(54) Title: ANTI-LIGATURE NOZZLE

FIG. 1

(57) Abstract: An anti-ligature nozzle (10) is provided and includes a cage (49) configured to support a bulb (30) configured to be breakable to activate a water spray and a support element (50) configured to support the cage (40) and to release the cage (40) responsive to a breakage of the bulb (30).
ANTI-LIGATURE NOZZLE

BACKGROUND OF THE INVENTION

[0001] The subject matter disclosed herein relates to an anti-ligature nozzle and, more particularly, to an anti-ligature nozzle that prevents people from hurting themselves by hanging on the nozzle.

[0002] In various types of buildings, individual units within the buildings include smoke and fire detecting equipment as well as fire-fighting equipment. Often, the smoke and fire detectors include a cage having a sensing element, which is integrated with a sprinkler that is connected to a main water line. When the sensing element of a cage of a smoke and fire detector detects a smoky or fiery condition in a given unit within a building, at least the local sprinklers activate to permit water to flow out of the sprinklers. In some cases, all the sprinklers in the building activate and in other cases, the activation of the sprinklers is combined with an alarm trigger event.

[0003] Normal cages on sprinklers are designed to withstand large forces to avoid damage and, as such, they can support significant weight. There is a need, however, for an anti-ligature nozzle in certain types of buildings such as mental institutions, psychiatric wards and prisons since the ability of cages to support significant weight can allow an individual to injure themselves while hanging from the cage. In particular, the current cage structure enables an individual to place a wire or thread into the cage and then hang from the wire or thread without breaking the sensing element (i.e., a bulb) and releasing the cage.

BRIEF DESCRIPTION OF THE INVENTION

[0004] According to one aspect of the invention, an anti-ligature nozzle is provided and includes a cage configured to support a bulb configured to be breakable to activate a water spray and a support element configured to support the cage and to release the cage responsive to a breakage of the bulb.

[0005] According to another aspect of the invention, an anti-ligature nozzle is provided and includes a bulb, which is breakable to activate a water spray, a cage configured to support the bulb and to direct a weighted wire threaded through cage to break the bulb and
a support element configured to support the cage and to release the cage upon a breakage of the bulb by the weighted wire.

[0006] According to yet another aspect of the invention, a fire sprinkler system including an anti-ligature nozzle is provided. The anti-ligature nozzle includes a bulb, which is breakable to activate a water spray, a cage configured to support the bulb and to direct a weighted wire threaded through cage to break the bulb and to activate the water spray and a support element configured to support the cage and to release the cage upon a breakage of the bulb.

[0007] These and other advantages and features will become more apparent from the following description taken in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] The subject matter, which is regarded as the invention, is particularly pointed out and distinctly claimed in the claims at the conclusion of the specification. The foregoing and other features, and advantages of the invention are apparent from the following detailed description taken in conjunction with the accompanying drawings in which:

[0009] FIG. 1 is a schematic illustration of a fire sprinkler system in accordance with embodiments;

[0010] FIG. 2 is a perspective view of an anti-ligature nozzle in an operable condition in accordance with embodiments.

[0011] FIG. 3 is a side view of the anti-ligature nozzle of FIG. 2 in an operating condition;

[0012] FIG. 4 is an enlarged side view of a cage of the anti-ligature nozzle of FIGS. 2 and 3 in accordance with embodiments;

[0013] FIG. 5 is an enlarged side view of a cage of an anti-ligature nozzle in accordance with alternative embodiments; and

[0014] FIG. 6 is a side view of a portion of a support element of the anti-ligature nozzle of FIGS. 2 and 3 in accordance with embodiments.
[0015] The detailed description explains embodiments of the invention, together with advantages and features, by way of example with reference to the drawings.

