(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 278 082 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
26.01.2011 Bulletin 2011/04

(51) Int Cl.:
E03F 9/00 *(2006.01)* ***B08B 9/049*** *(2006.01)*

(21) Application number: **10166361.5**

(22) Date of filing: **17.06.2010**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK SM TR
Designated Extension States:
BA ME RS

(30) Priority: **18.06.2009 IE 20090473**

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(54) A sewer cleaning nozzle

(57) A nozzle (1, 100) for cleaning an interior wall (2) of a sewer pipe (3). The nozzle comprises a base member (6) adapted to receive water to an inlet (9) thereof; a nose cone (14, 140) having a back end (16) mountable on the base member (6) and a front jet orifice (18) at a front end (20) for emitting a jet of water (22) generally axially of the nozzle (1, 100) to dislodge debris in the pipe (2). The nose cone (14, 140) is arranged on the base member (6) to form a rearward jet orifice (26) defined by a gap between the nose cone (14, 140) and the base member (6) which extends around the base member (6) for emitting a jet of water (30) in the form a hollow conical wall so that the jet (30) impacts against a full inner circumference of the interior wall of the sewer pipe.

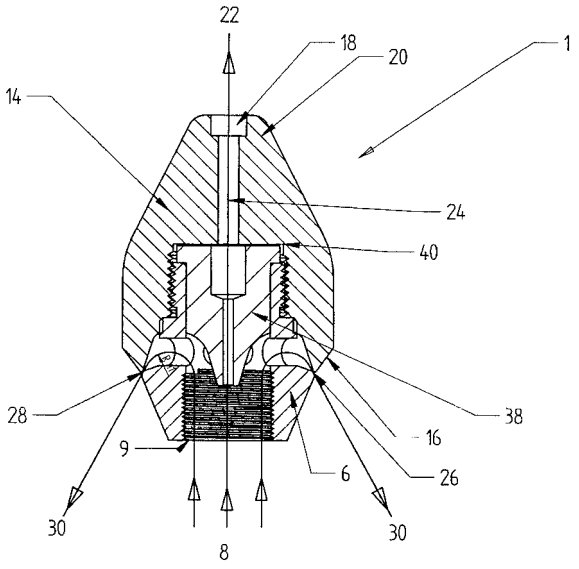

FIGURE 1

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a nozzle, and more particularly, a nozzle for cleaning the internal walls of sewer pipes.

BACKGROUND OF THE INVENTION

[0002] Nozzles for cleaning sewer pipes are known to comprise both forwardly and rearwardly directed water discharge jets. The forward jets are adapted to discharge a water jet for punching through built-up debris in the sewer pipe, and thus act to clear a path for the nozzle to move through the pipe. The rear jets are adapted to impact against and scour the pipe walls, whilst at the same time driving the nozzle forward through the pipe. When the nozzle is pulled back through the pipe the rear jets effectively scrape the loosened debris backwards through pipe to an accessible collection point for removal as necessary.

[0003] For example, US Patent No. 4,677,997 discloses a nozzle for cleaning a sewer pipe. The nozzle disclosed therein has rearwardly directed jets which are spaced in a circular arrangement around a rotary turbine. This particular nozzle emits multiple high pressure streams of water in a spiral or swirling action so as to clean the inner surfaces of a sewer pipe whilst also propelling the nozzle forward. However, the swirl action of the high pressure water jet in US Patent No. 4,677,997 requires that the nozzle is fitted within a frame and skid so as to steady the nozzle and prevent it wobbling within the pipe. The need for such a skid and frame severely restricts the free and unhindered movement of the nozzle through the sewer pipe and moreover, prevents it from moving around corners. Such swirling action nozzles are also known only to loosen debris and are not suited to effectively scrape the loosened debris backwards through pipe when the nozzle is retracted.

[0004] Other known nozzles rely on the use of a circular arrangement of jets to clean the wall of a sewer pipe. However, such a configuration suffers from the disadvantage that the entire inner circumference of the pipe wall is not impacted on by the water jets and this results in the pipe wall not being fully scoured. Moreover, debris is left behind when retracting the nozzle from the pipe.

[0005] Accordingly, it is an object of the present invention to provide a nozzle for cleaning the internal walls of sewer pipes which overcomes the above problems and/or which will provide the industry with a useful alternative.

[0006] It is acknowledged that the term "comprise" may, under varying jurisdictions be provided with either an exclusive or inclusive meaning. For the purpose of this specification, and unless otherwise noted explicitly, the term "comprise" shall have an inclusive meaning, i.e. that it may be taken to mean an inclusion of not only the listed components it directly references, but also other non-specified components. Accordingly, the term "comprise" is to be attributed with as broader interpretation as possible within any given jurisdiction and this rationale should also be used when the terms "comprised" and/or "comprising" are used.

[0007] Further aspects of the present invention will become apparent form the ensuing description which is given by way of example only.

SUMMARY OF THE INVENTION

[0008] According to the invention, there is provided a nozzle for cleaning an interior wall of a sewer pipe, the nozzle comprising:

a base member adapted to receive water to an inlet thereof;

a nose cone having a back end mountable on the base member and a front jet orifice at a front end thereof for emitting a jet of water generally axially of the nozzle to dislodge debris in the pipe,

wherein the nose cone is arranged on the base member to form a rearward jet orifice around a perimeter of the base member for emitting a jet of water having a shape adapted to impact against a full inner circumference of the interior wall of the sewer pipe.

[0009] The present invention provides a nozzle for cleaning a sewer pipe which is adapted to emit a spray from its rearward acting jet orifice to impact on the full circumference (360 degrees) of the interior of the sewer pipe. Such a provision ensures that the entire inner circumference of the pipe wall is impacted upon and scoured by the jet spray as the nozzle is propelled under the action of the spray through the pipe. Moreover, use of such a jet spray will also ensure that when the nozzle is retracted from the pipe there is no debris left behind in the pipe since the spray impacts against the entire inner pipe circumference to draw all of the debris with it as it is retracted.

[0010] Additionally, and keeping in mind the extremely harsh conditions and amount of debris in a sewer pipe, the present invention also alleviates problems associated with blockage of jets. Prior art nozzles will typically have an arrangement of separate jets, each of which is very small and prone to being blocked, especially when recycled water is being used as a jetting fluid. The present invention does not have small exposed jets but instead utilises a relatively large single jet orifice which extends around the entire perimeter of the base member of the nozzle. Such a configuration is significantly less prone to blockages of the type experienced by multiple orifice nozzles and the disadvantages thereof.

