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(54) **DEVICE FOR DISPENSING LIQUIS, IN PARTICULAR FOR FIRE PROTECTION**

(57) Device for dispensing liquids (100), in particular for fire protection systems, said device comprising a first tubular delivery element (10) adapted to be connected to a main supply piping, a second tubular dispensing element (12) hydraulically connected to said first tubular delivery element (10) for dispensing said liquids in the environment; wherein said second tubular dispensing element (12) is suited to be put into rotation.

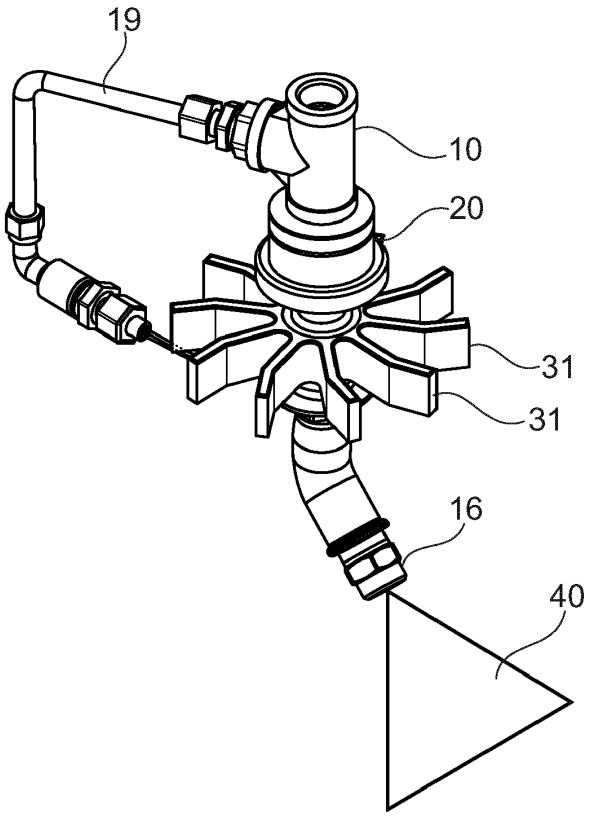

Fig. 5

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Description

TECHNICAL FIELD OF THE INVENTION

[0001] The present invention relates to the field of fire protection systems. In particular, the present invention relates to the field of fire protection systems, particularly suited for galleries, tunnels, underpasses and closed environments of not exclusively large size. In detail, the present invention relates to a device for dispensing liquids and/or fluids (in particular, water but also foaming solutions or the like) adapted to be used in systems of aforesaid type. In greater detail, the present invention relates to a device of the aforesaid type designed to allow the atomization of the dispensed liquid and/or fluid, i.e. its subdivision into small-size drops, in particular of smaller size than those which can be obtained by using spray nozzles and/or dispensers according to the prior art, the flow rate and supply pressure being equal.

BACKGROUND ART

[0002] The need is known among sector operators to ensure the highest safety standards in highway and railway tunnels. In particular, the need is particularly felt to prevent fires in the aforesaid tunnels, or at least to contain them or at most to appropriately extinguish them, i.e. as rapidly as possible, with means which are readily and immediately available, suited to be implemented in equally simple and immediate manner.

[0003] However, the arrangement of fire prevention systems in highway and/or railway tunnels which meet the aforesaid requirements poses various problems of both operational and logistic type, which are still at least partly unsolved.

[0004] Firstly, it is worth noting that the arrangement and the installation of a fire prevention system in a tunnel is made problematic by the intrinsic features of the tunnel itself, especially in the case of very long tunnels, in which the intrinsic features of the tunnels often make installing fire protection systems unfeasible although appreciable and effective when used in different environments, such as industrial and/or civil environments.

[0005] Indeed, the intrinsic features of the tunnels make it difficult to install permanent piping capable of guaranteeing the required water flow rate (precisely in consideration of the lengths of the aforesaid piping, often exceeding several kilometers); furthermore, the water flow rates required, precisely in consideration of the lengths of piping and the inevitable load losses, may be guaranteed only by installing storage and supplying tanks, as well as thrust pumps of considerable size. It goes without saying, however, that the installation of these storage tanks and/or thrust pumps inside tunnels is subject to the conformation of the tunnels themselves, so these installations must be provided outside of the tunnels since the necessary space lacks in many cases. Finally, it should not be overlooked that in the case of tunnels, since the possibility of diverting traffic is limited or null, operations both for installing and maintaining fire protection systems must necessarily be performed rapidly and at times during which the road and/or railway traffic is at least reduced.

[0006] In consideration of these issues, the orientation assumed in the recent past by sector operators has been to prioritize low-pressure fire protection systems with consequent low consumption of water (and/or of foaming solutions or the like), precisely in order to contain the size of the supply piping and that of the ancillary installations, such as, for example, the storage tanks and/or thrust pumps. Indeed, fire protection systems for tunnels inclusive of dispensing devices operating at low pressure (of the dispensed liquid and/or fluid) and distributed according to regular meshes inside tunnels (e.g. fixed to the tunnel roof) are known. The construction of these plants is further simplified by the existence, in all tunnels, of a piping with fire hoses installed at regular intervals.

