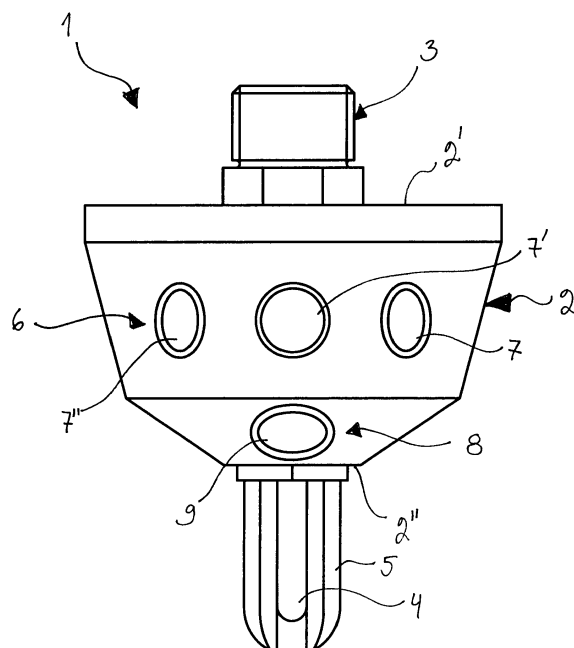


FIG. 1

Description

[0001] The invention relates to a nozzle for a low-pressure fire extinguishing system, a low-pressure fire extinguishing system and to a method for extinguishing fire according to preambles of the enclosed claims.

[0002] Fire extinguishing systems are important safety measures in public and industrial spaces. Numerous different nozzles and spray heads have been suggested in the prior art.

[0003] Many prior art solutions propose systems and nozzles using high pressures for spraying the extinguishing liquid. Some of the high pressure systems use large amounts of water for extinguishing the fire, whereby the damages caused by extinguishing water may be significant, even greater than damages caused by fire.

[0004] Fire extinguishing systems using low water pressure have been developed. An example of a low pressure system is described in WO 95/11060. This system employs nozzles that generate at low pressure an extinguishing fog or mist. However, there still exists a need to improve the extinguishing systems and to provide a system that would be able to generate a more concentrated extinguishing effect.

[0005] Document CN 200320102631.1 discloses a spray nozzle capable of producing different sizes of liquid droplets. This nozzle produces, at the lowest level, smaller water particles than at the higher level, where only water.

[0006] An object of this invention is to minimise or even eliminate the disadvantages existing in the prior art.

[0007] An object is also to provide a nozzle for low pressure extinguishing systems providing an improved extinguishing effect.

[0008] A further object of the invention is to provide a method for extinguishing fire that can be used even in spaces where a large amount of extinguishing liquid can be harmful.

[0009] These objects are attained with the present invention having the characteristics presented below in the characterising parts of the independent claims.

[0010] A typical nozzle according to the present invention for a low-pressure fire extinguishing system using an extinguishing liquid comprises

- a first end and a second end, the first end comprising means for attaching the nozzle head to a fire extinguishing system,
- adjacent to the first end a first spraying level comprising at least one first nozzle head having a liquid channel for the extinguishing liquid with a slot-like opening, the diameter of the channel decreasing towards the opening, and
- in addition, a second spraying level comprising at least one second nozzle head having a liquid channel for the extinguishing liquid and at least two guide wings arranged into the liquid channel for bringing the extinguishing liquid into a rotary motion.

[0011] A typical low-pressure fire extinguishing system according to the present invention and using extinguishing liquid comprises means for distributing the extinguishing liquid to a nozzle and at least one nozzle according to the present invention.

[0012] A typical method according to the present invention for extinguishing fire comprises

- distributing an extinguishing liquid to a nozzle, the pressure of the extinguishing liquid being from 0.5 to 9 bar,
- supplying the extinguishing liquid to a space surrounding the nozzle through a first nozzle head arranged on a first spraying level and through a second nozzle head arranged on a second spraying level of the nozzle,
- increasing the pressure of the extinguishing liquid supplied through the first nozzle head by a channel having a decreasing diameter towards the opening of the nozzle head, and
- bringing the extinguishing liquid supplied through the second nozzle head into a rotary motion.