[0011] Furthermore, a nozzle comprising of a coupling between the nose cone and the base member will also render an arrangement which is easy to disassemble for cleaning purposes.

[0012] It will be appreciated that the terms "front", "back", "forward", "rear" and their derivative are relative terms and are used for the purposes of the present specification in relation to the direction of movement of the nozzle in the pipe with the nose cone leading.

[0013] It will also be appreciated that the term water in the present specification is to be understood as including various liquid substances or solutions which are suitable for cleaning of sewer pipes.

[0014] Preferably, the jet of water emitted from the rearward jet orifice defines a truncated substantially cone shaped spray. The emitting of a cone shaped spray will ensure that the full inner circumference of the pipe wall is impacted against at all times. Preferably, the jet of water emitted from the rearward jet orifice is in the form of a hollow truncated cone defined by a substantially conical wall of water.

[0015] Preferably, the base member comprises at least one fluid passageway for the transmission of fluid from the inlet to the rearward jet orifice and at least one fluid passageway for the transmission of fluid to the nose cone.

[0016] Preferably, the nose cone comprises a fluid passageway for the transmission of water to the front jet orifice.

[0017] In one embodiment, the nose cone mounts a conduit member in a central chamber thereof, the conduit member being interposed between the base member and the fluid passageway of the nose cone. The conduit member effectively splits the water received at the inlet of the base member between the fluid passageway of the front jet and the fluid passageways leading to rearward jet orifice. The conduit member also maintains the velocity of the fluid in the nozzle whilst also reducing turbulence.

[0018] In a preferred variation, the base member comprises a plurality of fluid passageways for the transmission of fluid to the rearward jet orifice. For example, the base member may comprise two, three, four, five, six or more such fluid passageways.

[0019] In a preferred embodiment, the at least one fluid passageway for the transmission of fluid to the rearward jet orifice is arranged in communication with a plurality of ducts defined in the nose cone and/or in the base member, each duct terminating with an outlet aperture configured to emit an individual jet, wherein the outlet apertures are defined around a perimeter of the nose cone and/or that of the base member adjacent the rearward jet orifice up-stream a location at which the jet formed by the rearward jet orifice exits the rearward jet orifice, so that the individual jets emitted by the outlet apertures are directed to the rearward jet orifice. Ideally, the rearward jet orifice is defined in such a manner that the individual jets emitted by the outlet apertures adjacent the rearward jet orifice are transformed in the rearward jet orifice into the jet of water having a shape adapted to impact against a full inner circumference of the interior wall of the sewer pipe.

[0020] The provision of the ducts forming individual jets adjacent the rearward jet orifice improves the flow at the rearward jet orifice and provides for the reduction of the volume of an inner cavity defined between the nose cone and the base member immediately adjacent the rearward jet orifice compared with an arrangement where the fluid passageway of the base member for the transmission of fluid to the rearward jet orifice is connected directly with the rearward jet orifice. As a result, less dirt becomes trapped between the nose cone and the base member and accordingly the nozzle needs to be disassembled and cleaned less frequently.

[0021] The outlet apertures are preferably defined in one of the nose cone or the base member in such a manner that the individual jets impact against a surface around the perimeter of the other of the nose cone and the base member up stream a location at which the jet formed by the rearward jet orifice exits the nozzle.

[0022] Preferably, the base member comprises a male portion having an outer surface complementary to an inner surface of a female portion at the back end of the nose cone, such that when the nose cone and the base member are assembled, the outlet apertures of one of the nose cone or the base member are partially blocked by the respective inner or outer surface of the other of the nose cone or the base member. As a result, the individual jets emitted by the outlet apertures impact against the respective inner or outer surface of the nose cone or the base member up-stream a location at which the jet formed by the rearward jet orifice exits the nozzle and are guided by that surface directly to the rearward jet orifice.

[0023] Each duct preferably comprises a forward portion which directs fluid substantially towards the front end of the nose cone, a bend, and a rearward portion which directs fluid substantially towards the rearward jet orifice. Such an arrangement maintains the velocity of the fluid in the ducts.

[0024] In one preferred variation, the outlet apertures are defined in the nose cone. Preferably, the ducts are defined in the nose cone.

[0025] Advantageously, the nose cone comprises a front part comprising the front end of the nose cone and a back part comprising the back end, the front part and the back part being configured complementary to each other so as to define the nose cone when the front part and the back part are assembled. Preferably, the front part defines forward portions and the bends of the ducts and the back part defines the rearward portion of the duct and wherein the front part and the back part are releasably coupled together via a coupling means. This arrangement, in one aspect, simplifies the step of forming the ducts in the process of making the nozzle and, in another aspect, renders the ducts accessible for cleaning or inspection purposes.

[0026] In one arrangement, the fluid passageway for the transmission of fluid to the rearward jet orifice is defined between an outer surface of the conduit member in the central chamber of the nose cone and an inner

surface of the base member defining the inlet in the base member.

[0027] Preferably, the nozzle comprises means to block the passage of water to the fluid passageway of the front jet orifice so as to channel all water entering the base member inlet to the rearward jet orifice.

[0028] Conveniently, the base member is releasably coupled to the nose cone. In one variation, the coupling between the base member and the nose cone is of a screw thread type.

[0029] Preferably, the cone shaped spray has a cone angle in the range of about 20 to about 140 degrees with respect to a longitudinal axis of the nozzle.

[0030] Alternatively, the cone shaped spray has a cone angle in the range of about 40 to about 120 degrees with respect to a longitudinal axis of the nozzle.

[0031] Alternatively, the cone shaped spray has a cone angle in the range of about 60 to about 100 degrees with respect to a longitudinal axis of the nozzle.

[0032] Alternatively, the cone shaped spray has a cone angle in the range of about 70 to about 90 degrees with respect to a longitudinal axis of the nozzle.

[0033] Preferably, the nozzle comprises means to alter the size of the rearward jet orifice so that the cone angle of the conical spray oscillates within the range.

[0034] Preferably, the nozzle comprises means to dynamically alter the size of the rearward jet orifice so that the angularity of the conical spray oscillates within the range.

[0035] Preferably, the inlet of the base member comprises coupling means for connection to a hose for delivering water to the nozzle.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0036] The invention will be more clearly understood from the following description of some embodiments thereof, given by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a sectional view of a nozzle according to the invention;
Figure 2 is an exploded perspective view of the nozzle shown in Figure 1;
Figure 3 is a sectional view of the nozzle shown in Figure 1 showing exemplary spray patterns;
Figure 4 is a sectional view of a nozzle shown in Figure 1 according to further embodiment of the invention;
Figure 5 is a sectional view of the nozzles in Figures 1 to 4 shown in a sewer pipe;
Figure 6 is a stylised illustration of the nozzle shown in Figures 1 to 4 coupled to a water supply;
Figure 7 is a sectional view of yet a further embodiment nozzle according to the invention; and
Figure 8 is an exploded perspective view of the nozzle shown in Figure 7.