DETAILED DESCRIPTION OF THE INVENTION

[0016] An anti-ligature nozzle is provided and may be used in concert with a fire sprinkler system of a building. In such a system, a supply of fluid under pressure is coupled to sprinklers disposed around the building so that when any of the sprinklers detect or fiery condition, the local sprinklers can activate and respond with a flow of water in, e.g., a mist form. In particular embodiments, the building can be an office building where each individual office has its own individual sprinkler or the building may be a mental institution, a psychiatric ward or a prison. In the case of the mental institution, the psychiatric ward or the prison, each individual cell has its own individual sprinkler but that individual sprinkler is designed to prevent a person in that cell from harming himself by, e.g., hanging from the sprinkler.

[0017] With reference to FIG. 1, an anti-ligature nozzle 10 of a sprinkler system 11 is provided and may be used in a building, such as a school, an office, a mental institution, psychiatric ward and a prison. The system 11 may include multiple anti-ligature nozzles 10 and one or more of these may be designed to prevent or not allow a person to harm himself by hanging from its components. As shown in FIG. 1, the system 11 includes a main water line 12 through which pressurized water may be directed, the multiple anti-ligature nozzles 10 arrayed along the main water line 12 and sub-water lines 13 by which the main water line 12 supplies water to the anti-ligature nozzles 10. In accordance with embodiments, the multiple anti-ligature nozzles 10 may be disposed throughout the building in which the system 11 is deployed with at least one or more anti-ligature nozzles 10 provided in each room, office, unit or cell in the building. Of course, it is to be understood that some areas in the building, such as the lunchroom, may have multiple anti-ligature nozzles 10 deployed therein.

[0018] As shown in FIG. 1, the system 11 may further include an alarm system 14. In accordance with embodiments, this alarm system 14 may be operably coupled to each of the anti-ligature nozzles 10 and can be tripped and activated along with an activation of one or more of the anti-ligature nozzles 10.
[0019] With reference to FIGS. 2 and 3, each of the multiple anti-ligature nozzles 10 includes a nozzle body 20, a bulb 30, a cage 40 and a support element 50. The nozzle body 20 may be coupled to a corresponding one of the sub-water lines 13 or to the main water line 12 and may be provided with an upside-down frusto-conical shape. The nozzle body 20 includes a plurality of emitters 21 disposed about an exterior surface thereof which are disposed to emit water provided from the main water line 12 outwardly when the anti-ligature nozzle 10 is activated. When each of the emitters 21 emits water, the anti-ligature nozzle 10 produces a water spray in multiple radial directions.

[0020] The bulb 30 is breakable to activate the generation of the water spray and includes a temperature sensitive bulb element 31. The bulb 30 includes a glass encased expandable fluid that expands beyond the capacity of the glass encasement in the presence of elevated ambient temperatures. That is, in accordance with embodiments, the bulb 30 may be disposed to apply pressure to a pip cap within the nozzle body 20 that acts as a plug to prevent water from flowing into and through the emitters 21 until the ambient temperatures around the anti-ligature nozzle 10 reach a design activation temperature. At this temperature, the glass encasement bursts due to the interior pressure of the expandable fluid and allows the pip cap to unplug and permit water flow.

[0021] The cage 40 is configured to support the bulb 30 and to direct a weighted wire 60, which is threaded through cage 40, toward and into contact with the bulb 30 such that the bulb 30 breaks even if ambient temperatures are less than the design activation temperature to thereby activate the water spray. The cage 40 includes an upper portion 42 and a lower portion 43. As shown in FIG. 3, the upper portion 42 includes an annular body 420 having through-holes 421 defined therein. The annular body 420 of the upper portion 42 is normally fit inside an annular region defined in the nozzle body 20 and is held in place by the support element 50, as will be described below.

[0022] With reference to FIGS. 2-5, the lower portion 43 includes two or more leg portions 430 that extend downwardly from the annular body 420 in a tapered formation. The leg portions 430 may be integrally formed with the annular body 420 and meet at intersection 431 to define a downwardly curved interior facing surface 432. The interior facing surface 432 is coupled to a lower end of the bulb 30 proximate to the intersection 431. Thus, as shown in FIGS. 2 and 3, if a wire 60 were to be threaded into and through the cage 40 and weighed down (by any predefined weight), the wire 60 would tend to slide down the interior
facing surface 432 and impact the bulb 30. This impact will break the bulb 30 even if ambient temperatures are well below the design activation temperature and activate the water spray. In addition, if the weight applied to the wire 60 is greater than a design weight of the support element 50, the support element 50 will release the cage 40 so that the cage 40 drops away from the nozzle body 20.

