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(54) **Inner washing device for pipings and valves**

(57) A cleaning device suitable for pipes with a retractable boom (1), connected to a fluid supply comprising

several nozzles (3) at the inserted end which are partially covered by a rotatable ring (4) which moves under the influence of the fluid pressure.

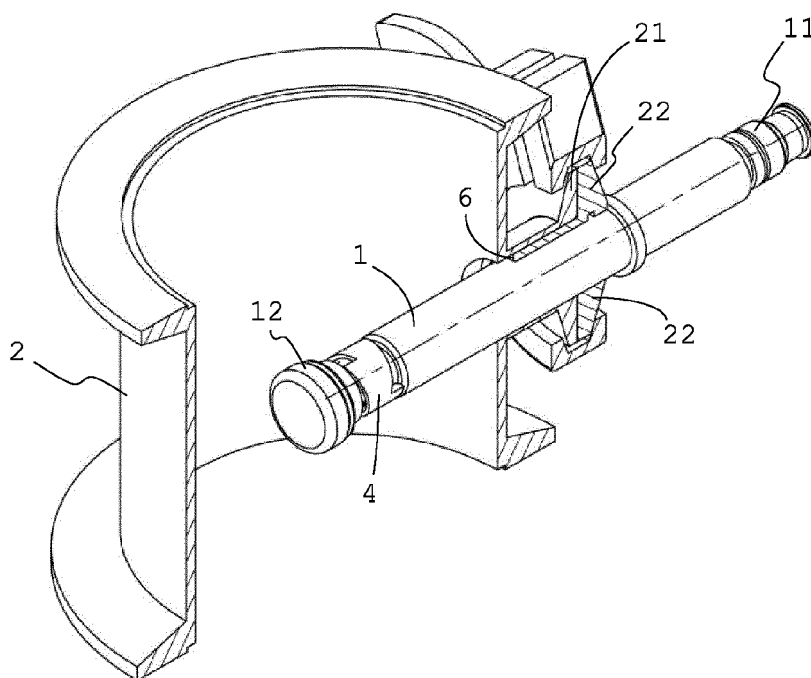


FIG. 2

Description

Technical field

[0001] The present invention belongs to the sector of the pipings and valves used in loading and unloading systems for bulk materials in the form of powder, grains, capsules, and similar, for instance those handled in the pharmaceutical, chemical, and food industries.

Prior art

[0002] In the chemical, food, and pharmaceutical industries, bulk materials shall often be handled using loading and unloading systems that include appropriate pipings, which are possibly complete with accessories, for instance on-off valves.

[0003] In many cases, these materials shall be handled in such a way as to avoid or minimize any contacts with the external world, in order not to contaminate the materials as well as to prevent the bulk materials from dispersing in the environment.

[0004] Another real problem is that of keeping the inner walls of the pipings clean and even more of cleaning those component parts of the loading and unloading system which possibly get in contact with both the piped material and the environment.

[0005] A number of systems have been set up, e.g. that described in EP 1550833 A2, which consists of a sleeve, to be installed between two butterfly valves, equipped with appropriate means to feed and exhaust a washing liquid by means of appropriate ducts, the liquid feeding duct, in particular, comprising a spray head, and the exhaust one being adjustable, to make it possible to place it as close as possible to the valve that closes the lower section of the sleeve.

[0006] However, the just-described solution has a number of disadvantages, specifically the jets of the spray head are static, consequently they do not scavenge the inner surface of the sleeve completely; moreover, the small holes of the spray head unavoidably get in contact with the substances that are piped in the duct, which means a substantial risk for them of clogging; finally, the spray head remains permanently internally to the sleeve, thus representing an obstacle to the flow of the materials.

[0007] Adjustable washing liquid exhaust heads have also been developed, hence capable of scavenging, with their jets, more continually than with fixed spray heads.

[0008] In particular, EP 1574762 A2 and EP 1604747 A2 describe a washing device comprising an exhaust head of the orbital type which, by rotating under the thrust of the washing liquid, is capable of addressing its own jets in all directions in a plane orthogonal to the axis of rotation of the head, so as to continually scavenge the inner walls of the pipings along a circumference.