[0037] Referring to the drawings, and initially to Figure 5, there is shown a nozzle, indicated generally by the reference numeral 1, for cleaning debris 4 from an interior wall 2 of a sewer pipe 3.

[0038] With reference to Figures 1 to 4, the nozzle 1 comprises a base member 6 adapted to receive water 8 to an inlet 9 thereof. In practice, the inlet 9 is coupled to a hose pipe 10 (see Figure 6) which is in turn coupled to a supply of water, shown as a water tanker or truck 12.

[0039] Also shown is a nose cone 14 having a back end 16 mountable on the base member 6 and a front jet orifice 18 at a front end 20 thereof for emitting a jet of water 22 generally axially of the nozzle 1 to dislodge debris 4 in the pipe 3. The nose cone 14 comprises a fluid passageway 24 for the transmission of water 8 to the front jet orifice 18. The base member 6 is releasably coupled to the nose cone 14 via a screw thread coupling 27, 29 between the nose cone 14 and base member 6. The nozzle 1 thus provides an arrangement which is very easy to disassemble for cleaning purposes. It will however be understood that the coupling between the nose cone 14 and base member 6 may be of any suitable type as required or as desired, as will be readily apparent to a person skilled in the art. It may for example be a snap lock type connection system or a latching mechanism. Accordingly, reference to a screw thread mechanism only should not be seen as limiting.

[0040] The nose cone 14 is arranged on the base member 6 to form a rearward jet orifice, indicated generally by the reference numeral 26 around a perimeter 28 of the base member 6 for emitting a jet of water 30 having a shape adapted to impact against a full inner circumference of the interior wall 2 of the sewer pipe 3. The rearward jet orifice 26 is thus a single opening formed by a gap between the nose cone 14 and the base member 6 which extends around the base member 6 and emits a single truncated substantially cone shaped spray pattern in the pipe 3. Such a cone shaped spray pattern will effectively propel the nozzle 1 through the pipe 3 and ensure that the entire inner circumference of the pipe wall is impacted upon and scoured. When the nozzle 1 is retracted back through the pipe 3 it will effectively scrape all of the debris 4 released from the pipe wall 3 back to an appropriate collection point.

[0041] The base member 6 comprises a number of fluid passageways, indicated generally by the reference numerals 36, for the transmission of water 8 received at the inlet 9 to the rearward jet orifice 26. In practice the base member may comprise one, two, three, four, five, six or more fluid passageways 36 leading to the rearward jet orifice 26.

[0042] The nose cone 14 mounts a conduit member 38 in a central chamber, indicated generally by the reference numeral 40. As shown, the conduit member 38 is interposed between the base member 6 and the fluid passageway 24 of the nose cone 14. The conduit member 38 effectively splits the water received at the inlet 9 of the nozzle 1 and allows a flow of water through pas-

sageway 34 into the nose cone 14 for delivery under pressure to the front jet orifice 18 and the fluid passageways 36 leading to rearward jet orifice 26. The nozzle 1 may optionally comprise means (not shown) to block the passage of fluid to the fluid passageway of the front jet orifice 18 so as to channel all water entering the base member inlet 9 to the rearward jet orifice 26.

[0043] Figure 3 shows exemplary spray patterns, indicated generally by the letters A and B, achievable by the rearward jet orifice 26 of the nozzle 1. In the instance shown, the nozzle 1 is adaptable to emit a cone shaped spray 30 having a cone angle in the range of about 20 degrees (indicated by the letter B) to 140 degrees (indicated by the letter B) to a longitudinal axis (indicated by the letter C) of the nozzle 1. It will however be understood that the spray patterns achievable by the rearward jet orifice 26 may be set as required in ranges of about 40 to 120 degrees, 60 to 100 degrees, 70 to 90 or any other range as required or as desired in order to achieve the object of impacting on the full inner circumference of the pipe wall whilst at the same time propelling the nozzle 1 through the pipe 3. Accordingly, reference to the spray patterns shown in Figure 3 are given by way of example only.

[0044] With reference to Figure 4, the rearward jet orifice 26 may optionally comprise strengthening inserts 42, which may be made of ceramics or other hard material to minimise the wear of the orifice 26.

[0045] The nozzle 1 also comprises means (not shown) to alter the size of the rearward jet orifice 26 so that the cone angle of the conical spray 30 oscillates between a defined cone angle range. Such means may be adapted to dynamically alter the size of the rearward jet orifice 26 so that the angularity of the conical spray automatically oscillates within the defined range. In this configuration the nozzle 1 has the ability to alter or adjust the shape of the cone spray 30 to provide an optimal spray pattern to scour the pipe walls 3 according to determined or sensed contours and debris 4 build up in the pipe 3.

[0046] Figures 7 and 8 show a preferred embodiment of the nozzle according to the invention, which is indicated generally by reference numeral 100 and in which elements which are common with the nozzle 1 of Figures 1 to 6 are indicated using the same reference numerals as those used to indicate the elements of the nozzle 1.

[0047] The nozzle 100 differs from the nozzle 1 in that in the nozzle 100, fluid passageways 136 for the transmission of water 8 received at the inlet 9 to the rearward jet orifice 26 are arranged in communication with a plurality of ducts 150 defined in a nose cone 140. Each duct 150 terminates with an outlet aperture 151 configured to emit an individual jet of water.

[0048] The outlet apertures 151 are formed around an inner surface 146 of a female portion at the back end 16 of the nose cone 140 adjacent the rearward jet orifice 26 up-stream a location at which the conical spray 30 formed by the rearward jet orifice 26 exits the nozzle 100. The base member 6 comprises a male portion 65 having an outer surface 60 complementary to the inner surface 146 of the nose cone 140. Thus, when the nose cone 140 and the base member are assembled, the outlet apertures 151 are partially blocked by the outer surface 60 of the base member 6. As a result, the individual jets emitted by the outlet apertures 151 impact against the outer surface 60 up-stream a location at which the conical spray 30 formed by the rearward jet orifice 26 exits the nozzle 100 and are guided by the outer surface 60 directly to the rearward jet orifice 26. At the rearward jet orifice 26, the portions of the nose cone 140 and the base member 6 which define the rearward jet orifice 26 transform the individual jets emitted by the outlet apertures 151 into the conical spray 30.