[0013] Now it has been surprisingly found out that improved extinguishing results can be obtained with a nozzle comprising nozzle heads on two different spraying levels, where the first level nozzle heads create extinguishing sprays with increased pressure and the second level nozzle heads create a fine extinguishing fog. The nozzle according to the present invention is able to combine the advantages of known low pressure nozzles, i.e. low water consumption and creation of cooling and extinguishing fog below the nozzle, with stronger targeted water sprays, which provide more extinguishing power.

[0014] The first and second spraying levels are separate from each other, and preferably situated adjacent to each other. However, it is possible that between the first and second spraying levels is arranged one or more third spraying levels, each third spraying level comprising at least one third nozzle head. The third nozzle head may be similar to first or second nozzle head.

[0015] Furthermore, the second spraying level is preferably arranged adjacent to the second end of the nozzle.

[0016] The first nozzle head also has a liquid channel for the extinguishing liquid, the channel leading to a slot-like opening. The diameter of the liquid channel decreases towards the opening, whereby the liquid pressure and the flow velocity of the extinguishing liquid are increased. The length of the liquid channel is typically 2-25 mm. The liquid channel diameter in the beginning of the liquid channel is typically around 8-11 mm, more typically about 10 mm, and the largest diameter of the slot-like, preferably elliptic, opening is typically 0.1 - 0.2 mm, more typically about 0.1 mm. The liquid channel decrease from the beginning of the liquid channel to the slot-like opening may be a decrease by tenth.

[0017] The second nozzle head has a liquid channel for the extinguishing liquid leading to an outlet, from which

the liquid is sprayed to the surrounding space. At least two guide wings are arranged into the liquid channel for bringing the extinguishing liquid into a rotary motion, so that it is discharged as a rotating conical spray, or so that the discharged spray progresses turning helically around its main axis. The spray that is discharged from the second nozzle thus comprises drops which are distributed in the discharge spray so that the frequency of the drops having a larger diameter is greater at the periphery of the discharge spray than in the inner part of it, and correspondingly, the frequency of the drops having a smaller diameter is greater in the inner part of the discharge spray than at its periphery. The discharge spray comprises drops that have a drop diameter of 0.1 - 1 mm, preferably 0.1 - 0.5 mm. The median size of the drop diameter increases from the inner part of the discharge spray to the periphery by at least 20 %, preferably by more than 50 %. For example, the drop diameter in the peripheral zone of the discharge spray is 0.25 - 0.35 mm and in the middle of the spray 0.15 - 0.25 mm. Second nozzle head is more closely described in WO 95/11060, which is incorporated herein as a reference.

[0018] In principle, one or both of the spraying levels may comprise only one nozzle head. Preferably, however, the nozzle comprises a plurality of first nozzle heads and/or second nozzle heads. This means that the first spraying level may comprise one nozzle head, while the second spraying level comprises a plurality of nozzle heads, or the first spraying level may comprise a plurality of nozzle heads, while the second spraying level comprises one nozzle head, or both the first spraying level and the second spraying level comprise a plurality of nozzle heads.

[0019] The nozzle heads in the different spraying levels are structurally different from each other. Preferably, all the nozzle heads in one level are structurally identical.

[0020] The number of the first nozzle heads and the second nozzle heads need not to be the same. According to one embodiment of the invention the number of first nozzle heads and the number of second nozzle heads are different from each other. According to one embodiment of the invention the total number of the first nozzle heads and the second nozzle heads is 8 - 20. The number of individual nozzle heads is preferably 2 - 8 on first and/or second spraying level. This means that the amount of individual nozzle heads on one spraying level is from 2 to 8, which guarantees effective fire extinguishing results and, at the same time, keeps the amount of used extinguishing liquid as small as possible.

[0021] Normally, when the nozzle is used the extinguishing liquid is supplied through the nozzle at the level from 0.5 to 50 l/minute, preferably at the level from 1 to 10 l/minute. These amounts are so low that the damages caused by extinguishing liquid can be minimised. The improved structure of the nozzle ensures at the same time targeted and effective extinguishing sprays, so that the amount of the extinguishing liquid may be minimised without endangering the extinguishing efficiency.