[0009] Moreover, the orbitating head of the washing device described in EP 1604747 A2 is mounted at an end of a movable arm, also rotating around its own axis,

through which the head can translate towards the center axis of the piping whenever a washing is to be made and can be retracted close to a wall, while the material flows, in a partially recessed position, so as to reduce the projection of the head internally to the duct.

[0010] Whereas the solution comprising a double-orbit head, rotating around two axes, allows to cover the complete solid angle by 4π steradians, on the other hand it is very complex to implement and difficult to use, in that it implies the use of complex kinematic mechanisms and motor-driven driving systems.

[0011] Furthermore, in these solutions too, the small holes through which the washing liquid comes out might get in contact with the bulk materials and clog.

Objects and brief description of the invention

[0012] Therefore, the purpose of the present invention is to provide a washing device that is simple, economical, and rugged, and simultaneously overcomes the drawbacks of the inventions described above, being capable of providing an effective washing of the inner walls without being necessarily motor-driven.

[0013] This scope and others are achieved using a washing device comprising a case formed of a pipe trunk (2) equipped with a side sleeve (21) with a washing pipe (1) slidably coupled therewith inside said side sleeve (21).

[0014] An end (11) of said washing pipe (1), external to the case, is connected to a hydraulic washing fluid feeding circuit, whereas the other end of said washing pipe (1), internal to the case, comprises a number of nozzles (3), arranged circumferentially, with a rotor (4) that covers some of them.

[0015] The rotor (4) can rotate around the axis of said washing pipe (1) only and its profiles are shaped like the drivers of a cylindric cam, so the nozzles are partly covered and partly uncovered.

[0016] Whenever the pressurized fluid is fed inside the washing pipe (1), then it comes out through the nozzles (3) at a high speed and, if a nozzle is partially covered by the rotor's (4) profile, then the jet impacts the profile, consequently its trajectory is modified and energy is transferred to the rotor, which is driven to rotation and, while some nozzles are covered, other become uncovered.

[0017] This way, because of the impact with the rotor's (4) profile, the washing liquid jets are forced to continually change their direction so as to ultimately hit the complete inner surface of the pipe trunk (2), including its side bases where butterfly valves or other devices are usually placed, a circumstance that is taken advantage of to intercept the material and for other purposes.

[0018] In a particularly accurate version of this invention, the inner side surface (43) of the rotor (4) and the surface of at least one of said terminating profiles (41, 42) are connected to each other by two surfaces (44, 45) having substantially the shape of a truncated cone to

enhance the rotational effect of the rotor and the deviation of the jets.

[0019] The impact of the washing liquid jets onto said tilted connection surfaces (44, 45) enhances the transfer of energy to the rotor (4) while simultaneously changing the direction of the jets, which ultimately scavenge the complete inner surface of the pipe trunk (2).

[0020] Another purpose of the present washing device is that of leaving the section that the material goes through, completely unobstructed, without hampering the pipe trunk at all during the loading/unloading operations. This prevents the passage from being obstructed and the nozzles from clogging because of the bulk material.

[0021] This latter purpose has been achieved by providing means to retract the washing pipe from the advanced operating position up to a rear idle position.

[0022] Tightness means (22) are interposed between the outer surface of the washing pipe (1) and the inner surface of the sleeve (21) to improve the insulation from the external world and vice versa.

[0023] The inner end of the washing pipe (1) is provided with a projection ridge (12), the functions of which are to prevent the washing pipe (1) from slipping off from the sleeve (21) and to adhere to a ring-shaped surface (6), placed in a position slightly set back with respect to the inner side wall of the pipe trunk while the washing pipe (1) is taken out, thus completely isolating the device with respect to the through flowing material and to the environment.

[0024] Advantageously, said ring-shaped surface (6) can be realized on the inner side of said tightness means (22), and the latter can be implemented using a polymeric material that guarantees both watertightness and smoothness.

[0025] A toroidal gasket (62) can be interposed between the ring-shaped surface (6) and the projection ridge (12) to improve their mutual isolation.