[0049] Each duct 150 preferably comprises a forward portion 152, which directs fluid substantially towards the front end 20 of the nose cone 140, a bend 153, and a rearward portion 154, which directs fluid substantially towards the rearward jet orifice 26. Such an arrangement maintains the velocity of the fluid in the ducts 151.

[0050] As shown in Figure 7, the nose cone 140 also comprises a front part 141 comprising the front end 20 of the nose cone 140 and a back part 142 comprising the back end 16. The front part 141 and the back part 142 are configured complementary to each other so as to define the nose cone 140 when the front part 141 and the back part 142 are assembled. The front part 141 defines the forward portions 152 and the bends 153 of the ducts 151 and the back part 142 defines the rearward portions 154. The front part 141 and the back part 142 are releasably coupled together via a screw thread arrangement 145 for easy disassembly for cleaning and/or inspection. Other coupling arrangements for releasably coupling the front part 141 and the back part 142 would be readily envisaged by a person skilled in the art.

[0051] It will be appreciated that instead of being provided in the nose cone 140, the ducts 150 can be provided in the base member 6, or indeed, in each of the nose cone 140 and the base member 6. For example, the same duct 151 can pass through both the nose cone 140 and the base member 6. Alternatively, one duct 151 can be formed in the nose cone 140 while another duct 151 can be formed in the base member 6.

[0052] As shown in Figure 7, the fluid passageway 136 for the transmission of fluid to the rearward jet orifice 26 is defined between an outer surface 39 of the conduit member 38 in the central chamber 40 of the nose cone 140 and an inner surface 67 of the base member which defines the inlet 9 in the base member 6.

[0053] Aspects of the present invention have been described by way of example only and it should be appreciated that additions and/or modifications may be made thereto within the scope of the appended claims defining the invention.

Claims

1. A nozzle for cleaning an interior wall of a sewer pipe, the nozzle comprising a base member adapted to receive water to an inlet thereof;
a nose cone having a back end mountable on the base member and a front jet orifice at a front end thereof for emitting a jet of water generally axially of the nozzle to dislodge debris in the pipe,
wherein the nose cone is arranged on the base member to form a rearward jet orifice around a perimeter of the base member for emitting a jet of water having a shape adapted to impact against a full inner circumference of the interior wall of the sewer pipe.

2. A nozzle as claimed in Claim 1, wherein the rearward jet orifice is defined by a gap between the nose cone and the base member which extends around the base member.

3. A nozzle as claimed in Claim 1 or Claim 2, wherein the rearward jet orifice is configured to emit a jet of water in the form of a hollow truncated cone defined by a substantially conical wall of water.

4. A nozzle as claimed in any preceding claim, wherein the nozzle comprises a releasable coupling between the nose cone and the base member.

5. A nozzle as claimed in any preceding claim, wherein the base member comprises at least one fluid passageway for the transmission of fluid from the inlet to the rearward jet orifice and at least one fluid passageway for the transmission of fluid to the nose cone.

6. A nozzle as claimed in Claim 5, wherein the at least one fluid passageway for the transmission of fluid to the rearward jet orifice is arranged in communication with a plurality of ducts defined in the nose cone and/or in the base member, each duct terminating with an outlet aperture configured to emit an individual jet, wherein the outlet apertures are defined around a perimeter of the nose cone and/or that of the base member adjacent the rearward jet orifice up-stream a location at which the jet formed by the rearward jet orifice exits the rearward jet orifice, so that the individual jets emitted by the outlet apertures are directed to the rearward jet orifice.

7. A nozzle as claimed in Claim 6, wherein, the rearward jet orifice is defined in such a manner that the individual jets emitted by the outlet apertures adjacent the rearward jet orifice are transformed in the rearward jet orifice into the jet of water having a shape adapted to impact against a full inner circumference of the interior wall of the sewer pipe.

8. A nozzle as claimed in Claim 6 or Claim 7, wherein the outlet apertures are defined in one of the nose cone or the base member in such a manner that the individual jets impact against a surface around the perimeter of the other of the nose cone and the base member up stream a location at which the jet formed by the rearward jet orifice exits the nozzle.

9. A nozzle as claimed in any one of Claims 6 to 8, wherein the base member comprises a male portion having an outer surface complementary to an inner surface of a female portion at the back end of the nose cone, such that when the nose cone and the base member are assembled, the outlet apertures of one of the nose cone or the base member are partially blocked by the respective inner or outer surface of the other of the nose cone or the base member so that the individual jets emitted by the outlet apertures impact against the respective inner or outer surface of the nose cone or the base member upstream a location at which the jet formed by the rearward jet orifice exits the nozzle and are guided by that surface directly to the rearward jet orifice.

10. A nozzle as claimed in any one of Claims 6 to 9, wherein the outlet apertures are and the ducts are defined in the nose cone.

11. A nozzle as claimed in any one of Claims 6 to 10, wherein each duct comprises a forward portion which directs fluid substantially towards the front end of the nose cone, a bend, and a rearward portion which directs fluid substantially towards the rearward jet orifice.

12. A nozzle as claimed in Claim 11, wherein the nose cone comprises a front part comprising the front end of the nose cone and a back part comprising the back end, the front part and the back part being configured complementary to each other so as to define the nose cone when the front part and the back part are assembled, wherein the front part defines forward portions and the bends of the ducts and the back part defines the rearward portion of the duct and wherein the front part and the back part are releasably coupled together via a coupling means.

13. A nozzle as claimed in any preceding claim, wherein the nozzle comprises means to dynamically alter the size of the rearward jet orifice so that the angularity of the conical spray oscillates within the range.

14. A nozzle as claimed in any preceding claim, wherein the nose cone mounts a conduit member in a central chamber thereof, the conduit member being interposed between the base member and the fluid passageway of the nose cone so that the conduit member effectively splits the water received at the inlet

of the base member between the fluid passageway of the front jet and the at least one fluid passageway leading to rearward jet orifice.

15. A nozzle as claimed in any preceding claim, wherein the nose cone comprises a fluid passageway for the transmission of water to the front jet orifice.