[0007] The low-pressure devices and/or systems according to the prior art with the features outlined above, although appreciable from many points of view, have several drawbacks and/or disadvantages which the present invention aims to overcome.

[0008] In particular, the most important drawback is related to the fact that the use of small amounts of liquid (with respect to more traditional solutions) is in all cases subject to the possibility of appropriately atomizing the liquid and/or the fluid itself. Indeed, low liquid consumption systems are based on the widely demonstrated concept that small amounts of appropriately atomized liquid and/or fluid guarantee the same fire control effectiveness as decidedly greater quantities of non-atomized liquid and/or fluid. However, in systems of the known type, the liquids are atomized either by adding compressed air, wherein the impact of the drops of liquid with the compressed air jet results into the fractioning of the drops into much smaller droplets, or by supplying the liquid at high pressure, the latter solution not being always feasible, in particular being not feasible in the case of tunnels of a given length in view of the aforesaid inevitable load losses along the supply piping.

[0009] From the above, it is however easily and immediately apparent that the known type solutions require the installation of compressed air piping and of air compressing means, so that the advantages deriving from the possibility of containing the size of the installations for supplying the water or the fluid (piping, storage tanks, thrust pumps etc.) are at least partly compromised.

[0010] It is thus the main object of the present invention to overcome or at least minimize the drawbacks outlined above and affecting the fire protection devices and/or systems according to the prior art.

[0011] In particular, it is a first object of the present invention to make available a device for dispensing liquids and/or fluids in general which allows the delivery of appropriately atomized liquids and/or fluids without using compressed air or gas. It is a further object of the present

invention to provide a device of the aforesaid type which can also be made and/or installed at low costs and by means of equally low and/or contained complexity operations.

[0012] Finally, it is a further object of the present invention to provide a device of the aforesaid type adapted to be used in fire prevention systems which can be installed in road and/or railway tunnels, underpasses and/or similar large-size environments, in particular closed environments, by means of simple and/or immediate operations and that in particular avoid drastic structural interventions on such structures.

DESCRIPTION OF THE PRESENT INVENTION

[0013] The present invention is based on the general consideration according to which a proper atomization of liquids and/or fluids in general can be obtained, not (or at least not only) by investing the liquids with a jet of compressed air, but rather by conferring speed to liquids with respect to the air of the external environment (concerned by dispensed liquids), which is usually immobile. So, the present invention is based on the decidedly innovative consideration according to which a result comparable to that guaranteed by a conventional atomizer can be achieved by imparting speed to dispensed liquids and thus by creating a speed differential between the drops and the surrounding environment air.

[0014] On the basis of the considerations outlined above, and in consideration of the problems and/or drawbacks encountered in the fire protection devices and/or systems according to the prior art, a first embodiment the present invention relates to a device for dispensing liquids and/or fluids, in particular for fire protection systems, said dispensing device being specified in claim 1.

[0015] According to an embodiment, said device comprises a first tubular delivery element adapted to be connected to a main supply piping, a second tubular dispensing element hydraulically connected to said first tubular delivery element for dispensing said liquids in the environment; wherein said second tubular dispensing element is adapted to be put into rotation, wherein said device comprises means for putting into rotation said second tubular dispensing element.

[0016] According to an embodiment, said second tubular dispensing element comprises a first substantially rectilinear portion, and said second tubular dispensing element is adapted to be put into rotation about a rotation axis substantially parallel to the longitudinal extension axis of said substantially rectilinear portion. According to an embodiment, said means for putting into rotation said second tubular dispensing element are suited to guarantee a rotation speed of said second tubular delivery element such to guarantee the atomization of the liquids, e.g. comprised between 40 and 800 rpm.

[0017] According to an embodiment, said means for putting into rotation said second tubular dispensing element comprise a splined turbine on said first substantially rectilinear portion, wherein said turbine comprises a plurality of blades which extend in a radial direction with respect to the longitudinal extension axis of said first substantially cylindrical portion.

[0018] According to an embodiment, said means for putting into rotation said second tubular dispensing element comprise a splined turbine for putting said turbine into rotation by means of a fluid conveyed to strike the blades of said turbine.

[0019] According to an embodiment, said means for putting into rotation said turbine comprise means for pressurizing the fluid upstream of said turbine.

[0020] According to an embodiment, said means for putting into rotation said turbine comprise a third tubular branch element connected to said first tubular element for diverting liquid from said first tubular element to said turbine.

[0021] According to an embodiment, said device comprises a sealed rotary joint interposed between said first tubular element and the second tubular element for the hydraulic sealed connection of said first tubular element and second tubular element.

[0022] According to an embodiment, said device comprises a support frame, in that said second tubular element is suited to be put into rotation with respect to said main support frame, and in that it comprises means for reducing and/or limiting the friction interposed between said support frame and said first substantially rectilinear portion of said second tubular element.

[0023] According to an embodiment, said device comprises a dispensing nozzle fixed to said second tubular element, wherein said dispensing nozzle is adapted to form a fan-shaped jet of fluid let out from said second tubular element.

[0024] According to an embodiment, said dispensing nozzle is adapted to form a jet of fluid with a fan opening angle comprised between 10° and 90°.

