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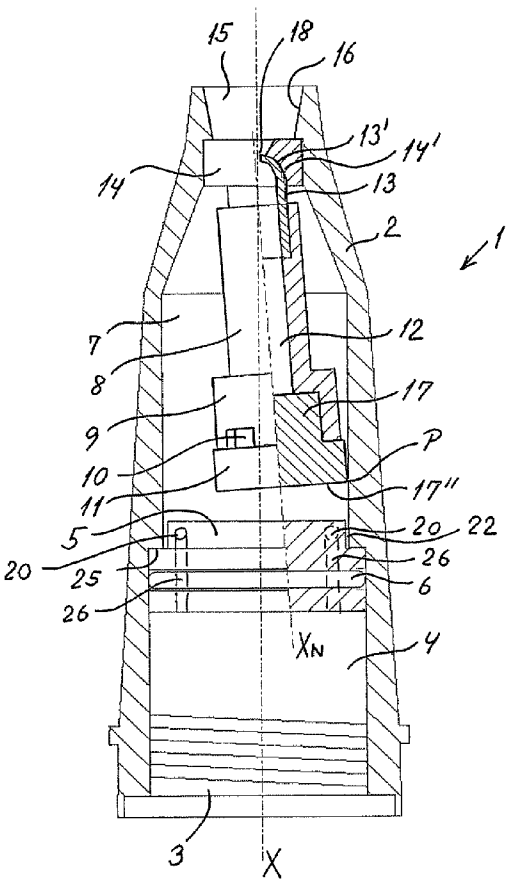
(54) **Title:** ROTATING NOZZLE



(57) **Abstract:** The present invention relates to a rotating nozzle for high-pressure cleaning devices comprising a nozzle house (2) provided with a fluid exit opening (15) comprising a seat (14) co-operating with a first end portion (13) of a nozzle member (8), such that the nozzle member (8) can undergo pivotal or rotational movement relative to a lon- gitudinal axis (X) through the nozzle house (2), the nozzle house (2) being provided with an inlet charnber(4), from which fluid flows through a diffuser (5) into a nozzle house chamber (7), in which said nozzle member (8) is provided, where the nozzle member (8) according to a specific embodiment of the invention, is furthermore provided with a second end portion (9) longitudinally opposite the first end portion (13) of the nozzle member (8), which second portion is provided with at least one opening (10) serving the dual purpose of initiating rotation of the nozzle member (8) and determining its maximum rotational velocity.

WO 2008/004030 A1

ROTATING NOZZLE

TECHNICAL FIELD

The present invention relates generally to nozzles for high-pressure cleaning devices, and particularly to such nozzles provided with means making the jet of pressure fluid leaving the nozzle rotate relative to the main body of the nozzle of the cleaning device.

BACKGROUND OF THE INVENTION

It is known within the art to apply rotating nozzles in connection with high-pressure cleaning devices.

Thus for instance EP 0 879 644 B1 describes a rotating nozzle section of a cleaning device comprising a cylindrical nozzle house chamber in which there is provided a nozzle member, the exit end of which is in engagement with a seat in such a manner that the nozzle member can undergo pivotal or rotational movement within the cylindrical nozzle house chamber under the influence of high-pressure fluid circulating in the chamber. The nozzle member comprises a frusto-conical portion, the outer surface of which rests against the inner wall of a corresponding portion of the nozzle house chamber, when the nozzle member is rotating. The desired maximum rotational velocity of the nozzle member about its longitudinal axis is determined by the frictional force between the surface of the frusto-conical portion of the nozzle member and the corresponding portion of the inner wall of the nozzle house chamber. Specific materials suitable for these parts and specific coefficients of friction are mentioned in the document. By the choice of suitable materials or coefficients of friction the rotational velocity of the nozzle member about its own longitudinal axis can be determined.

DE 40 13 446 C1 describes a rotating nozzle section provided with a nozzle house chamber into which high-pressure fluid is led in a manner making the fluid in the nozzle house chamber rotate about the longitudinal axis hereof. As in the above

document a nozzle member is rotatably provided in the nozzle house chamber and brought to rotate under the influence of the fluid rotating in the nozzle house chamber. A portion of the outer circumferential surface of the nozzle member is during rotation in contact with a corresponding portion of the inner wall of the nozzle house chamber via an O-ring. The coefficient of friction between this O-ring and the inner wall of the nozzle house chamber is described as limiting the rotational velocity of the nozzle member itself about its own longitudinal axis, thereby maintaining a compact jet of cleaning fluid circulating in the surrounding space as a consequence of the rotation of the nozzle member about the longitudinal axis of the nozzle house itself.