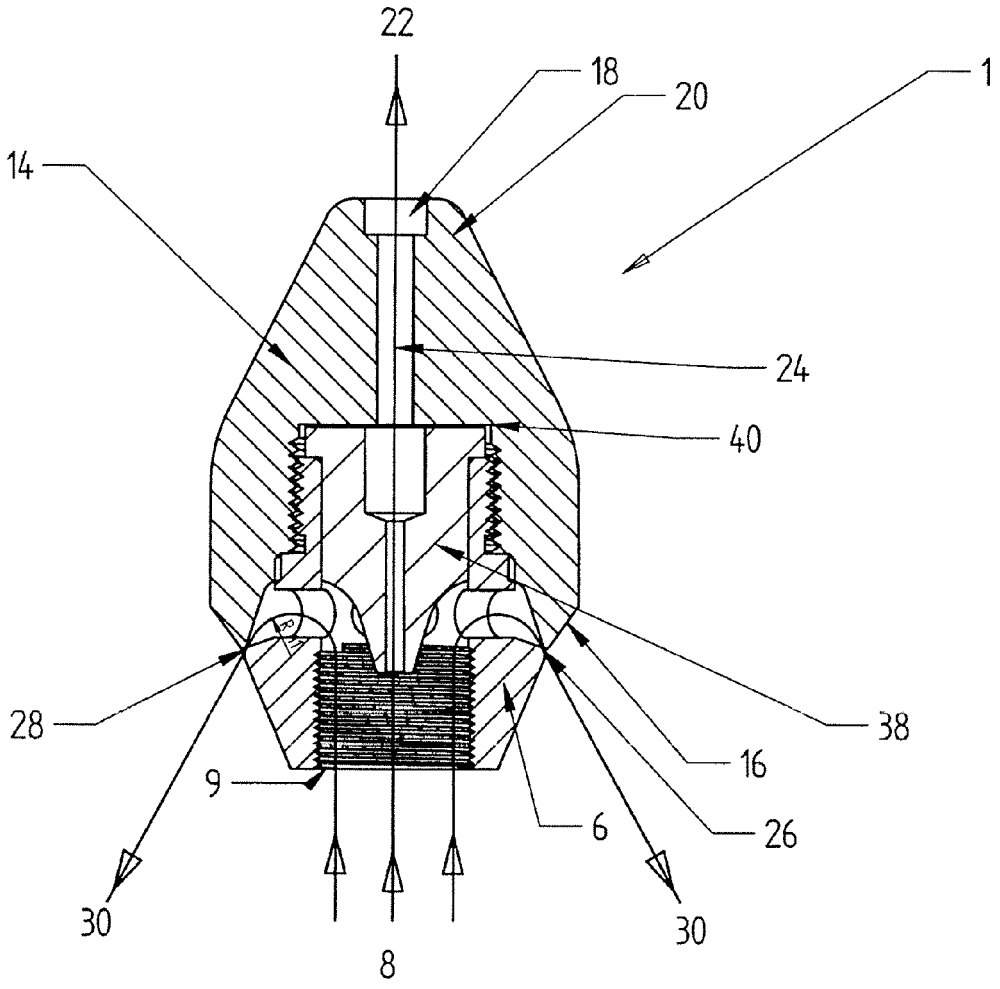

FIGURE 1

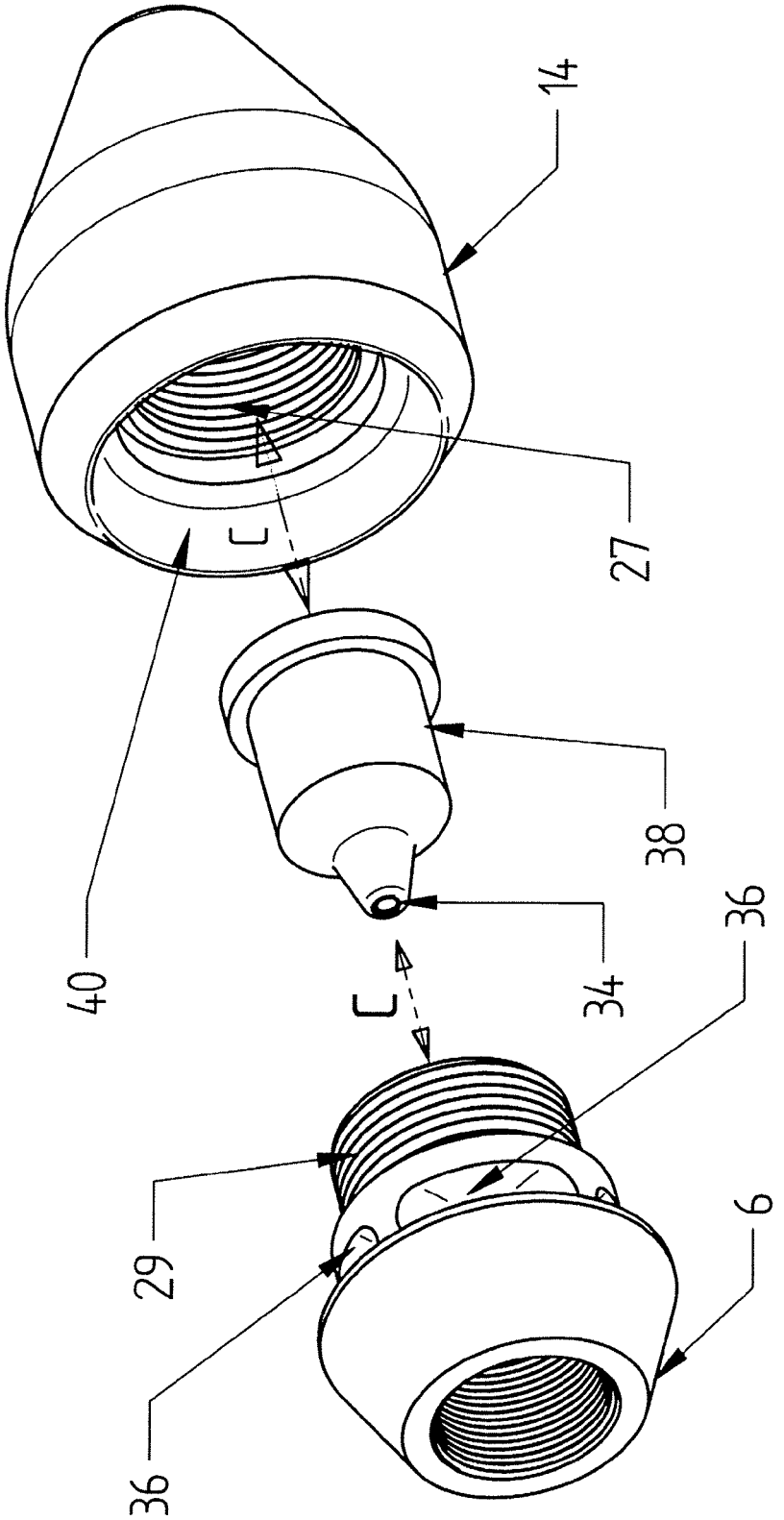

FIGURE 2

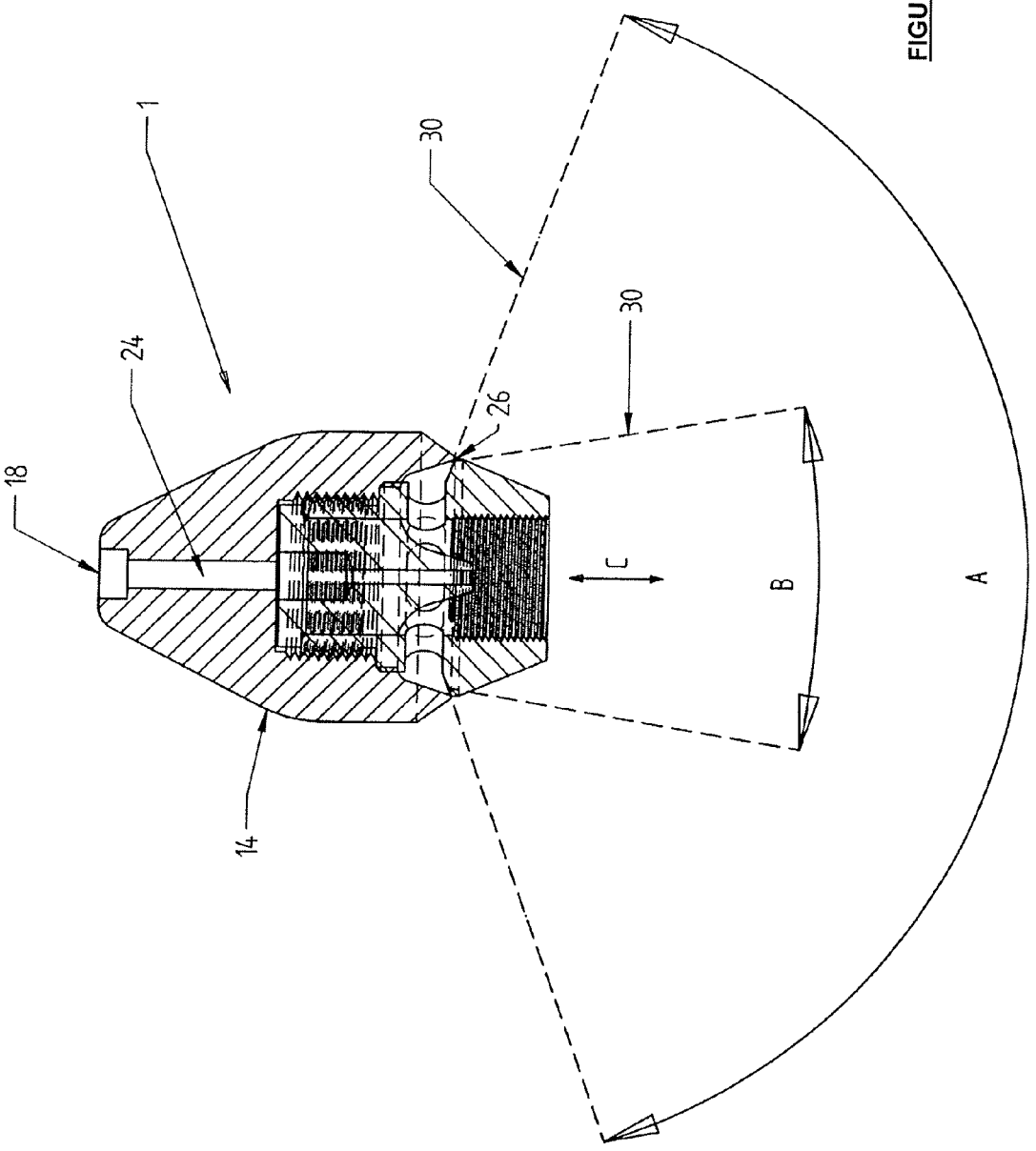

FIGURE 3

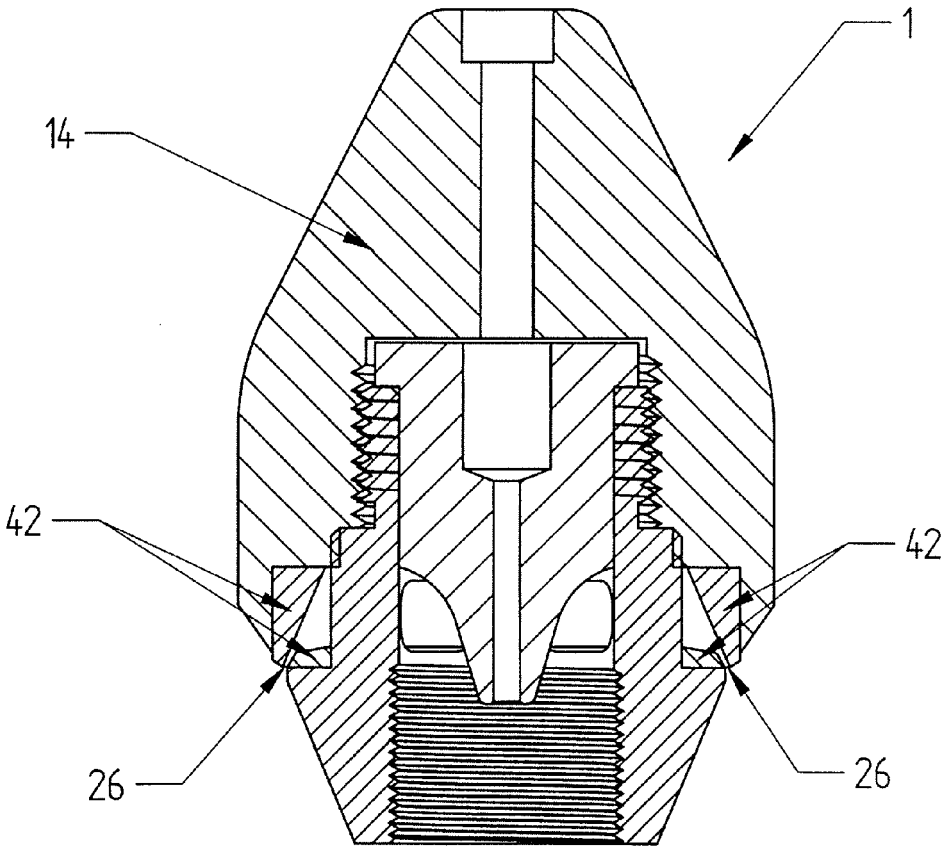