Brief description of drawings

[0026]

- Fig. 1 shows an axonometric view of the present invention, the washing pipe (1) being located in its advanced operating position.
- Fig. 2 shows an axial section of the pipe trunk (2), the side sleeve (21), and the tightness means (22) of the present washing device; the figure is drawn so as to make the washing pipe (1), along with the projection ridge (12) and the rotor (6), visible. The ring-shaped surface (6) is also partially visible.
- Fig. 3 shows a more detailed view of that end of the washing pipe (1) which remains inside the case; the projection ridge (12), the nozzles (3), and the rotor (4) are visible. In the embodiment shown in Figure 3, a toroidal gasket (62) is interposed between the ring-shaped surface (6) and the projection ridge (12).

Figure 3 also indicates the track of cross-section plane A-A.

- Fig. 4 shows cross-section A-A of the present washing device.
- Figures 5, 6, 7, and 8 show a number of detailed views of that end of the washing pipe (1) which moves inside the case; each of the mentioned figures shows a different position possibly assumed by the rotor (4) around the axis of said washing pipe (1). Figure 5 shows the track of the cross-section B-B plane; Figure 6 that of the cross-section C-C plane; Figure 7 that of the cross-section D-D plane; and Figure 8 that of the cross-section E-E plane.
- Figures 5a, 6a, 7a, and 8a represent cross-section B-B, cross-section C-C, cross-section D-D, and cross-section E-E of the present washing device, respectively.

Detailed description of an embodiment of the invention

[0027] The inner washing device for pipings that is the object of the present invention comprises a washing pipe (1), which slides inside a sleeve (21) located on the side wall of a pipe trunk (2) between an advanced operating position and a rear idle position.

[0028] Conveniently, said sleeve (21) can be of a standard type, as well as the pipe trunk (2). One of the outstanding advantages associated with the adoption of standard elements consists of the possibility of using standard locking means to join them to each other.

[0029] That end (11) of said washing pipe (1) which is external to the case formed of the pipe trunk (1) to which the sleeve (21) is secured, comprises means to connect to a hydraulic feeding circuit, whereas the other end of said washing pipe (1), internal to said pipe trunk (2), comprises a plurality of nozzles (3) arranged so as to describe at least one circumference.

[0030] In a preferred embodiment of this invention, the nozzles are arranged so as to describe two adjacent circumferences.

[0031] Irrespective of whether the nozzles describe one circumference only or more than one, some of them are partially covered by a rotor (4), which is free to rotate around the axis of said washing pipe (1) only. At least one of the two terminating profiles (41, 42) of said rotor (4) is shaped like the driver of a cylindrical cam delineating one or several ramps, each of which always covers at least two consecutive nozzles.

[0032] When the nozzles (3) are arranged along two circumferences (31, 32), each of the terminating profiles (41, 42) of said rotor (4) delineates at least one ramp. The ramps are so tilted that, whenever the rotor (4) turns, all ramps simultaneously feature the same growing or lowering pattern.

[0033] Advantageously, the inner side surface (43) of said rotor (4) and the surface of at least one of said terminating profiles (41, 42) are connected to each other by

surfaces (44, 45) having the shape of substantially a truncated cone.

[0034] Whenever a pressurized fluid is fed into the washing pipe (1), a fluid jet comes out at a high speed from each individual nozzle, be it completely or partially unobstructed.

[0035] Those jets which come out from the uncovered nozzles follow a substantially rectilinear trajectory until they impact the surface to be washed; on the contrary, those jets which come out from partially covered nozzles impact the ramp profile of the rotor, consequently they deviate from their own trajectories and transfer a part of their energy to the rotor, which is thus driven to rotation. The deviation from the original trajectory caused by the impact with the rotor results in changing the direction of the liquid jets, so as to reach all internal areas of the pipe trunk, including both the side surfaces and the base surfaces.

[0036] In order to enhance the transfer of energy from the jets to the rotor (4) and the deviation of the jets from the trajectory, the inner side surface (43) of the rotor (4) and the surface of at least one of said terminating profiles (41, 42) can be connected to each other by surfaces (44, 45) having the shape of substantially a truncated cone.

