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(54) **Device and cleaning installation for removing soot or the like**

(57) The present invention concerns a device for removing soot or similar inside deposits on the inside of a processing system such as a boiler, heat exchanger, flue gas filter or the like, by intermittently blasting a gaseous medium into the processing system in directions specified by a direction means which may be rotated. By the present invention, difficult accessible walls of the insides of processing systems, such as boilers or the like may be cleaned for soot or similar inside deposits.

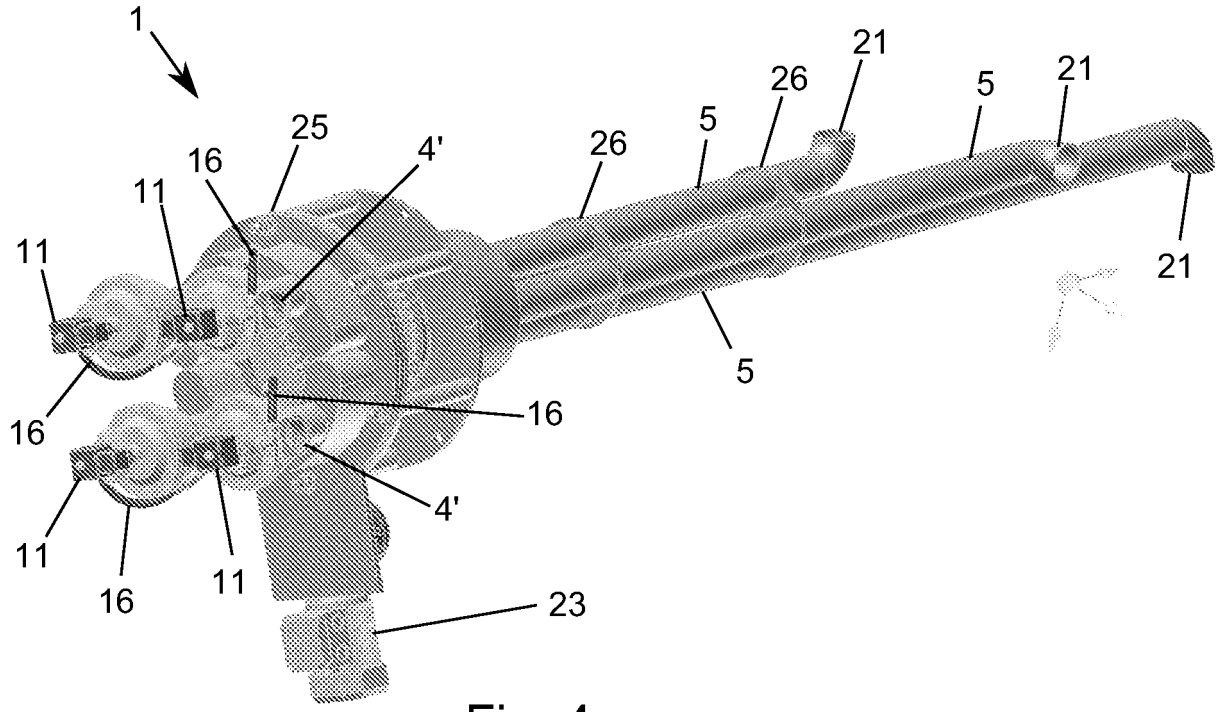

Fig. 4

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Description

[0001] The present invention relates to a device and cleaning installation for removing soot or similar inside deposits on the inside of a processing system such as a boiler, heat exchanger, flue gas filter or the like, by intermittently blasting a gaseous medium into the processing system. A cleaning installation of this kind is known from EP 1 134 537 A2.

[0002] Boiler installation sediments of soot or the like often occur on the inside of heat surfaces that are in contact with flue gasses. This seriously reduces the thermal conductivity and thereby also the efficiency of the boiler if not removed.

[0003] For removal of these deposits, methods are known, such as mechanical cleaning or blast cleaning using steam, water or air as cleaning means for the removal of soot. Some of these cleaning methods require shut-down of the boiler installation whilst other methods allow for the boiler to remain in operation at a reduced level of efficiency.