FIGURE 4

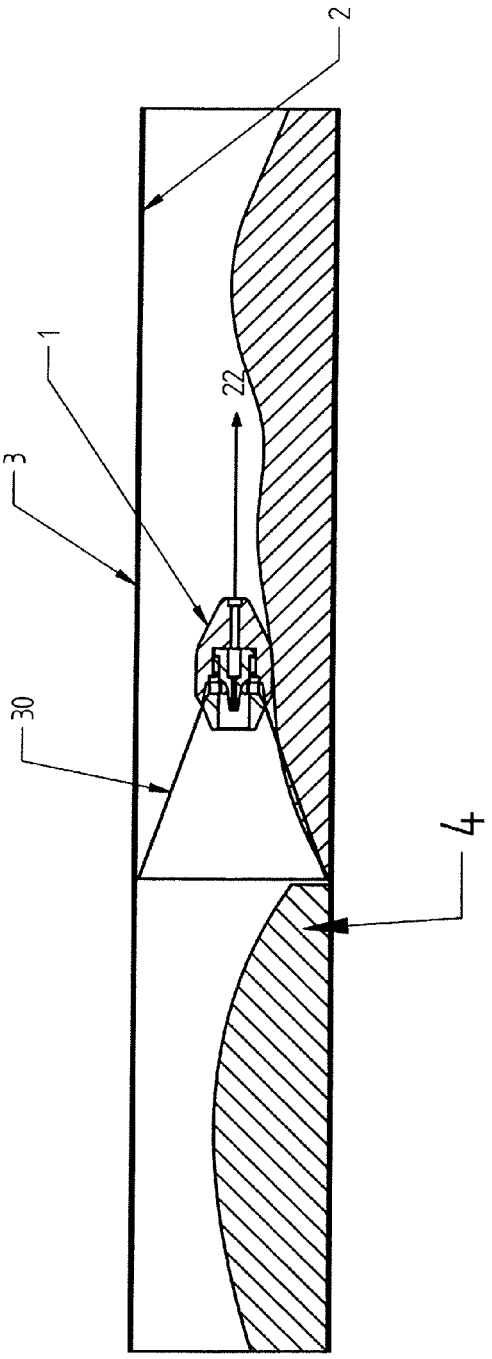

FIGURE 5

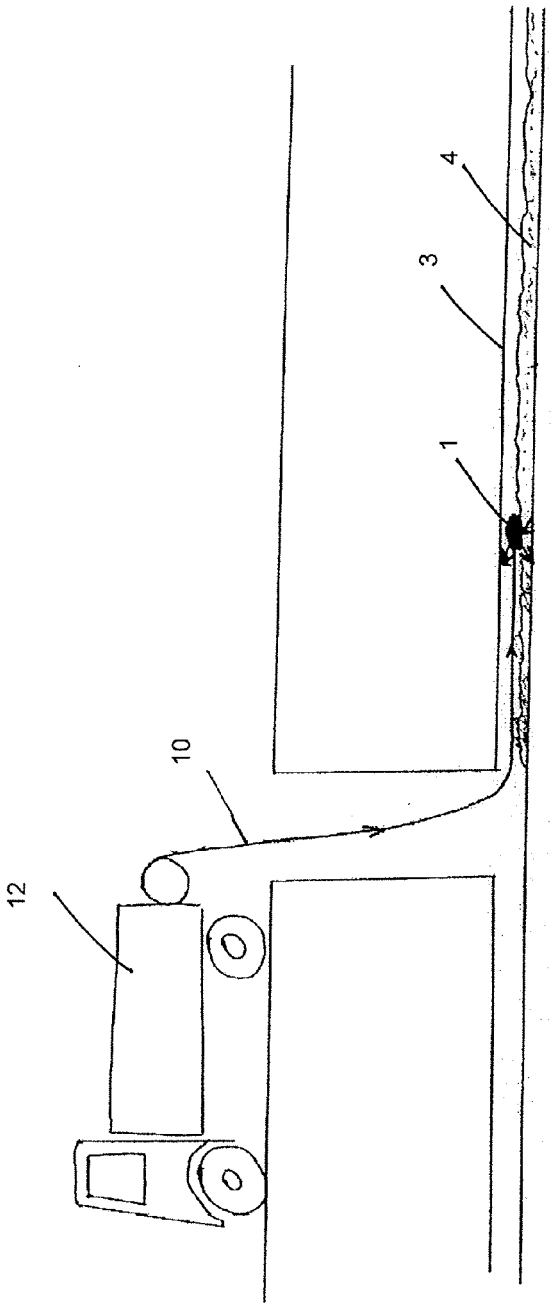

FIGURE 6

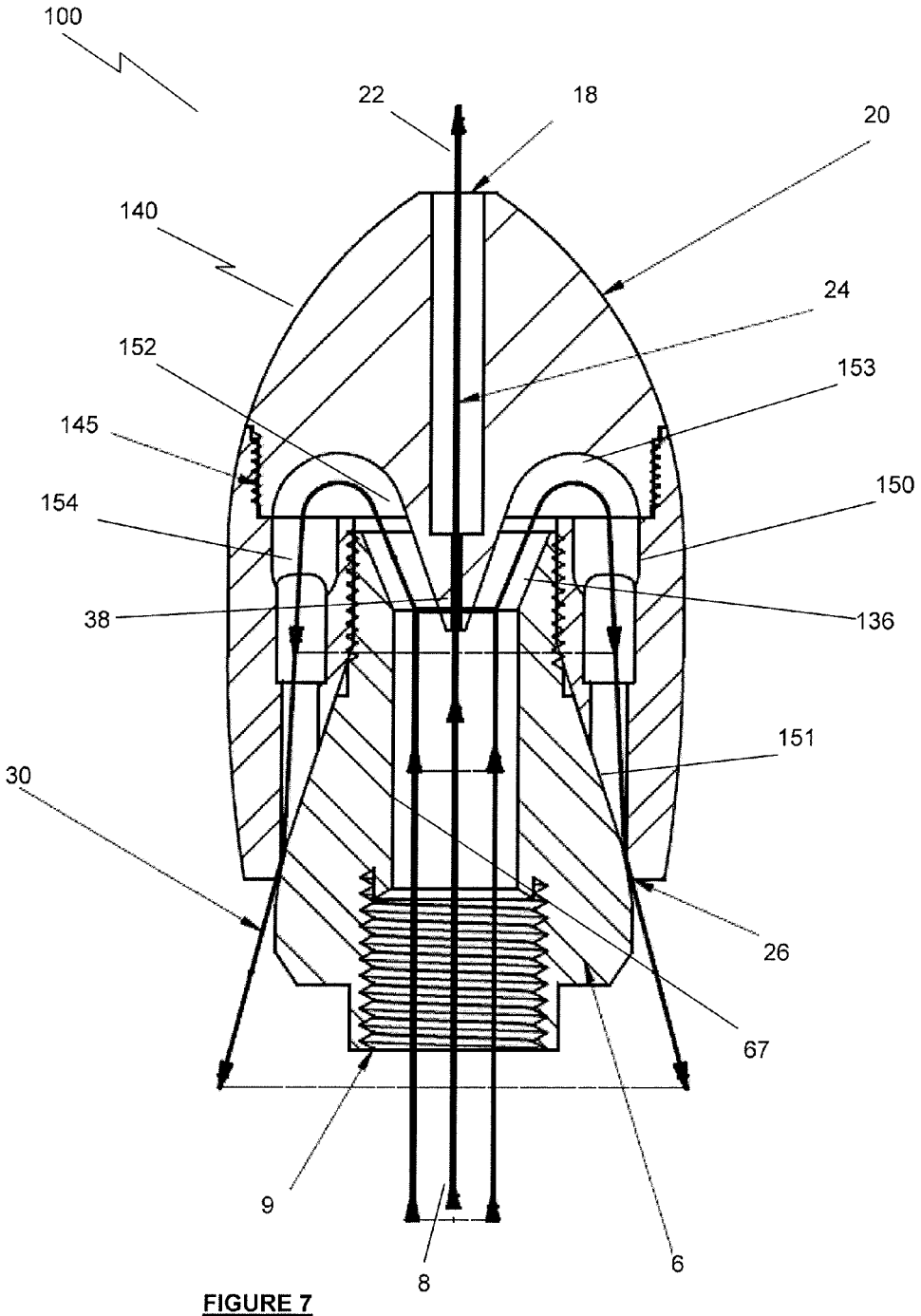

FIGURE 7