[0037] According to a preferred embodiment of this invention, the nozzles (3) are arranged radially and are perpendicular to the axis of the washing pipe (1).

[0038] In order to guarantee the necessary isolation between the internal part of the case and the external world, the sliding coupling between said washing pipe (1) and said sleeve (21) takes place through a tightness element (22) interposed between them.

[0039] In order not to hamper the flow of materials in the pipe trunk, nor to risk the obstruction of the nozzles, the washing pipe (1) stays in the advanced operating position just for the time necessary for washing, whereas the washing pipe (1) slides back towards the external world while the material flows inside the pipe trunk, so as to leave the section where the material flows, unobstructed.

[0040] Advantageously, that end of said washing pipe (1) which is internal to said pipe trunk (2) is blind and forms a circular anti-slip-off projection ridge (12) having an outer diameter greater than that of that section of said washing pipe which is slidingly coupled with said sleeve (21).

[0041] The projection ridge (12) operates in such a way as to prevent the washing pipe (1) from being completely taken out, because of wrong operations, when moving from the advanced operating position to the rear idle position.

[0042] In a simple and economical embodiment of said circular projecting ridge (12), use is made of a plug (12), which is also used to close the end located inside the washing pipe (1).

[0043] A ring-shaped surface (6), coaxial to said washing pipe (1), is located in a position slightly set back with respect to the side wall of said pipe trunk (2). Whenever

the washing pipe (1) goes back towards the idle position, said projection ridge (12) approaches said ring-shaped surface (6); the tightness between the projection ridge (12) and the ring-shaped surface (6) can be enhanced by interposing a toroidal gasket (62) between them; this way, the complete device remains isolated from both the through flowing bulk material and the environment.

[0044] For practical reasons, the ring-shaped surface (6) can be realized directly on the tightness element (22).

Claims

1. An inner washing device for ducts, comprising a washing pipe (1), slidingly coupled with the inner part of a sleeve (21) located on the side wall of a pipe trunk (2) and movable between an advanced operating position and a rear idle position; the outer end (11) of said washing pipe (1) being equipped with means to connect to a hydraulic feeding circuit, and the end of said washing pipe (1) internal to said pipe trunk (2) being provided with a plurality of nozzles (3), **characterized in that** said nozzles (3) are arranged circumferentially and some of them are covered by a rotor (4) which is free of rotating around the axis of said washing pipe (1) only.
2. A washing device according to the previous claim, **characterized in that** at least one of the two terminating profiles (41, 42) of said rotor (4) is shaped like the driver of a cylindrical cam delineating one or several ramps.
3. A washing device according to one or several of the previous claims, **characterized in that** each of said one or several ramps always covers at least two consecutive nozzles (3).
4. A washing device according to one or more of the previous claims, **characterized in that** said nozzles (3) are arranged along two circumferences (31, 32) and each of the terminating profiles (41, 42) of said rotor (4) delineates at least one ramp and, whenever said rotor (4) rotates, all of said ramps simultaneously feature the same growing or lowering pattern with respect to the external world.
5. A washing device according to one or several of the previous claims, **characterized in that** the inner side surface (43) of said rotor (4) and the surface of at least one of said terminating profiles (41, 42) are connected to each other by surfaces (44, 45) having the shape of substantially a truncated cone.
6. A washing device according to one or more of the previous claims, **characterized in that** said nozzles (3) are arranged radially and are perpendicular to the axis of said washing pipe (1).

7. A washing device according to one or several of the previous claims, **characterized in that** that end of said washing pipe (1) which is internal to said pipe trunk (2) is blind and forms a circular anti-slip-off projection ridge (12) having an outer diameter greater than that of that section of said washing pipe which is slidingly coupled with said sleeve (21). 5
8. A washing device according to one or several of the previous claims, **characterized in that** the sliding coupling between said washing pipe (1) and said sleeve (21) takes place through the interposition of a tightness element (22). 10
9. A washing device according to one or more of the previous claims, **characterized in that**, in a position slightly set back with respect to the side wall of said pipe trunk (2), there is a ring-shaped surface coaxial to said washing pipe (1), which approaches said projection ridge (12) whenever the washing pipe (1) is in the rear idle position, tightness being provided by a toroidal gasket (62) interposed therebetween. 15 20
10. A washing device according to one or more of the previous claims, **characterized in that** said ring-shaped surface (6) is built on said tightness element (22). 25