[0023] As shown in FIG. 5 and, in accordance with further embodiments, the cage 40 may further include a downwardly curved exterior facing surface 433. The exterior facing surface 433 is coupled to an upper end of the bulb 30 and, in cooperation with the interior facing surface 432, provides only a small window 434 by which the bulb 30 is exposed to ambient temperatures. In this embodiment, the cage 40 has an increased thermal mass but the bulb 30 is provided with greater mechanical support and there is a reduced amount of space through which the wire 60 can be threaded.

[0024] With reference to FIGS. 1, 2 and 6, the support element 50 is configured to support the cage 40 to remain suspended by the nozzle body 20 and to release the cage 40 from the nozzle body 20 upon a breakage of the bulb 30 and/or upon an application of weight to the cage 40 that exceeds a design weight limit of the support element 50 (in accordance with some embodiments, the design weight will be the weight of a human being). That is, if an individual attempted to harm himself by hanging from the wire 60, the individual's weight would exceed the design weight limit of the support element 50. As a result, the wire 60 will be drawn by the individual's weight into the bulb 30 such that the bulb 30 will break and the anti-ligature nozzle 10 will be activated to generate the water spray. The individual's weight will also cause the support element 50 to release the cage 40 from the nozzle body 20 (see FIG. 3) so that the individual will be prevented from hanging from the any part of the cage 40.

[0025] As shown in FIG. 6, the support element 50 includes a ball bearing support structure 51. The nozzle body 21 is provided with a bearing ring 52 that includes one or more ball bearings 53. The ball bearings 53 are normally biased to extend inwardly from the bearing ring 52 such that they extend into the through-holes 421 defined in the annular body 420 of the upper portion 42 of the cage 40. The bias applied to the ball bearings 53 is sufficient to suspend the cage 40 in nozzle body 20 but will be insufficient to withstand a weight applied to the cage 40 that exceeds the design weight limit of the support element 50 if the bulb 30 is broken. In the case of an excessive weight being applied to the cage 40 so
that the bulb 30 is broken, the ball bearings 53 will be forced outwardly from the through-holes 421 and into the bearing ring 52 in opposition to the bias. This will in turn release the cage 40 from the nozzle body 20 and allow the cage 40 to fall.

[0026] As noted above, the release of the cage 40 from the nozzle body 20 will cause the anti-ligature nozzle 10 to activate to generate the water spray and may cause the alarm system 14 to activate as well. The water spray or the resultant alarm will then serve as an indication that assistance may be required for the individual who caused the release of the cage 40.

[0027] While the invention has been described in detail in connection with only a limited number of embodiments, it should be readily understood that the invention is not limited to such disclosed embodiments. Rather, the invention can be modified to incorporate any number of variations, alterations, substitutions or equivalent arrangements not heretofore described, but which are commensurate with the spirit and scope of the invention. Additionally, while various embodiments of the invention have been described, it is to be understood that aspects of the invention may include only some of the described embodiments. Accordingly, the invention is not to be seen as limited by the foregoing description, but is only limited by the scope of the appended claims.
CLAIMS:

1. An anti-ligature nozzle, comprising:
   a cage configured to support a bulb configured to be breakable to activate a water spray; and
   a support element configured to support the cage and to release the cage responsive to
   a breakage of the bulb.

2. The anti-ligature nozzle according to claim 1, wherein the cage is configured to
direct a weighted wire threaded through the cage to break the bulb.

3. The anti-ligature nozzle according to claim 1, wherein the cage comprises:
   a downwardly curved interior facing surface coupled to a lower end of the bulb; and
   a downwardly curved exterior facing surface coupled to an upper end of the bulb.