[0022] According to one embodiment of the present invention the longitudinal axis of the first nozzle head and/or the second nozzle head is arranged in an angle between 0° and 90°, preferably in an angle between 1° and 30°, in relation to a perpendicular line from the first end to the second end of the nozzle. It has been realised that use of these angles improve further the extinguishing efficiency of the nozzle and enable a targeted and specific sprays. It is possible that the longitudinal axes of the first nozzle head and second nozzle head may be arranged in different angles from each other in relation to a perpendicular line from the first end to the second end of the nozzle. Thus it is possible to still further optimise the orientation of the sprays and improve the extinguishing result.

[0023] When the nozzle comprises a plurality of nozzles on the first and second spraying level, the distance of the individual nozzles from each other is 5 - 150 mm, preferably 10-80 mm. The nozzle heads in one level are usually spaced symmetrically on the outer periphery of the nozzle body.

[0024] Moreover, the nozzles heads on the different levels are preferably arranged such that they are on different locations with respect to the line from the first end to the second end of the nozzle.

[0025] According to one embodiment of the invention spray angle of the extinguishing liquid exiting from the opening of the first and/or second nozzle head is 10-120 degrees. This makes it possible to obtain a broad spray of extinguishing liquid which is at the same time rich in small mist particles or droplets.

[0026] The nozzle may comprise also sensor means which monitor the surroundings and trigger the extinguishing action if a certain limit value is exceeded, or the nozzle may be actively connected to such sensor means. The sensor may be a temperature sensor, gas sensor or smoke sensor. The limit temperature that triggers the extinguishing action may be 57 - 260 °C, and it may be selected to suit the surroundings.

[0027] According to one embodiment of the invention the fire extinguishing system comprises a plurality of nozzles having nozzle heads arranged on two spraying levels. The distance between the nozzles is typically 1 - 5 m, preferably 3 - 4 m, most preferably around 3.5 meters.

[0028] According to one embodiment of the invention the pressure of the extinguishing liquid, distributed to the nozzle is at the pressure range from 5 to 8 bar. Typically water is used as extinguishing liquid. If needed, different additives may be added to the water in order to facilitate mist building and/or extinguishing action.

[0029] The present invention is suitable for extinguishing fires for example in confined spaces, such as marine vessels, distribution substations, hotel rooms, churches, care and nursing homes, hospitals and museums.

[0030] The invention is described in more detail with reference to the enclosed Figures, which are to be taken as purely schematic and are not to be construed as limiting the scope of the claims.

[0031] Figure 1 shows a nozzle according to one embodiment of the present invention.

[0032] Figure 1 shows a nozzle according to one embodiment of the present invention. The nozzle 1 has a nozzle body 2. The first end 2' of the nozzle body 2 is connected to means for attaching the nozzle to a fire extinguishing system, such as pipe fitting 3. The extinguishing liquid which is typically water is lead to the nozzle through the pipe fitting 3 from the central extinguishing liquid supply system. The second end 2" of the nozzle body 2 is connected to a trigger element 4 which may comprise a temperature and/or smoke sensor. When the trigger element reacts to heat/smoke the fire extinguishing system is set in action and feed of the extinguishing liquid to the nozzle is started. The trigger element 4 is protected by a frame 5.

[0033] The nozzle body 2 comprises a first spraying level 6 at the first end 2' of nozzle body 2. The first spraying level comprises a plurality of first nozzle heads 7, 7', 7" opening to the surrounding environment. These first nozzle heads 7, 7', 7" comprise liquid channels (not shown) for the extinguishing liquid, which is supplied to the nozzle 2 through the pipe fitting 3. The first nozzle heads 7, 7', 7" comprise liquid channel (not shown) which have a decreasing diameter towards the opening of the first nozzle head 7, 7', 7". This increases the flow velocity and liquid pressure of the extinguishing liquid when it is travelling through the liquid channel towards the opening. When the extinguishing liquid is discharged from the slot-like opening of the first nozzle head 7, 7', 7" it has higher pressure and flow velocity than the liquid, which is fed to the nozzle 2 through the pipe fitting 3.