[0025] According to an embodiment, the fluid is dispensed by means of a dispensing bulb with at least one substantially hemispherical portion and comprises a plurality of orifices and/or nozzles distributed on said substantially hemispherical portion and each adapted to shape and/or generate a fluid jet, e.g. rectilinear and/or fan-shaped and/or conical with axis coinciding with the rotation axis, of amplitude comprised between 50° and 270°.

[0026] According to an embodiment, said second tubular element comprises an end portion extending from said first substantially rectilinear portion along an extension direction different from said extension direction of said first substantially rectilinear portion.

[0027] According to an embodiment, the extension direction of said end portion forms an angle comprised between 0° and 45° with a plane substantially perpendicular to the extension direction of said first substantially rectilinear portion.

[0028] The present invention also relates to a fire prevention system, in particular for galleries, tunnels, under-

passes or similar environments, in particular of large size and/or closed, said system comprising a main piping for supplying a liquid, and at least one dispensing device according to one of the embodiments outlined above hydraulically connected to said main piping by means of said first tubular element.

[0029] According to an embodiment, said system comprises at least two dispensing devices according to one of the embodiments outlined above connected to said main piping and placed at a mutual distance from 5m to 120m, according to the requirements and/or circumstances.

[0030] Further possible embodiments of the present invention are defined in the claims.

BRIEF DESCRIPTION OF THE FIGURES

[0031] Hereafter, the present invention will be further explained by means of the following detailed description of the possible embodiments thereof as depicted in the drawings, in which corresponding or equivalent features and/or component parts of the present invention are identified by the same reference numbers. It must be noted however that the present invention is not limited to the embodiments described below and depicted in the accompanying drawings; on the contrary, all the variants of and/or changes to the embodiments described below and depicted in the accompanying drawings that will appear obvious and immediate to a person skilled in the art fall within the scope of the present invention.

[0032] In the drawings:

- Figure 1 shows a first side view of a device according to an embodiment of the present invention;
- Figure 2 shows a second side view of a device according to an embodiment of the present invention;
- Figure 3 shows a plan view (from the top) of a device according to an embodiment of the present invention;
- Figure 4 shows a perspective view of a device according to an embodiment of the present invention;
- Figure 5 shows a perspective view of the components of a device according to an embodiment of the present invention;
- Figure 6 shows a section view of the device according to an embodiment of the present invention;
- Figure 7 shows a perspective view from the bottom of a device according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE PRESENT INVENTION

[0033] The present invention finds particular application in the field of fire protection systems, in particular for road tunnels and/or railway tunnels, underpasses and/or similar environments, in particular closed and/or of large size, this being the reason why hereafter, the present invention will be described with particular reference to its application in the field of fire protection systems.

[0034] However, it is worth specifying that the possible applications of the present invention are not limited to those described below. Conversely, the present invention can be conveniently applied in all cases in which the possibility of delivering atomized liquids with drops of size preferably smaller than that of the drops obtainable by using spray nozzles and/or dispensers according to the prior art, the supplied liquid flow rate and pressure being equal, is either necessary or desired.

[0035] According to the embodiment depicted in the figures, the dispensing device 100 according to the present invention comprises a first tubular element 10 with an attachment (e.g. threaded) 11 for the hydraulic connection of the device 100 to a main piping for feeding and/or supplying a liquid (water and/or foaming solutions) according to methods substantially known and therefore not described in greater detail for the sake of brevity. The device 100 further comprises a second tubular element 12 with an end portion 15 to which a dispensing nozzle 16 is applied with a conformation chosen according to the particular application, e.g. able to shape a projection of the fluid (40) let out from said second tubular element (12) which is a substantially fan, cone or arrow-shaped. The first tubular element 10 and the second tubular element 12 are also mutually connected (joined) hydraulically by means of a sealed rotary joint 20, also of substantially known type, in which the liquid entering the device 100 through the first tubular delivery element 10 flows, in succession, through the fitting 20 and the second tubular element 12 to then be dispensed through the dispensing nozzle 16. One of the peculiarities of the device 100 according to the present invention is thus related to the fact that the tubular element 12 is adapted to be placed in rotation with respect to the tubular element 10 according to methods and/or solutions described below in greater detail, in which the rotation of the tubular element 12 with simultaneous dispensing of liquid or fluid through the nozzle 16 makes it possible to convey to the released liquid a differential speed with respect to the environment air (which is substantially immobile) and thus to fraction the released liquid drops.

[0036] In particular, as depicted in figure 6, the tubular element 10 comprises a substantially rectilinear portion which extends between the fitting 11 and the rotary joint 20, wherein in the same manner the tubular element 12 comprises a substantially rectilinear portion which extends from the sealed rotary joint 20 and an intermediate portion 14 which extends from the rectilinear portion 13 along an extension direction different from the extension direction of the substantially rectilinear portion 13, as well as an end portion 15 which extends from the intermediate portion 14 and on which the dispensing nozzle 16 is applied. So, the second tubular element 12 is suited to be put into rotation around a rotation axis substantially parallel to (in the illustrated case, coinciding with) the longitudinal extension and/or symmetry axis of the substan-

tially rectilinear portion 12, the rotation axis being parallel to (in the specific case, coinciding with) the longitudinal extension and/or symmetry axis of the straight portion of the first tubular element 10.