[0004] The cleaning equipment is subjected to a heat and corrosive impact from the gasses inside the boiler installation. Due to the aggressive environment in the flue gasses, the cleaning equipment is often mounted on the outside of the gas chamber of the boiler. Permanent mounting of the blasting tubes in the boiler wall may cause a deterioration of the components in the soot removal equipment exposed to the gasses inside the boiler and in particular to valve and membrane components.

[0005] The components are in particular subject to corrosion due to the hot, aggressive flue gasses during the off-cycles, i.e. when no air is blasted through the valve assembly, the associated tube passage and into the boiler. When there is no forced air flow in the valve assembly, flue gas will escape from the main gas stream in the boiler and fill the passage space. This causes mechanical wear and corrosion of the exposed components of the cleaning equipment which, in turn, reduces the cleaning efficiency and again causes a drop in the efficiency of the boiler installation.

[0006] The cleaning equipment typically comprises a pressure vessel from which pressurized air is fed to a number of diaphragm valves. The valves are controlled by control means.

[0007] The control means activates the valves in a preprogrammed sequence and the pipes in the boiler governed by the associated valve are blasted with the pressurized air.

[0008] The air is blasted for 0.1-1 second at an interval of approx. 2-10 minutes. This cleaning cycle, i.e. the duration and the frequency, can be adjusted according to requirements, such as the type of fuel, the amount of fouling and the boiler output. The pressure vessel is usually operated at about 7-11 bars. However, these parameters may be adjusted in accordance with the actual needs of the boiler installation.

[0009] There are many different types of boilers in power plants. Particularly municipal waste burning plants, bio-mass fuelled plants and waste heat recovery installations generate corrosive flue gasses during the burning process.

[0010] A cleaning installation for removing soot is known from EP 1 134 537 A2, wherein is disclosed a device for use in a cleaning installation for removing soot or similar inside deposits in a flow channel in a processing system such as a boiler, heat exchanger, flue gas filter or the like, by intermittently blasting a fluid or gaseous medium into the processing system, said device comprising a flow passage, between associated valve means and the flow channel, which is provided with an inlet allowing for a continuous flow of protective gas around the flow passage into the flow channel in the processing system.

[0011] It is an object of the invention to provide a device and a cleaning installation for reducing soot or similar inside deposits on the inside of a cleaning installation.

[0012] The object is achieved by a device for use in a cleaning installation for removing soot or similar inside deposits on the inside of a processing system such as a boiler, heat exchanger, flue gas filter, flow channel or the like, by intermittently blasting a gaseous medium into the processing system, said device comprising at least one flow passage extending from associated valve means into the processing system, wherein said at least one flow passage comprises at least one direction means for directing the gaseous medium.

[0013] In a preferred embodiment of the invention, the device comprises rotation means for rotatably mounting the said device and/or at least one flow passage to the processing system. The processing system may comprise a mounting, such as a base, for rotational engagement with the device. Preferably, the mounting comprises an engagement member having an opening with a circular cross section, which may be adapted for engagement with a cylinder member, which engagement may comprise ball bearings.

[0014] In a second preferred embodiment of the invention, the rotating means comprises an electric motor, which may engage with the device by means of gears. The rotation means allows for easy rotation of the device, which is advantageous for cleaning otherwise non-accessible or difficult available inside areas, components and the like of the processing system.

[0015] In one embodiment of the invention, a gaseous medium and/or a fluid medium is used in the blasting procedure, which may be advantageous for cleaning heavily soiled surfaces or for cleaning where a fluid is needed for dissolving solids, liquids, gaseous solutes and the like.

[0016] In a preferred embodiment of the invention, the device and/or at least one flow passage is retractably mounted to the processing system. By a retractable mounting, the device may easily be taken out of the processing system for cleaning and in operation; the device may be retracted and deployed for blasting a larger

range of inside areas of the processing system. In one embodiment, the device is slidably mounted.