[0034] The nozzle body 2 comprises also a second spraying level 8 at the second end 2" of nozzle body 2. The second spraying level 8 may comprise a plurality of second nozzle heads, but in Fig. 1 only one second nozzle head 9 is visible. The second nozzle head 9 brings the liquid into a rotary motion with the aid of guide wings (not shown) arranged into the liquid channels. When the liquid comes out from the second nozzle head 9 in rotating motion a broad fine mist spray is obtained.

[0035] Even if the invention was described with reference to what at present seems to be the most practical and preferred embodiments, it is appreciated that the invention shall not be limited to the embodiments described above, but the invention is intended to cover also different modifications and equivalent technical solutions within the scope of the enclosed claims.

Claims

1. A nozzle for a low-pressure fire extinguishing system using an extinguishing liquid, the nozzle having

- a first end and a second end, the first end comprising means for attaching the nozzle to a fire extinguishing system,

- adjacent to the first end a first spraying level comprising at least one first nozzle head having a liquid channel for the extinguishing liquid with a slot-like opening, the diameter of the channel decreasing towards the opening, and
- in addition, a second spraying level comprising at least one second nozzle head having a liquid channel for the extinguishing liquid and at least two guide wings arranged into the liquid channel for bringing the extinguishing liquid into a rotary motion.

2. Nozzle according to claim 1, **characterised in that** it comprises a plurality of first nozzle heads and/or second nozzle heads.
3. Nozzle according to claim 1 or 2, **characterised in that** the total number of first nozzle heads and second nozzle heads is 8 - 20.
4. Nozzle according to claim 2, **characterised in that** the number of first nozzle heads and the number of second nozzle heads is different from each other.
5. Nozzle according to claim 2, **characterised in that** it comprises 2—8 nozzle heads on first and/or second spraying level.
6. Nozzle according to claim 1, **characterised in that** the longitudinal axis of the first nozzle head(s) and/or the second nozzle head(s) is arranged in an angle between 0° and 90° in relation to a perpendicular line from the first end to the second end of the nozzle.
7. Nozzle according to claim 6, **characterised in that** the longitudinal axis of the first nozzle head(s) and/or second nozzle head(s) is arranged in an angle between 1 ° and 30° in relation to a perpendicular line from first end to second end of the nozzle.
8. Nozzle according to claim 6 or 7, **characterised in that** the longitudinal axes of the first nozzle head(s) and second nozzle head(s) are arranged in different angles from each other in relation to a perpendicular line from first end to second end of the nozzle.
9. Nozzle according to claim 1, **characterised in that** spray angle of the extinguishing liquid exiting from the opening of the first and/or second nozzle head is 10- 120 degrees.
10. A low-pressure fire extinguishing system using extinguishing liquid comprising means for distributing the extinguishing liquid to a nozzle and at least one nozzle according to claim 1.
11. A method for extinguishing fire, comprising

- distributing an extinguishing liquid to a nozzle,
the pressure of the extinguishing liquid being
from 0.5 to 9 bar,
 - supplying the extinguishing liquid to a space
surrounding the nozzle through a first nozzle 5
head arranged on a first spraying level and
through a second nozzle head arranged on a
second spraying level of the nozzle,
 - increasing the pressure of the extinguishing
liquid supplied through the first nozzle head by 10
a channel having a decreasing diameter to-
wards the opening of the nozzle head, and
 - bringing the extinguishing liquid supplied
through the second nozzle head into a rotary
motion. 15
12. Method according to claim 11, **characterised in** us-
ing the extinguishing liquid at the pressure range
from 5 to 8 bar. 20
13. Method according to claim 11, **characterised in**
supplying extinguishing liquid through the nozzle at
the level from 0.5 to 50 l/minute.
14. Method according to claim 11, **characterised in** 25
supplying extinguishing liquid through the nozzle at
the level from 1 to 10 l/minute.
15. Method according to claim 9, **characterised in** using
water as extinguishing liquid. 30