[0037] With regards to the orientation of the intermediate portion 14 and of the end portion 15 with respect to the substantially rectilinear portion 12, it is worth noting that an intermediate portion 14 (and respective end portion 15) with extension direction such as to form a predetermined angle (preferably comprised between 0° and 90°, in particular between 0° and 45°) with a plane perpendicular to the rotation axis X, and thus to the extension direction of the substantially cylindrical portion 12, offers the additional advantage of increasing the volume of the surrounding space concerned by liquid or fluid itself, the speed of the released liquid or fluid being equal.

[0038] According to a preferred but not limiting embodiment of the present invention, the dispensing nozzle 15 is shaped so to confer a fan-shape to the released jet with a vertex at the nozzle 15 and opening of the fan preferably but not exclusively and/or necessarily comprised between 10° and 45°, possibly with substantially negligible thickness of the fan, wherein the fan shape of the object makes it possible to increase the fractioning effect of the drops achieved by putting into rotation the second tubular element 12.

[0039] With regards to the rotation of the second tubular element 12, according to the present invention, different means according to the requirements and/or circumstances can be provided for the purpose. For example, an electric motor, a small internal combustion engine or other electromechanical or even hydraulic solutions may be provided. A detailed description of the means provided according to an embodiment of the present invention for putting into rotation the second tubular element 12 will be provided below.

[0040] As depicted in detail in figures 5 and 6, a turbine which comprises a plurality of blades 31, which extend in radial direction with respect to the rotation axis X of the second tubular element 12, is splined onto the substantially rectilinear part of the tubular element 12 which extends from the sealed rotary joint 20; the blades 31 are thus integral with the substantially rectilinear portion of the tubular element 12, at this point it being apparent that a pushing action on the blades 31 along a direction different from the preferably and substantially perpendicular extension direction of the blades 31, translates into a rotation of the turbine 30, and therefore ultimately of the tubular element 12, the nozzle 15 and, finally of the dispensed jet 40. For example, the thrust on the blades 31 can be applied by conveying a jet of fluid against the blades 31, e.g. a pressurized gas, but also a liquid or fluid. For this purpose, according to an embodiment of the present invention, a branch piping 19 is provided which extends from the fitting 11 to an end portion adjacent to the turbine 30, the branch piping 19 thus allowing the diversion toward the turbine 30 of part of the liquid entering the delivery fitting 11, and thus putting into rotation the turbine 30. For the purpose, the blades 31 of the turbine 30 are housed in a box-like element 32 (figure 1), which comprises a pierced outer wall, the box-like element 32 being inserted in the support frame 18 provided for fixing the device, e.g. to the roof a tunnel and/or of a gallery.

[0041] Furthermore, according to a further embodiment (not depicted in the drawings), it is possible to fraction the thrust liquid of the branch piping 19 into a plurality of branches with outlets arranged around the turbine and corresponding orientation. Furthermore, along the one or more of branch pipes 19 means may be provided to increase the speed of the liquid or of the fluid inside them; for example, one or more of the pipes 19 may comprise a plurality of contiguous sections with cross-section (diameter in the case of cylindrical pipes) decreasing from the fitting 11 towards the end near the turbine 30 in order to gradually increase the speed of the let out fluid, wherein by increasing the speed of the fluid impacting on the blades of the turbine will proportionally increase the rotation speed of the turbine itself 30, whereby increasing the fractioning effect of the drops of liquid or fluid let out from the nozzle 16. Obviously, the end of the piping 19 near the turbine 30, according to an embodiment of the present invention, may be equipped with a nozzle of diameter and shape such as to confer a desired shape to the released liquid or fluid, e.g. as a function of the shape of the blades of the turbine 30.

[0042] Furthermore, means, such as for example bearings, ball bearings or even hydraulically support, or low-friction components, such as PTFE components (centering bushings or the like), may be provided in order to containing the friction on the tubular element 12, between the tubular element 12 and the support frame 18.

[0043] The operation of the device can at least in part be inferred from the foregoing description of the component parts of the device itself; a brief summary is provided all the same below. Assuming the device 100 connected to a main piping (not shown) by means of the connection fitting 11, supplying the device with a pressurized liquid (e.g. water and/or foaming solutions at a pressure of approximately 5 bar), the dispensing of the liquid is obviously achieved, the jet 40 being in particular being shaped according to the methods outlined above. At the same time, by diverting about 15% of the liquid entering the device 100 from the fitting 11 to turbine 30, the rotation of the turbine 30 and therefore of the jet 40 is obtained, with sufficient rotation speed to obtain the fractioning of the drops and thus the atomization of the jet; by way of non-limiting example, the rotation speed of the tubular element 12 is comprised between about 40 and 800 rpm, preferably between 200 and 600 rpm, preferably between 300 and 500 g/min guarantees the best results in terms of drop fractioning and atomization of the jet 40. For this purpose, on the end of the branch 19 positioned near the turbine 10 further branches may be provided with respective nozzles in order to increase the impact of the liquid let out from the branch 19 onto the blades 31 of the turbine

30.