Furthermore EP 0 600 937 B1 describes a rotating nozzle for a cleaning device of a kind somewhat similar to the one described above and also comprising a nozzle house chamber in which a nozzle member is mounted for rotation about the longitudinal axis of the nozzle house driven by the cleaning fluid rotating in the nozzle house chamber. The nozzle house chamber is provided with frusto-conical sidewalls along which the nozzle member moves rotated by the fluid in the chamber. Between the nozzle member and the side walls of the nozzle house chamber is inserted two O-rings, which (partly through interaction with the fluid in the chamber) during rotation of the nozzle member impede the rotational movement of the nozzle member about the longitudinal axis of the nozzle house and hence function as a break, limiting the rotational velocity of the nozzle member about the longitudinal axis of the nozzle house. The nozzle member is furthermore at the end opposite its fluid exit provided with an axially extending channel, in which is accommodated a ball that due to the centrifugal force exerted on the ball during rotation of the nozzle member is urged against a contact surface provided at an adjacent longitudinal end of the nozzle house chamber. The frictional force between the ball and the contact surface, which force increases with the rotational velocity of the nozzle member, also serve to limit the rotational velocity of the nozzle member about the longitudinal axis of the nozzle house.

It is a problem of rotating nozzle arrangements that a very high velocity of cleaning fluid is required in order to initiate rotational movement of the nozzle member in the nozzle house chamber and to overcome friction. Furthermore it is required to limit the rotational velocity of the nozzle member both above the longitudinal axis of the

nozzle house and about the nozzle members own longitudinal axis in order to obtain optimal cleaning efficiency.

SUMMARY OF THE INVENTION

On the above background it is an object of the present invention to provide a rotating nozzle of the above kind comprising means for limiting the rotational velocity of the nozzle member about the longitudinal axis of the nozzle house and about its own longitudinal axis, hence maintaining a compact jet of cleaning fluid rotating at a certain predetermined optimal rotational velocity about the longitudinal axis of the nozzle house or within a certain predetermined velocity interval. Although other velocity intervals may be chosen a desirable interval is between 2500 RPM to 3500 RPM.

It is a further object of the invention to provide means for initiating the rotation of the nozzle member.

Desirably, although not necessarily, these objects are attained by a single technical feature, thus serving the dual function of initiating the rotation of the nozzle member and limiting the final rotational velocity of the nozzle member.

At least according to specific embodiments of the invention, it is a further object to provide said velocity limiting/rotation initiating means in such a manner that these means can also function at least as part of one or more fluid communication passages leading cleaning fluid from the nozzle house chamber to the fluid exit of the nozzle member.

The above objects are advantageously attained according to the present invention with a rotating nozzle member not comprising parts undergoing relative displacement or rotation to other parts of the nozzle member, as for instance the ball member described in EP 0 879 644 B1. Furthermore the rotating nozzle according to the invention does in principle not place specific requirements on materials used for the different parts of the rotating nozzle or frictional coefficients between adjacent materials in the rotational nozzle apart from the fact that a sufficient friction must during

rotation of the nozzle member in the nozzle house chamber be present at the contact point between the nozzle member and the corresponding portion of the inner wall of the nozzle house chamber in order to ensure that the nozzle member actually rolls on the inner wall of the nozzle house chamber during operation of the rotating nozzle.

These and further objects and advantages are according to the invention attained with a rotating nozzle for a high-pressure cleaning device as defined by claim 1. An alternative to the rotating nozzle defined by claim 1, which does also fall within the scope of the present invention, is defined in claim 2.

Thus the rotor nozzle according to the invention comprises a nozzle house provided with a nozzle house chamber having a fluid exit opening through which a jet of cleaning fluid is ejected, where the exit opening comprises a seat co-operating with a first end portion of a nozzle member accommodated within said nozzle house chamber, such that the nozzle member can undergo pivotal and rotational movement relative to a longitudinal axis X through the nozzle house, the nozzle house being provided with an inlet chamber or inlet portion receiving cleaning fluid from a suitable fluid source, from which inlet chamber fluid flows through a diffuser into said nozzle house chamber, in which said nozzle member is provided, said diffuser causing the fluid in the nozzle house chamber to rotate about the longitudinal axis X of the nozzle house, in such a manner that this rotation of fluid causes the nozzle member to rotate about the longitudinal axis X of the nozzle house, and where a second end portion of the nozzle member longitudinally opposite said first end portion of the nozzle member is provided with at least one opening in the circumferential surface of the nozzle member and adapted for co-operation with the fluid flowing in the nozzle house chamber. As an alternative, as defined by claim 2, at least one protrusion extending substantially radially outwardly from the circumferential surface of the nozzle member and adapted for co-operation with the fluid flowing in the nozzle house chamber could, according to the invention, be provided on the nozzle member. Even combinations of said openings and protrusions provided on the nozzle member would be conceivable and would fall within the scope of the present invention.

Specifically the said one or more openings could be of a substantially square or rectangular configuration and formed in said second end portion of the nozzle member, as will be described in further details in the detailed description of the invention. Alternatively, other shapes of openings may be used according to the invention, such as circular or elliptic openings.

The diffuser is, in a manner that is known per se within the art, provided with fluid passages leading from the inlet chamber and exiting substantially tangentially in the nozzle house chamber, whereby the fluid entering the nozzle house chamber is brought to rotate about the longitudinal axis of the nozzle house.