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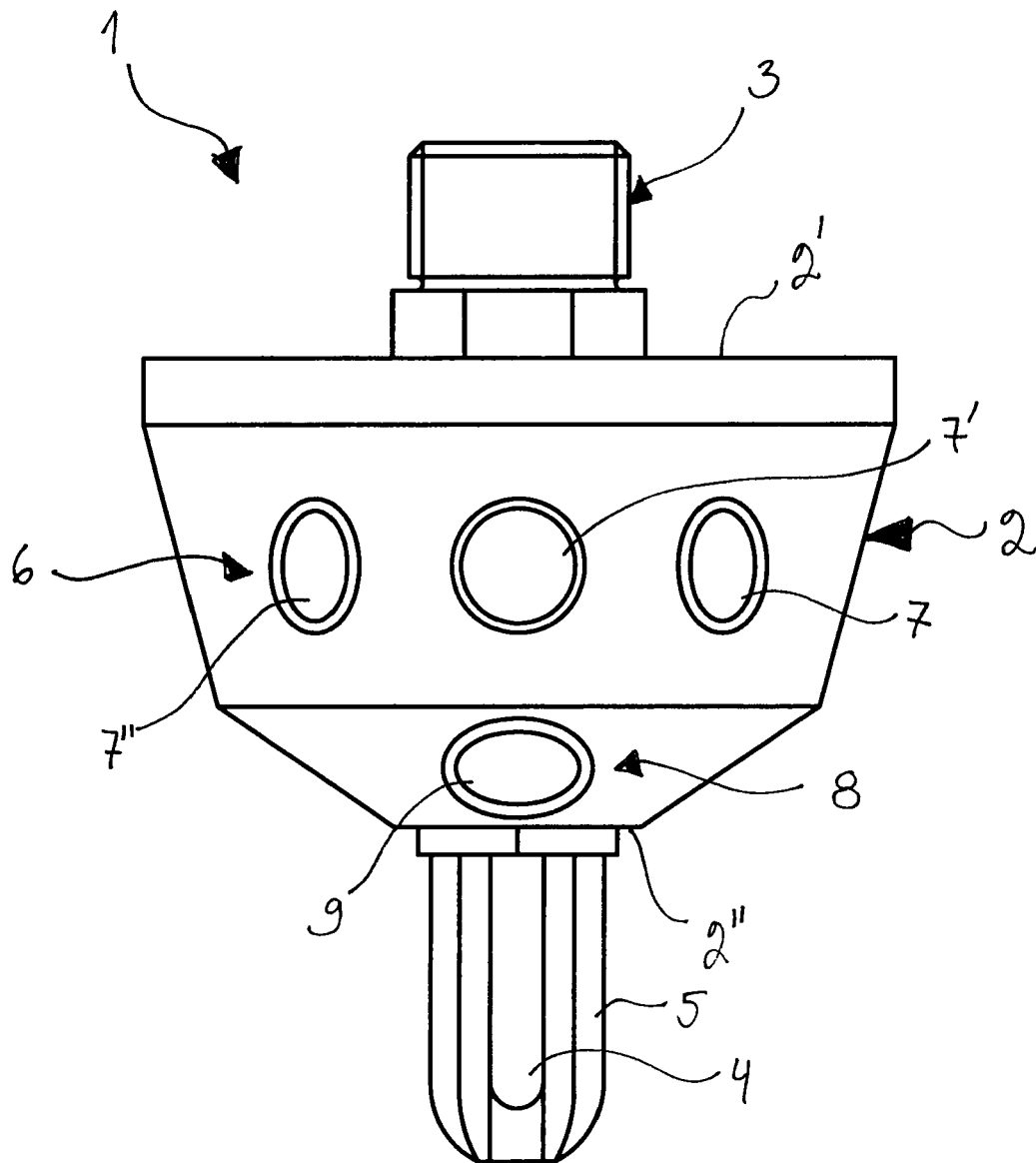


FIG. 1

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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