[0044] The holes in the outer wall of the box-like element 32 allow the disposal of liquid impacting on the turbine 30, with respective fire prevention action, in addition to that provided by the jet 40.

[0045] Figure 7 shows an embodiment according to the present invention in perspective view from the bottom; in figure 7, features and/or component parts of the device described above with reference to figures 1 to 6 are identified by the same reference numerals.

[0046] As depicted in figure 7, in the depicted embodiment, the box-like element 32 is shaped as a cover open downwards, in which the intermediate portion 14 and the end portion 15 of the tubular element 12 are replaced by a dispensing bulb 16 with at least one hemispherical portion 16, which displays a plurality of dispensing orifices and/or nozzles 160 distributed on said hemispherical portion according to the requirements and/or circumstances.

[0047] Said orifices and/or nozzles can be different to conform respectively different the jets and/or projections of fluid; for example, orifices and/or nozzles can be such as to conform a combination of rectilinear and/or cone and/or fan projection and/or the like. Furthermore, said orifices and/or the nozzles are distributed on the hemispheric portion 16 so that the combination of projections and/or jets is subtended by a conical solid angle with longitudinal symmetry axis coinciding with the rotation axis and a width comprised between 50° and 270°.

[0048] It has thus been demonstrated by means of the detailed description given above of the embodiments of the present invention as depicted in the drawings that the present invention makes it possible to obtain the desired objects and to overcome or at least limit the drawbacks affecting the prior art.

[0049] In particular, by means of the present invention a device for dispensing liquids and/or fluids in general is made available, said device allowing the delivery of appropriately atomized liquids and/or fluids without using compressed air or gas.

[0050] Furthermore, with the present invention, a device of the aforesaid type is provided which can be made and/or installed at low cost and by means of low complexity and/or equally contained operations, and which can be used in fire protection systems adapted to be installed in road tunnels and/or railway tunnels, underpasses and/or similar environments, in particular closed and/or of large size, by means of simple and/or immediate operations and which in particular do not require drastic structural interventions on such structures.

[0051] Furthermore, the device according to the present invention makes it possible to provide fire protection systems in even very long tunnels, the installation of the fire protection system can optionally provide assembly stations at the ends of the tunnel, while still allowing a simple and immediate arrangement of delivery devices, e.g. 10 devices each 100 m of tunnel, with the possibility of managing the supply of said devices in individual manner, e.g. by means of solenoid valves. Furthermore, the devices according to the present invention can be easily adapted to the needs and/or circumstances, in particular, the availability of water and/or the intrinsic conditions, e.g. by choosing the most appropriate nozzles. Furthermore, considering that many of the existing tunnels are already equipped with a main piping for supplying fire hydrants, the device according to the present invention allows makes it possible to reduce the installation costs to very low values, and to limit the traffic restriction for installation and/or maintenance works.

[0052] Although the present invention is explained above by means of a detailed description of the embodiments thereof shown in the drawings the present invention is not obviously limited to the embodiments described above and shown on the drawings; on the contrary, all the variants and/or changes to the embodiments described and shown on the accompanying drawings will appear obvious and immediate to a person skilled in the art. For example, the device according to the present invention allows the widest choice of components, e.g. of fittings for connecting the various tubular elements, as well as of materials for the making the components themselves. Finally, according to the present invention, the jet of liquid impacting on the turbine 30 can be subdivided into several jets (e.g. two), e.g. by arranging two nozzles on the end of the branch 19.

[0053] The scope of protection of the present invention is thus defined by the claims.

Claims

1. A device for dispensing liquids (100), in particular for fire protection systems, said device comprising a first tubular delivery element (10) adapted to be connected to a main supply piping, a second tubular dispensing element (12) hydraulically connected to said first tubular delivery element (10) for dispensing said liquids in the environment; said second tubular dispensing element (12) being adapted to be put into rotation, wherein said device (100) comprises means for putting into rotation said second tubular dispensing element (12); wherein said second tubular dispensing element (12) comprises a first substantially rectilinear portion (13), said second tubular dispensing element (12) being adapted to be put into rotation about a rotation axis (X) substantially parallel to the longitudinal extension axis of said substantially rectilinear portion (13); **characterized in that** said means for putting into rotation said second tubular dispensing element (12) comprise a turbine (30) keyed on said first substantially rectilinear portion (13), **and in that** said means for putting into rotation said turbine (30) comprise a third tubular branch element (19) connected to said first tubular element (10) for diverting liquid from said first tubular element (10) to said turbine (30).

2. A device (100) according to claim 1, **characterized in that** said means for putting into rotation said second tubular dispensing element (12) are suited to guarantee a rotation speed of said second tubular delivery element (12) such as to guarantee the atomization by impact with the surrounding air of the liquid jet let out from said second tubular delivery element (12).

3. A device (100) according to any one of the claims from 1 to 2, **characterized in that** said turbine (30) comprises a plurality of blades (31) extending in a radial direction with respect to the longitudinal extension axis of said first substantially cylindrical portion (13).

4. A device (100) according to any one of the claims from 1 to 3, **characterized in that** said means for putting into rotation said turbine (20) comprise means for pressurizing the fluid upstream of said turbine (30).