The one or more rotation impeding openings (or alternatively protrusions) are acted upon by the rotating body of fluid in the nozzle house chamber in a manner which will be more fully understood with reference to a description of an embodiment of the invention given in the following. The fluid action of said one or more openings will initially have the effect that the nozzle member starts to rotate, and when a certain maximum desired rotational velocity of the nozzle member has been reached, fluid action on the opening(s) will impede the rotation of the nozzle member due to a counter rotation of the nozzle member itself about its own longitudinal axis, thus setting the maximum rotational velocity of the nozzle member.

According to an embodiment of the invention, said openings can furthermore provide fluid communication between the nozzle house chamber and a nozzle chamber in-side the nozzle member from which the fluid can exit through a nozzle outlet in the first end portion of the nozzle member as a jet of cleaning fluid.

According to a preferred embodiment of the invention, the nozzle member is furthermore provided with a stabiliser at the second end portion of the nozzle member, which due to the inertia/moment of inertia of the stabiliser stabilises the movement of the nozzle member. Preferably – although not necessarily – the stabi-liser could form part of the velocity limiting means and/or the above-mentioned fluid passages.

According to a specific embodiment of the invention, said stabiliser could be made of metal (for instance aluminium) or another relatively heavy material, the first end portion of the nozzle could be made of a ceramic material to reduce abrasion of this

portion of the nozzle member, and the remaining parts of the nozzle member could be made of a plastics material, for instance the same material as the nozzle house itself. The seat mentioned above could for instance also be made of a ceramic material.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention itself and its mode of operation will be better understood with reference to the following detailed description of an embodiment hereof in conjunction with the figures of the drawing, where

figure 1(a) shows a longitudinal cross sectional view of the nozzle section according to an embodiment of the invention;

figure 1(b) shows a diffuser used in the embodiment of figure 1(a);

figure 2 shows a further longitudinal cross sectional view of the nozzle section of the embodiment shown in figure 1, specifically illustrating the presence of a fluid passage leading from the nozzle house chamber to an interior chamber in the nozzle member;

figure 3 shows a schematic representation of a lateral cross sectional view along line A - A in figure 2, illustrating the operational principle of the invention; and

figure 4 shows a schematic exploded perspective view of an embodiment of the nozzle member according to the invention.

DETAILED DESCRIPTION OF THE INVENTION

In the following a detailed description of a specific embodiment of the rotating nozzle according to the invention is described, but it is understood that a person skilled in the art will be able to conceive other embodiments of the basic inventive concepts

set forth in the summary of the invention without deviating from the scope of the invention as defined by the independent claim.

Thus with reference to figure 1(a) there is shown a longitudinal cross sectional view of the rotating nozzle according to an embodiment of the invention generally indicated by reference numeral 1 in figure 1(a). The rotary nozzle 1 comprises a nozzle house 2, forming a body of revolution about a longitudinal axis X. At one longitudinal end the nozzle house 2 is provided with an inlet 3, through which cleaning fluid under pressure is led to an inlet chamber 4 terminated by a diffuser 5 sealed against the inner surface of the inlet chamber 4, for instance by an O-ring 6.

The details of the diffuser 5 according to this embodiment of the invention are shown in figure 1(b). The diffuser 5 comprises two portions 23 and 24, the latter provided with the sealing O-ring 6, and an internal chamber 21 effectively forming part of the total inlet chamber 4, when the diffuser is provided in the nozzle house. The upper end face of the portion 24 rests against a shoulder portion 25 on the inside of the nozzle house. Portion 23 of the diffuser 5 has a diameter a little less than the diameter of the corresponding portion of the inner surface of the nozzle house, whereby a circumferential gap 22 is formed between portion 23 of the diffuser 5 and the corresponding portion of the inner surface of the nozzle house. Fluid communicating canals 26 are provided between the chamber 21 and the circumferential surface of portion 23 of the diffuser 5 in such a manner that fluid is led substantially tangentially relative to the longitudinal axis X of the nozzle house out into the gap 22 through openings 20. By these means fluid leaving the diffuser will eventually rotate in the nozzle house chamber 7.

Referring again to figure 1(a) the nozzle house 2 is provided with an internal chamber, the nozzle house chamber 7, in which a hollow nozzle member 8 is pivotably/rotationally guided by engagement between a first end portion 13 of the nozzle member 8 and a corresponding seat 14. This seat 14 is provided at a fluid exit opening 15 of the nozzle house longitudinally opposite the inlet 3.

A nozzle member 8 according to an embodiment of the invention will now be described with reference to figures 1(a) and 2.