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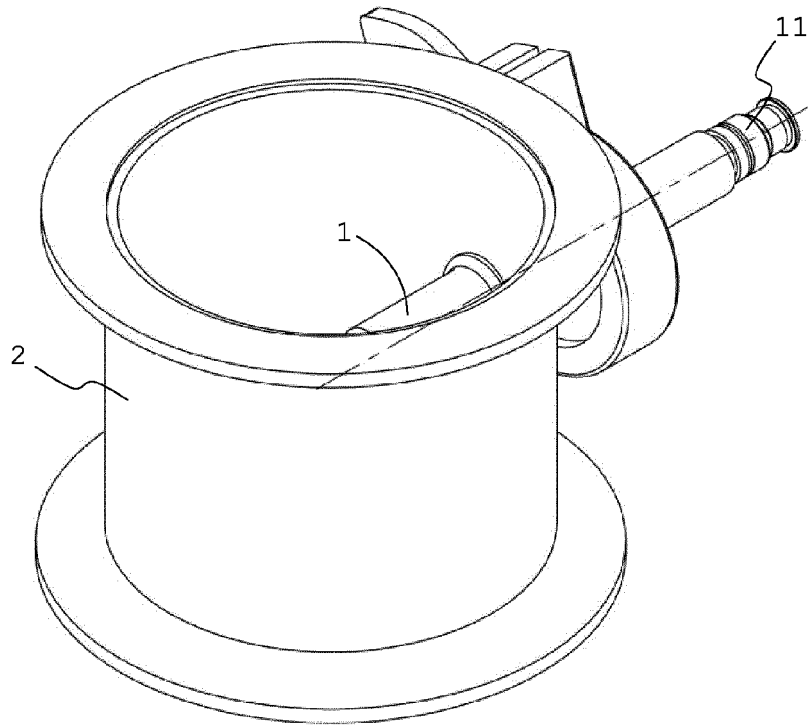