5. A device (100) according to any one of the claims from 1 to 4, **characterized in that** said device (100) comprises a sealed rotary joint (20) interposed between said first tubular element (10) and the second tubular element (12) for the hydraulic sealed connection of said first tubular element (10) and second tubular element (12).

6. A device (100) according to any one of claims 1 to 5, **characterized in that** said device (100) comprises a support frame (18), **in that** said second tubular element (12) is suited to be put into rotation with respect to said main support frame (18), **and in that it comprises** means for reducing and/or limiting the friction interposed between said support frame (18) and said first substantially rectilinear portion (13) of said second tubular element (12).

7. A device (100) according to one of claims 1 to 6, **characterized in that** it comprises a dispensing nozzle (15) fastened to said second tubular element (12), and **in that** said dispensing nozzle (15) is adapted to form a jet of fluid (40) let out from said second tubular element (12) substantially fan, or cone or arrow shape.

8. A device (100) according to claim 7, **characterized in that** said dispensing nozzle (15) is adapted to form a jet of fluid (40) with a fan opening angle comprised between 10° and 45°.

9. A device (100) according to one of claims 1 to 8, **characterized in that** said second tubular element (12) comprises an end portion (15) which extends from said first substantially rectilinear portion (13) along an extension direction different from said extension direction of said first substantially rectilinear portion (13).

10. A device (100) according to claim 9, **characterized in that** the extension direction of said end portion (15) forms an angle comprised between 0° and 45° with a plane substantially perpendicular to the extension direction of said first substantially rectilinear portion (13).

11. A fire protection system, in particular for galleries, tunnels, underpasses or similar environments, said system comprising a main liquid supply piping, **characterized in that** it comprises at least one dispensing device (100) according to one of claims from 1 to 10 hydraulically connected to said main piping by means of said first tubular element (10).

12. A system according to claim 11, **characterized in that said system** comprises at least two dispensing devices (100) according to one of claims from 1 to 10 connected to said main piping and placed at a predetermined mutual distance.