The nozzle member 8 comprises a substantially tubular body around a longitudinal axis X_N. The nozzle member 8 is provided with an internal nozzle chamber 12 at one longitudinal end terminated by a first end portion 13 comprising a rounded (spherical) portion 13' for engagement with a similarly shaped inner portion of the seat 14. This arrangement allows the nozzle member 8 to undergo pivotal or rotational movement relative to the seat 14 and hence to the nozzle house 2. The end portion 13 is provided with a nozzle outlet 18 for fluid passing through the nozzle member 8. This fluid can leave the nozzle house 2 through the fluid exit opening 15. The longitudinal end of the nozzle member 8 opposite the first end portion 13 is provided with an end portion 9, in the shown embodiment of a somewhat larger outer diameter than the main middle portion of the nozzle member 8. In this end portion 9 there is inserted a stabilising member 11 made of a relatively heavy material, such as aluminium, which stabilises the movement of the nozzle member 8 due to its inertia/moment of inertia. The stabiliser 11 may be provided with a cylindrical end portion 17 fitting tightly into the cylindrical inner space of the end portion 9 of the nozzle member 8. During rotational movement of the nozzle member 8 within the nozzle house chamber 7, a portion of the circumferential surface of the stabiliser 11 moves in contact with the inner surface of the nozzle house chamber as indicated by P in figure 1(a).

The end portion 9 of the nozzle member 8 is furthermore provided with one or more radial openings 10 distributed over the circumferential surface of the end portion 9. The purposes of these openings have been described initially in the summary of the invention and will be further described in connection with figure 3.

Referring to figure 2, the complete fluid path from the inlet 3 to the nozzle outlet 18 of the rotating nozzle according to this embodiment of the invention is described. Specifically the nozzle member 8, is according to this embodiment, provided with fluid passages 19 connecting the openings 10 with the internal nozzle chamber 12 of the nozzle member 8. Such passages, of which only a single is shown in cross sectional view in figure 2, are distributed along the insert portion 17 of the stabiliser 11 from each corresponding opening 10 to the internal nozzle chamber 12. Thus the complete fluid path through the rotating nozzle according to this embodiment of the invention is from the inlet 3 through the inlet chamber 4 and via the passages 26 in the stabiliser 5 to the nozzle house chamber 7, and from hence via the passages 19

to the inner nozzle chamber 12 of the nozzle member 8, and finally through the nozzle outlet 18.

Referring to figure 3, there is shown a schematic representation of a lateral cross sectional view along line AA in figure 2, shown partly to explain the function of the rotating nozzle mechanism according to the present invention. Figure 3 thus shows a cross sectional view through the nozzle house chamber 7 of the nozzle house 2 viewed towards the end face 17" of the stabiliser 11. Also indicated in figure 3 is a single of the openings 10 in the circumferential surface of the end portion 9 of the nozzle member 8. During operation of the rotating nozzle cleaning fluid rotates within the nozzle house chamber 7, as indicated by arrow B in figure 3, and this fluid rotation causes the end of the nozzle member longitudinally opposite the nozzle exit 18 to rotate within the nozzle house chamber 7 along the inner circumferential surface hereof, as indicated by P. During this rotation of the complete nozzle member (arrow B) the nozzle member 8 itself is forced - due to friction at point P between the corresponding portions of the nozzle member and the inner wall of the nozzle house chamber - to undergo rotation in the opposite rotational direction about its longitudinal axis X_N as indicated by arrow C in figure 3. The nozzle member 8 will thus undergo rotation against the rotational direction of the fluid in the nozzle house chamber as it rolls on the inner circumferential surface of the nozzle house chamber. This counter rotation of the nozzle member will cause the openings 10 to impede the rotation of the nozzle member 8 around the longitudinal axis X of the nozzle house, thereby functioning as a break, which determines the maximum rotational velocity of the nozzle member 8 about the longitudinal axis X of the nozzle house 2. Thus, as described previously, the openings 10 serve the dual function initially to help starting the rotation of the nozzle member 8 and to determine the maximum rotational velocity of the rotating nozzle 8 according to the invention.

Referring to figure 4, there is shown an exploded view of a specific embodiment of the nozzle member 8 according to the invention. In this embodiment the inner wall of the end portion 9 of the nozzle member 8 is provided with a number of fluid channels 19 formed between thicker wall portions 27 of the inner wall of the end portion 9 and the outer circumferential surface of the insert portion 17 of the stabiliser 11, when this is inserted into the end portion 9 of the nozzle member 8. These fluid

channels terminate in radially inwardly extending sections 28 communicating with the second nozzle chamber 12 in the nozzle member 8.

It is understood that other specific configurations of fluid channels may also be devised by a person skilled in the art without deviating from the scope of the invention.