4. The anti-ligature nozzle according to claim 1, wherein the support element
comprises a ball bearing support structure releasably coupled to the cage.

5. An anti-ligature nozzle, comprising:
   a bulb, which is breakable to activate a water spray; and
   a cage configured to support the bulb and to direct a weighted wire threaded through
cage to break the bulb; and
   a support element configured to support the cage and to release the cage upon a
breakage of the bulb by the weighted wire.

6. The anti-ligature nozzle according to claim 5, wherein the bulb comprises a
temperature sensitive bulb.

7. The anti-ligature nozzle according to claim 5, wherein the bulb comprises a glass
encased expandable fluid.

8. The anti-ligature nozzle according to claim 5, wherein the cage comprises a
downwardly curved interior facing surface coupled to a lower end of the bulb.
9. The anti-ligature nozzle according to claim 5, wherein the cage further comprises a downwardly curved exterior facing surface coupled to an upper end of the bulb.

10. The anti-ligature nozzle according to claim 5, wherein the support element comprises a ball bearing support structure releasably coupled to the cage.

11. A fire sprinkler system including an anti-ligature nozzle, comprising:

   a bulb, which is breakable to activate a water spray; and

   a cage configured to support the bulb and to direct a weighted wire threaded through the cage to break the bulb and to activate the water spray; and

   a support element configured to support the cage and to release the cage upon a breakage of the bulb.

12. The fire sprinkler system according to claim 11, wherein the bulb comprises a temperature sensitive bulb.

13. The fire sprinkler system according to claim 11, wherein the bulb comprises a glass encased expandable fluid.

14. The fire sprinkler system according to claim 11, wherein the cage comprises a downwardly curved interior facing surface coupled to a lower end of the bulb.

15. The fire sprinkler system according to claim 11, wherein the cage further comprises a downwardly curved exterior facing surface coupled to an upper end of the bulb.

16. The fire sprinkler system according to claim 13, wherein the support element comprises a ball bearing support structure releasably coupled to the cage.

17. The fire sprinkler system according to claim 11, further comprising an alarm system, which is configured for activation in response to the breakage of the bulb.
**A. CLASSIFICATION OF SUBJECT MATTER**

INV. A62C37/14 A62C31/28

ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

A62C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>wo 03/074131 AI (PERBRISU LTD [IE] ; COSGROVE JOHN JAMES [IE] ) 12 September 2003 (2003-09-12) page 1, line 8 - line 20 page 3, line 9 - line 20 figure 2</td>
<td>1,5,11</td>
</tr>
</tbody>
</table>

Further documents are listed in the continuation of Box C. See patent family annex.

- Special categories of cited documents:
  - "A" document defining the general state of the art which is not considered to be of particular relevance
  - "E" earlier application or patent but published on or after the international filing date
  - "L" documents which may throw doubts on priority claim(s) one of which is cited to establish the publication date of another citation or other special reason (as specified)
  - "O" document referring to an oral disclosure, use, exhibition or other means
  - "P" document published prior to the international filing date but later than the priority date claimed
  - "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
  - "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
  - "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
  - "A" document member of the same patent family

**Date of the actual completion of the international search**

4 July 2014

**Name and mailing address of the ISA**

European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016

**Date of mailing of the international search report**

15/07/2014

**Authorized officer**

Nehrdich, Martin
<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patent document cited in search report</td>
<td>Publication date</td>
<td>Patent family member(s)</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>-----------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CA 2522077 A1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FI 20030620 A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>JP 2006524125 A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 2006237199 A1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WO 2004094000 A1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EP 1487545 A1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 2005224240 A1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WO 03074131 A1</td>
</tr>
<tr>
<td>US 2002088624 A1</td>
<td>11-07-2002</td>
<td>NONE</td>
</tr>
<tr>
<td>WO 2013117907 A2</td>
<td>15-08-2013</td>
<td>NONE</td>
</tr>
</tbody>
</table>