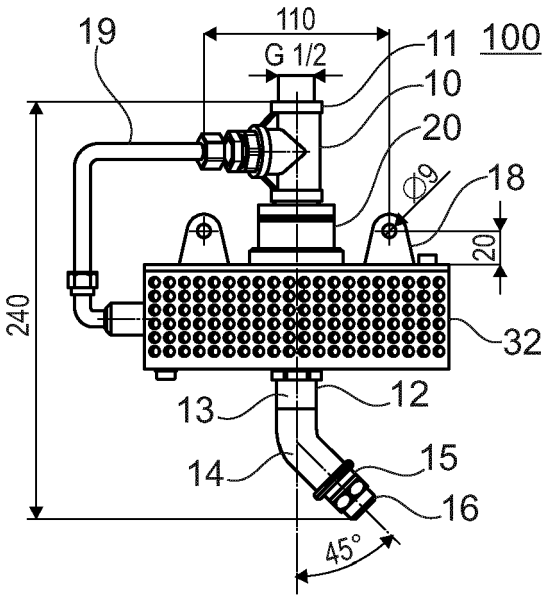

Fig. 1

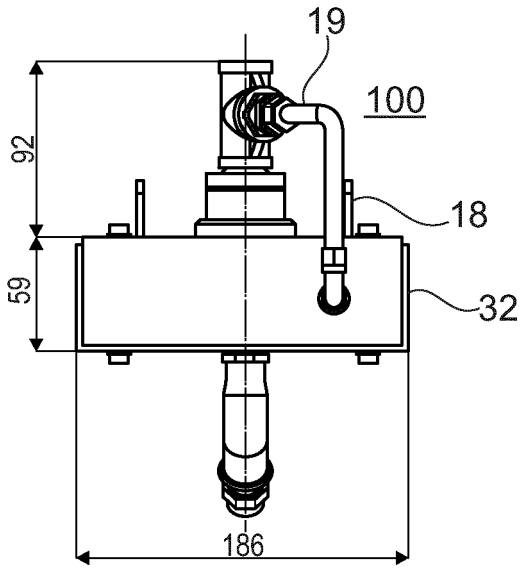

Fig. 2

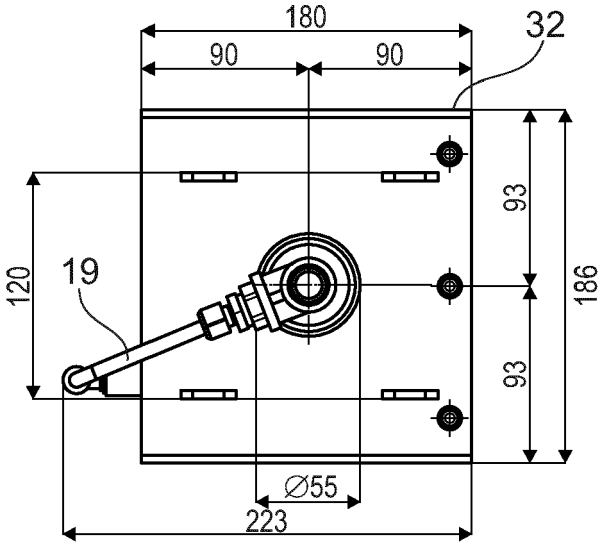

Fig. 3

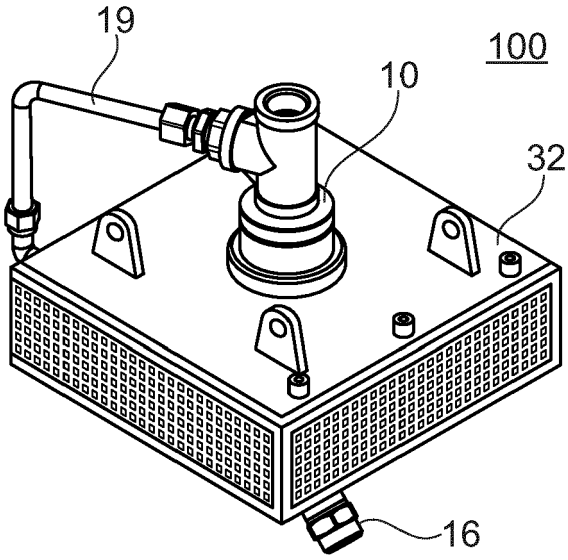

Fig. 4

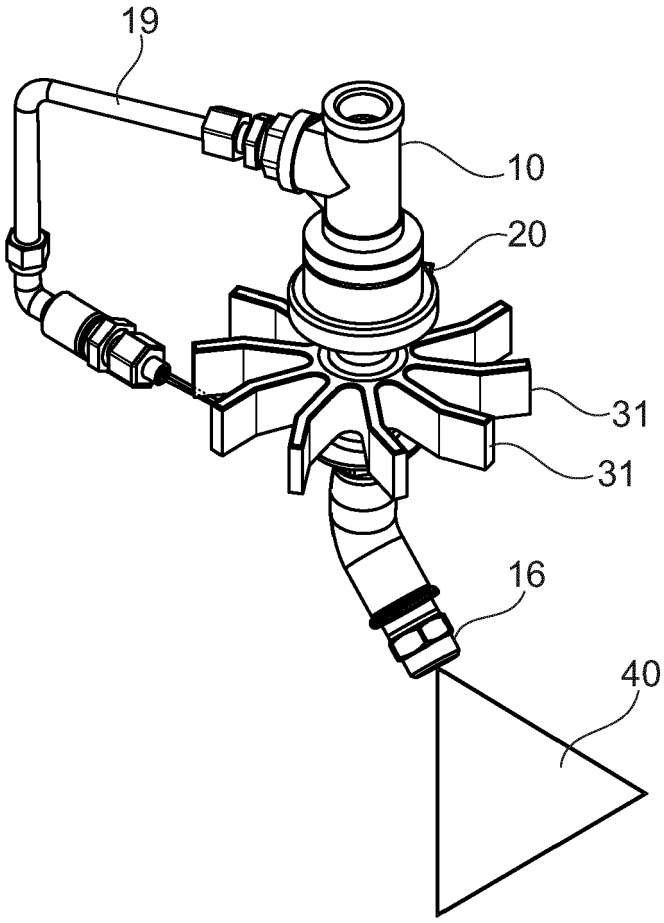

Fig. 5

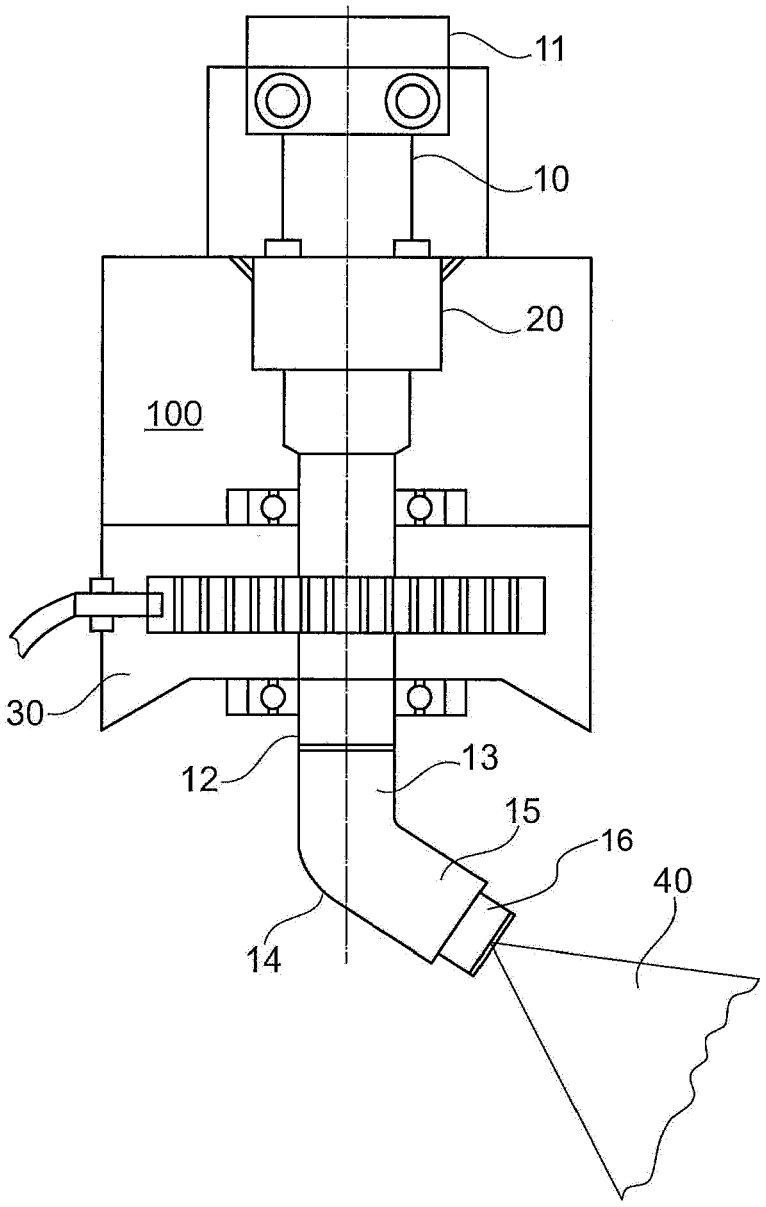

Fig. 6