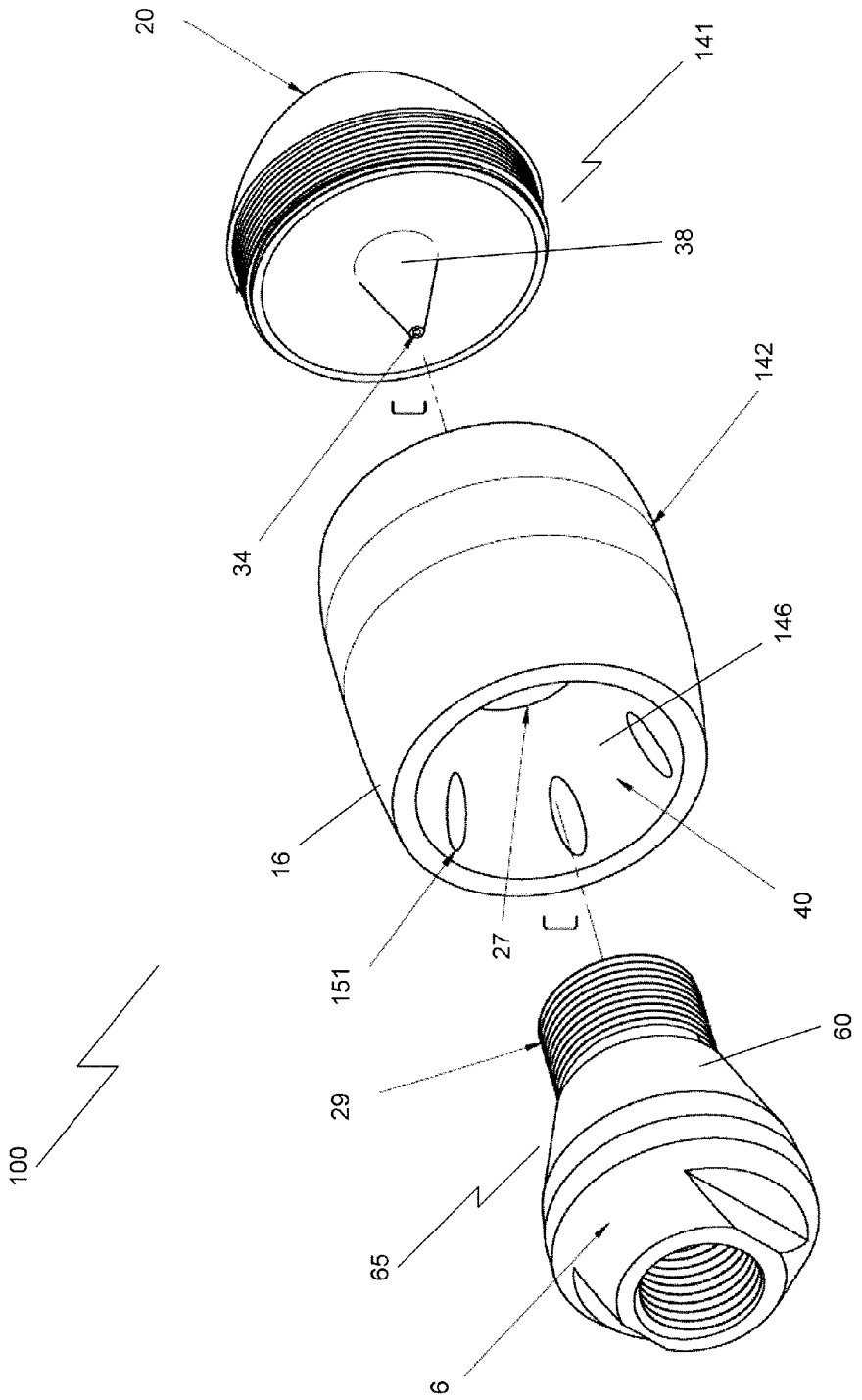

FIGURE 8

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EUROPEAN SEARCH REPORT

Application Number
EP 10 16 6361

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 195 16 780 C1 (HOERGER KURT [DE]; LUTZE HANS PROF DR [DE]) 8 August 1996 (1996-08-08)	1-9,14, 15	INV. E03F9/00 B08B9/049
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