FIG. 1

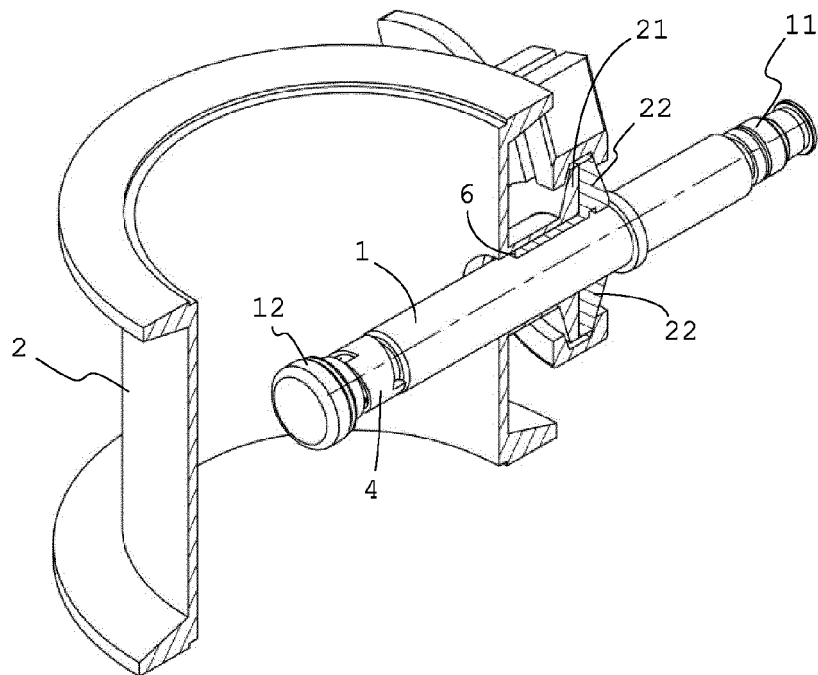


FIG. 2

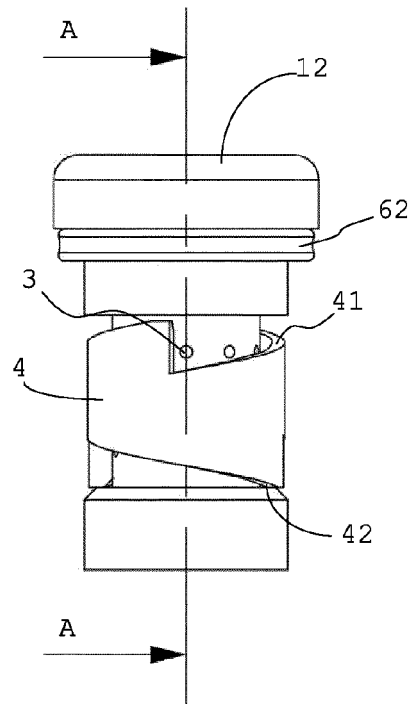


FIG. 3

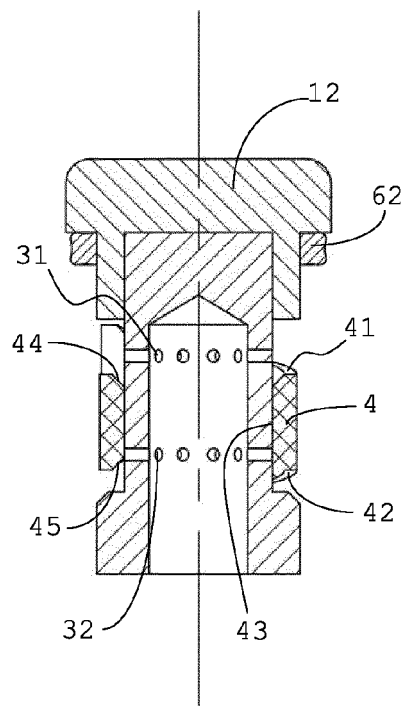


FIG. 4

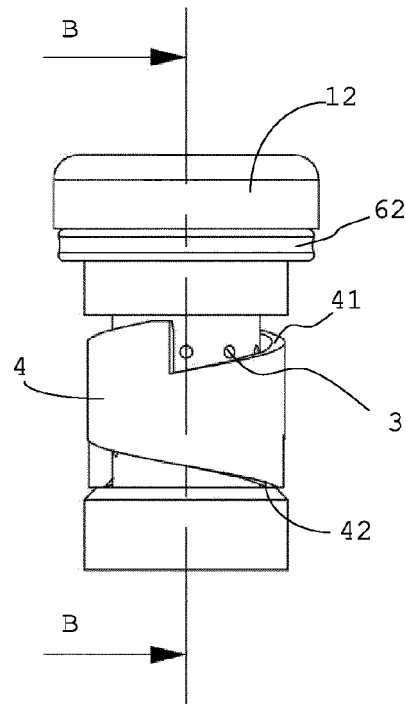


FIG. 5

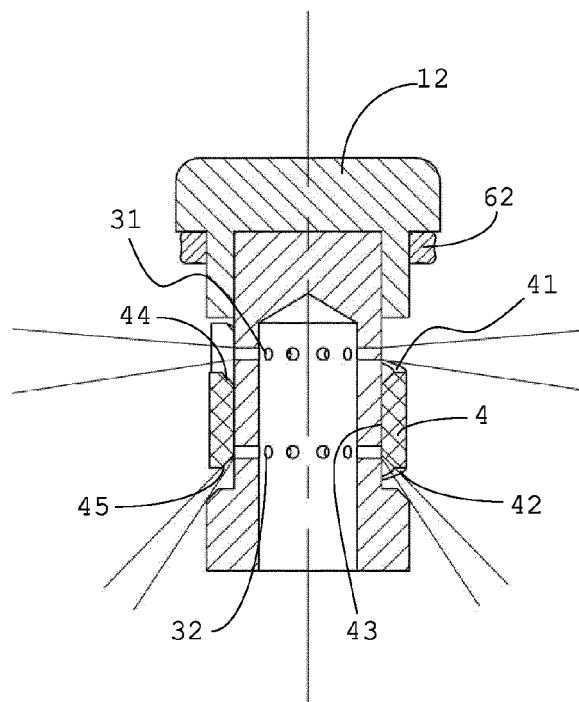


FIG. 5a

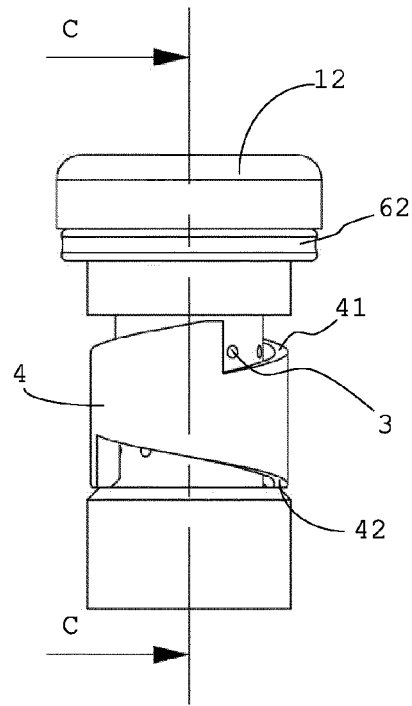


FIG. 6

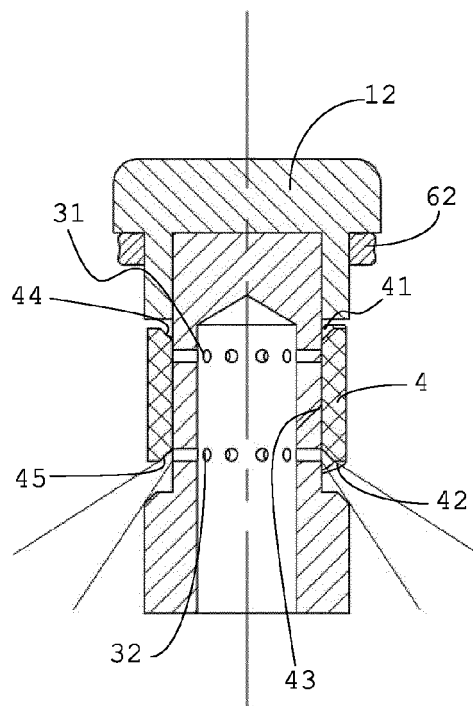


FIG. 6a

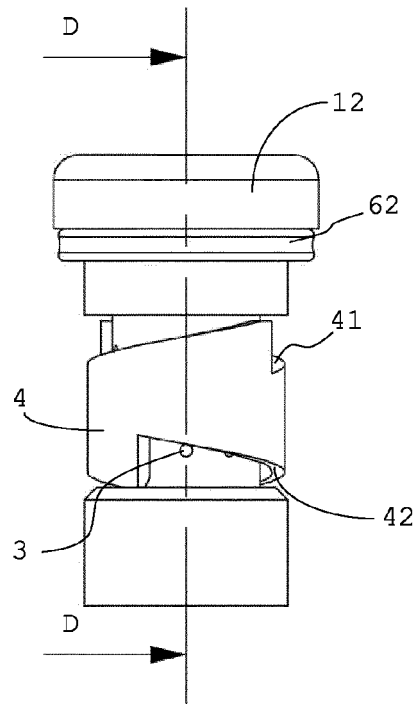


FIG. 7

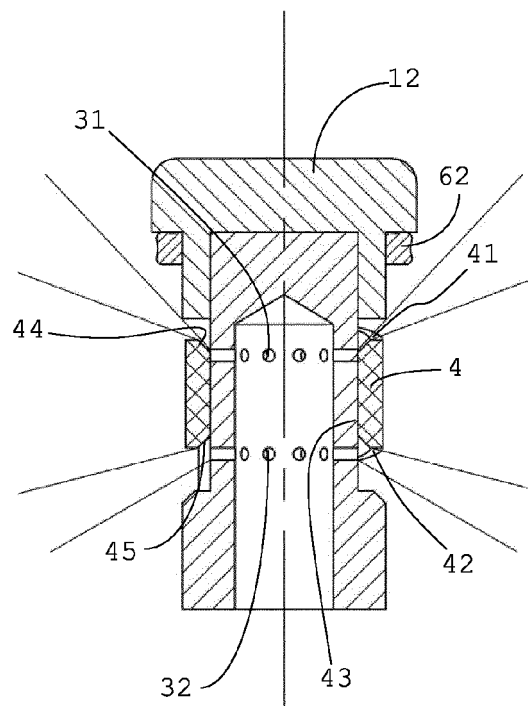


FIG. 7a

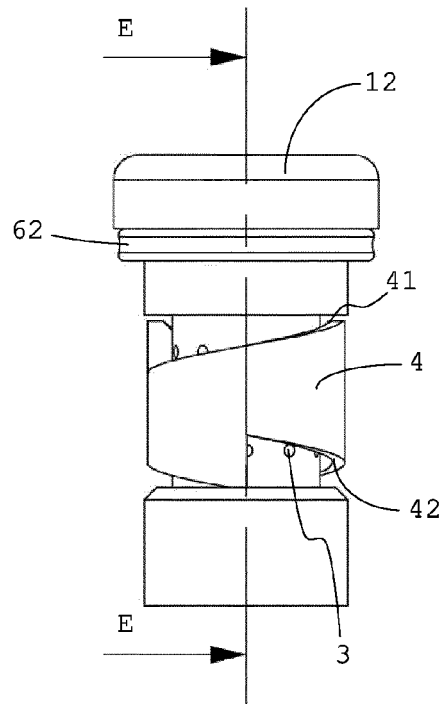


FIG. 8

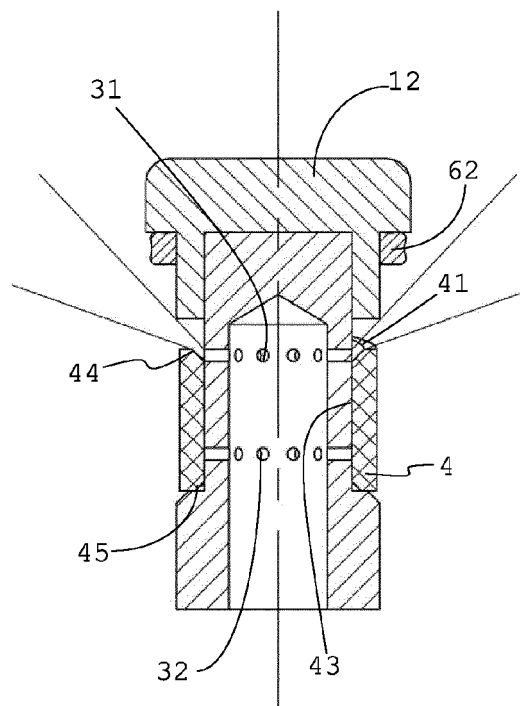


FIG. 8a



EUROPEAN SEARCH REPORT

Application Number
EP 13 15 3999

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	GB 2 346 945 A (HARING CHRISTOPHER GEORGE [GB]) 23 August 2000 (2000-08-23) * abstract * * page 1, line 1 - page 19, line 6; claims 1-31; figures 1-14 *	1-10	INV. B08B9/093 B08B9/032 B05B1/16 B05B1/26 B05B3/02 B05B13/06
Y	US 1 734 580 A (HIPPENMEYER IRVING R) 5 November 1929 (1929-11-05) * page 1, line 2 - page 2, line 36; claims 1-2; figures 1-4 *	1-10	
			TECHNICAL FIELDS SEARCHED (IPC)
			B08B B05B
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 21 May 2013	Examiner Psoch, Christian
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ON EUROPEAN PATENT APPLICATION NO.**

EP 13 15 3999

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 2346945	A	23-08-2000	NONE
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US 1734580	A	05-11-1929	NONE
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REFERENCES CITED IN THE DESCRIPTION

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- EP 1574762 A2 [0008]
- EP 1604747 A2 [0008] [0009]