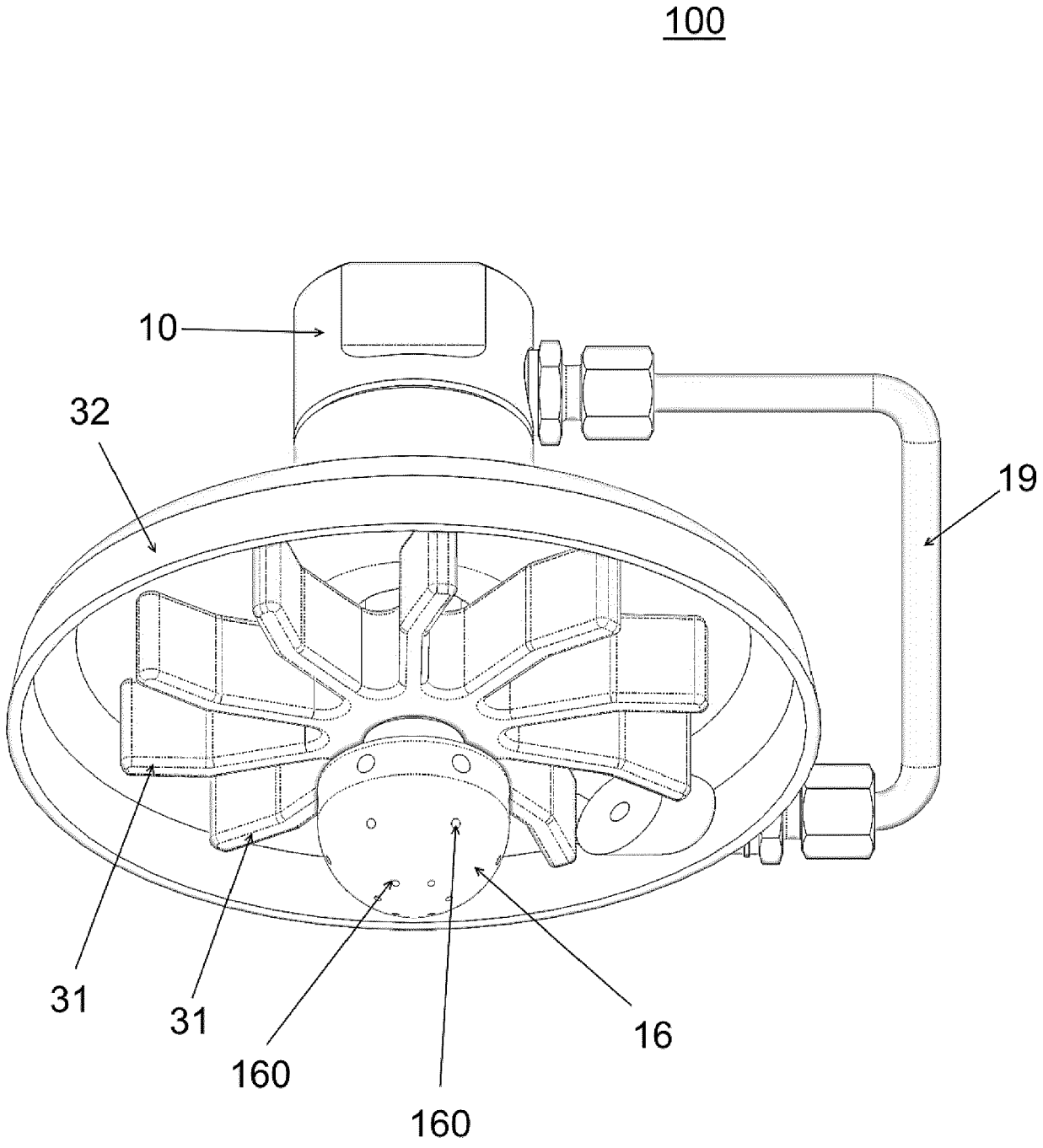

Fig. 7

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EUROPEAN SEARCH REPORT

Application Number
EP 18 16 4687

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	22 August 2018	Douskas, K

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