LIST OF REFERENCE NUMERALS

1. Nozzle section
2. Nozzle house
3. Inlet
4. Inlet chamber
5. Diffuser
6. O-ring
7. First nozzle chamber
8. Nozzle member
9. End portion of nozzle member
10. Opening in end portion
11. Stabiliser
12. Second nozzle chamber
13. Ceramic end portion of nozzle member
13'. Rounded portion of ceramic end portion
14. Ceramic seat
14'. Rounded portion of ceramic seat
15. Fluid exit opening of nozzle house
16. Inclined inner wall of fluid exit opening
17. Insert portion of stabiliser
18. Nozzle outlet
19. Fluid passage in nozzle member
20. Tangential openings in fluid passages in diffuser
21. Internal chamber of diffuser
22. Gap between diffuser and nozzle house chamber
23. Gap-forming portion of diffuser
24. Second (sealing) portion of diffuser
25. Internal shoulder of nozzle house chamber
26. Fluid communication canals in diffuser
27. Inner wall portions of second portion of nozzle member
28. Thicker (radially inwardly extending) wall portions 27
X. Longitudinal axis of nozzle house
X_N Longitudinal axis of nozzle member

CLAIMS

1. Rotating nozzle for a high-pressure cleaning device comprising a nozzle house (2) provided with a fluid exit opening (15) comprising a seat (14) co-operating with a first end portion (13) of a nozzle member (8) comprising a nozzle chamber (12), such that the nozzle member (8) can undergo pivotal and rotational movement relative to a longitudinal axis (X) through the nozzle house (2), the nozzle house (2) being provided with an inlet chamber(4), from which fluid flows through a diffuser (5) into a nozzle house chamber (7), in which said nozzle member (8) is provided, characterised in that a second end portion (9) of said nozzle member (8) longitudinally opposite said first end portion (13) of the nozzle member (8) is provided with at least one opening in the circumferential surface of the nozzle member (8).

2. Rotating nozzle for a high-pressure cleaning device comprising a nozzle house (2) provided with a fluid exit opening (15) comprising a seat (14) co-operating with a first end portion (13) of a nozzle member (8) comprising a nozzle chamber (12), such that the nozzle member (8) can undergo pivotal or rotational movement relative to a longitudinal axis (X) through the nozzle house (2), the nozzle house (2) being provided with an inlet chamber(4), from which fluid flows through a diffuser (5) into a nozzle house chamber (7), in which said nozzle member (8) is provided, characterised in that a second end portion (9) of said nozzle member (8) longitudinally opposite said first end portion (13) of the nozzle member (8) is provided with at least one protrusion extending from the circumferential surface of the nozzle member (8) or a combination of at least one opening (10) in the circumferential surface of the nozzle member (8) and at least one of said protrusions.

3. Rotating nozzle according to claim 1 or 2, characterised in that said nozzle member (8) at the longitudinal end opposite said first end portion (13) is provided with a stabilising member (11) that stabilises the rotational movement of the nozzle member (8) due to the inertia/moment of inertia of the stabilising member (11).

4. Rotating nozzle according to claim 3, characterised in that said stabilising member (11) is releasably inserted into and retained in a longitudinal end of said second end portion (9) of the nozzle member (8).

5. Rotating nozzle according to claim 3 or 4, characterised in that said openings (10) are formed at the interface between said second end portion (9) and said stabilising member (11), such that a portion of the opening is formed by the stabilising member (11).

6. Rotating nozzle according to any of the preceding claims, characterised in that said one or more openings are substantially square or rectangular or circular or elliptic.

7. Rotating nozzle according to claim 1, characterised in that said nozzle chamber (12) is in fluid communication with said nozzle house chamber (7) via one or more passages (19) in the nozzle member (8).

8. Rotating nozzle according to claim 7, characterised in that said one or more passages (19) connect said nozzle chamber (12) with said one or more openings (10) in the circumferential surface of the nozzle member (8), whereby fluid can flow from the nozzle house chamber (7) through said openings (10) and said passages (19) into the nozzle chamber (12).

9. Rotating nozzle according to claim 8, characterised in that said passages (19) are formed in the inner circumferential wall of the end portion (9) of the nozzle member (8) and defined by radially inwardly extending wall portions (27) of the end portion (9) of the nozzle member (8) and the outer circumferential surface of the insert portion (17) of the stabiliser (11), when the latter is inserted into the end portion (9).

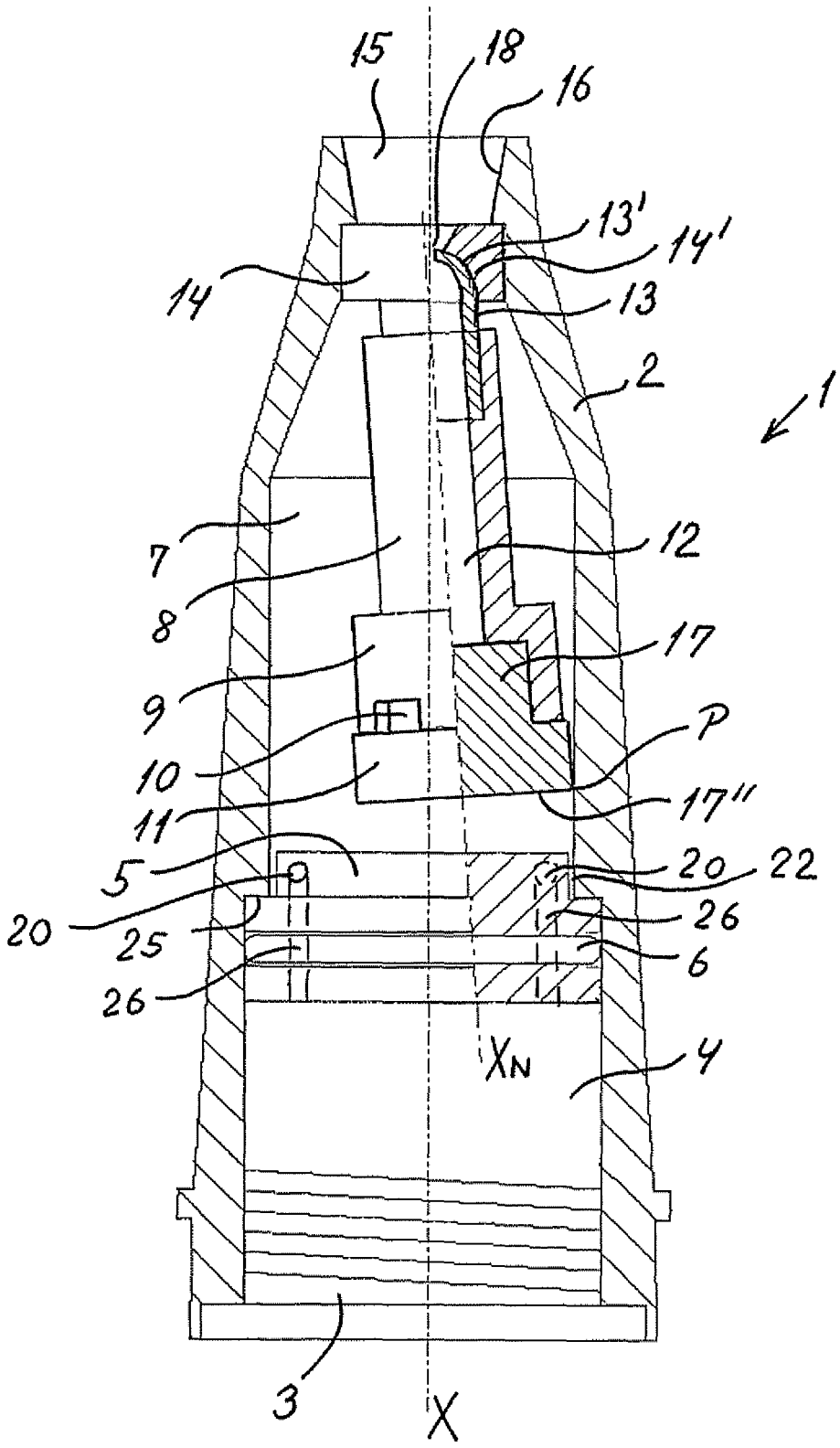


Fig. 1(a)

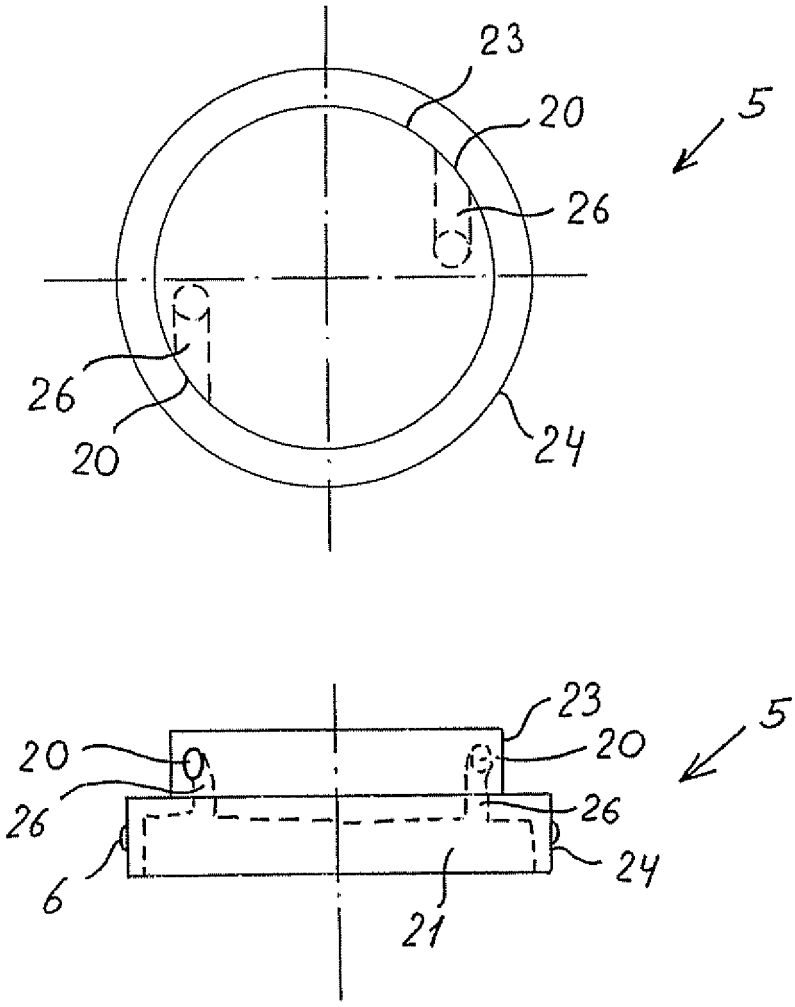


Fig. 1(b)

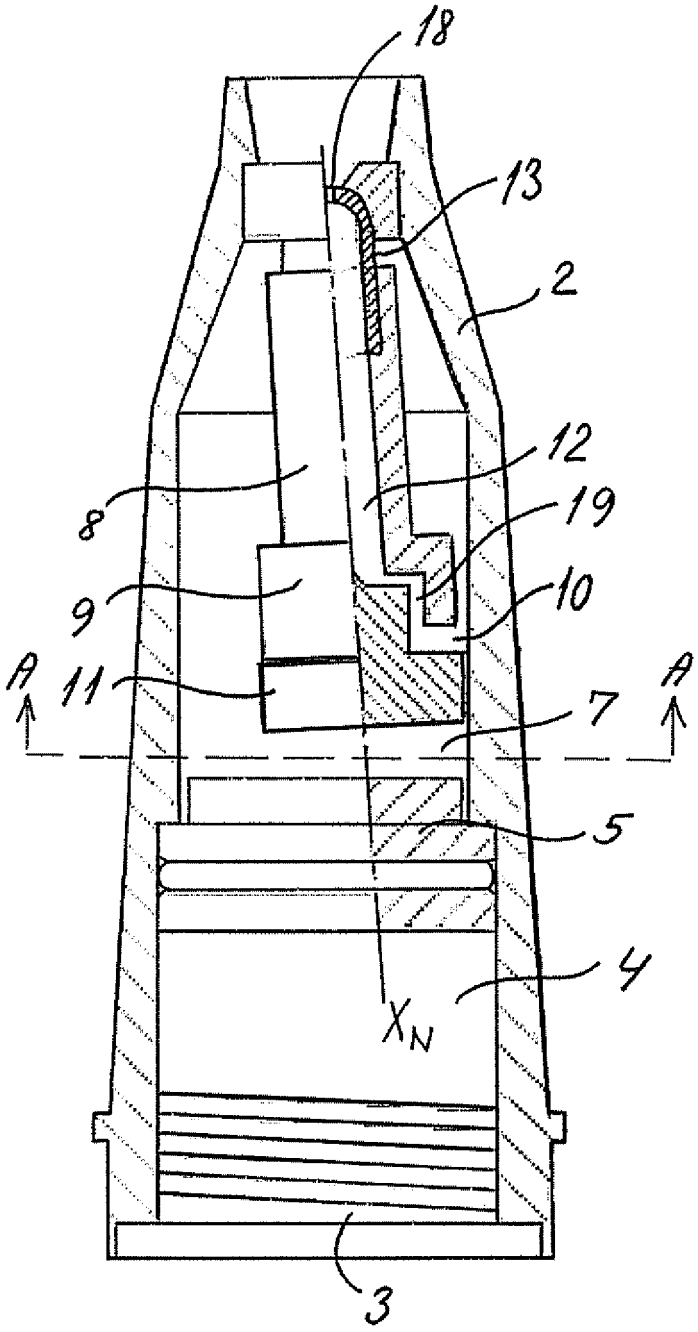


Fig. 2

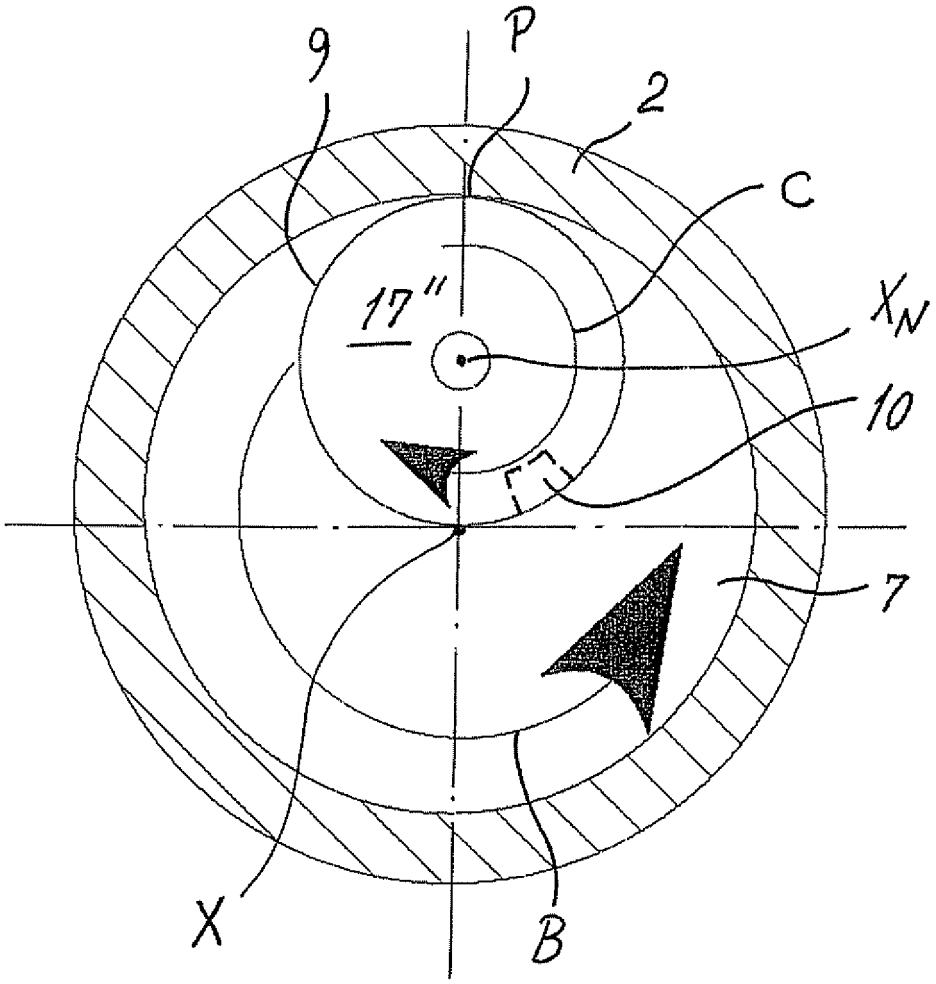


Fig. 3

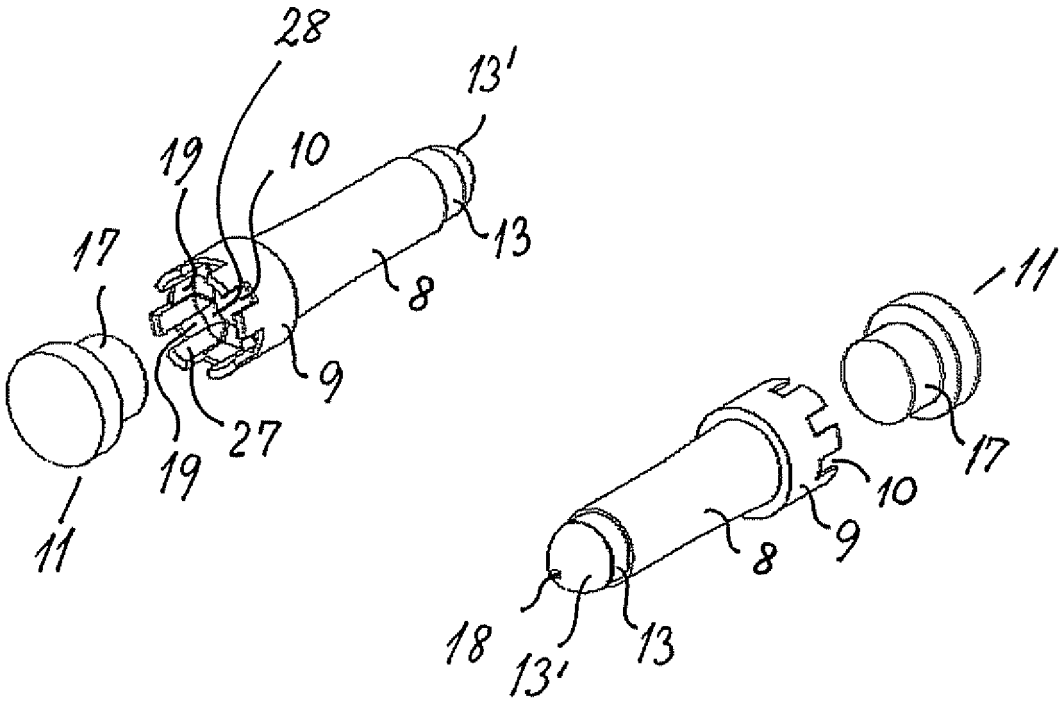


Fig. 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2006/052200

A. CLASSIFICATION OF SUBJECT MATTER
INV. B05B3/04

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)
B05B

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

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X	DE 10 2004 047586 A1 (KAERCHER GMBH & CO KG ALFRED [DE]) 6 April 2006 (2006-04-06) paragraph [0021] - paragraph [0023] paragraph [0037] - paragraph [0038] paragraph [0042] figures	1-8
E	EP 1 719 557 A1 (EINHELL HANS AG [DE]) 8 November 2006 (2006-11-08) paragraph [0030] claims 18,20 figure 1	1,3-9

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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"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

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Date of the actual completion of the international search	Date of mailing of the international search report
18 January 2007	29/01/2007

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Barré, Vincent

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2006/052200

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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