[0017] In another preferred embodiment of the invention, at least one flow passage and/or at least one directing means comprises at least one tubular member. The tubular member may have a circular cross section and may be a pipe, which is often advantageous when delivering or conveying pressurized air or the like.

[0018] In another preferred embodiment of the invention, at least one directing means comprises a tubular member having a curved shape. A tubular member with a smooth curved form may be used for directing the blasts with minimal resistance for the pressurized air moving or blasted through the tubular member. In one embodiment, the flow passage and the directing means comprise tubular members which allow low resistance transmission of pressurized air and the like. Low resistance transmission may provide more blast power delivered against soot and the like by the pressurized air compared to transmission involving considerable or large resistance.

[0019] In another preferred embodiment of the invention, at least one flow passage comprises a tubular member, with a tubular member axis, and a directing means extending from the end of the tubular member, said directing means having at least one outlet defining an outlet flow direction with an axis having an angle with respect to the tubular member axis. The angle may advantageous take a value from 0 - 90 degrees. Preferably, the angle is less than 90 degrees, such as 60 degrees since the blasting effect may decline with large angles. When a blast is produced, the recoil force may be balanced out by other forces, such as forces from another blast produced at the same time and forces related to structure reinforcements.

[0020] In another preferred embodiment of the invention, the device comprises a plurality of flow passages mounted in pairs wherein each pair comprises: a first and a second tubular member defining a common tubular member axis, and a first and second direction means having a first and second outlet defining first and second outlet flow directions with first and second axes having first and second angles with respect to the common tubular member axis, preferably the first and second angles are equal in magnitude. The first and second tubular members may have different lengths, whereby a larger span of reachable cleaning area or cleaning space is achieved. In one embodiment of the invention, the flow passages are mounted in combinations other than pairs, such as in groups of odd numbers or in groups of even numbers larger than two.

[0021] In another preferred embodiment, the common tubular axis of a first and a second tubular member in a pair, and the first and the second axes lie substantially in the same plane, such that the first and second outlets are substantially oppositely directed, whereby the forces, from the recoil produced by intermittently blasting through a pair of flow passages, are substantially equal and oppositely directed. The forces or components of the forces from the recoil may substantially cancel or cancel to a large degree or to some degree. In addition, if the flow passages are of different length, by which the device may reach different areas or space for blasting, the forces or components of the forces may still substantially cancel or cancel to a large degree or to some degree.

[0022] In another preferred embodiment of the invention, a plurality of flow passages comprises a plurality of reinforcement members. The reinforcement members may serve for stability and, in addition, the reinforcement members may strengthen the device in relation to recoil forces.

[0023] In an embodiment of the invention, the device comprises a first connection member and a second connection member for at least one flow passage, said first connection member having a first flange with at least one first hole, said first flange adapted for a plurality of engagements with a second flange of the second connection member, said second flange having at least one second hole, preferably a curved elongated hole, such that the first flange is adapted for a plurality of rotationally defined engagements with the second flange, by which at least one first hole is connected to a second hole. Preferably, the first and second flanges have a circular shape. More preferably, a first hole is only connected to one second hole and vice versa. Preferably, the second hole has an area larger than the area of the first hole, whereby there is a large overlap area between the first and second holes when the first and second flanges are engaged. This is advantageous, because it is easier to align the first and second flange so that holes overlap and the risk of pressure build up due to misalignment of the flanges is lesser. Preferably, the rotationally defined engagements are discrete, such as one engagement per 15 degrees of rotation. Preferably, the first and second flanges share a common axis passing through the center of each flange. In one embodiment, one first hole and one second hole are provided per flow passage.

[0024] In one embodiment of the invention, at least one flow passage is provided with an inlet allowing for a continuous flow of a protective gas around the flow passage into the flow channel in the processing system. The flow passage may comprise an annular space between an inner tubular and an outer tubular member, where the outer tubular member is provided with an inlet providing a continuous gas flow around the flow passage into the flow channel in the processing system. Corrosion is reduced since a cushion of air is generated at the end of the flow passage during the off-cycles of the cleaning operation, as air is constantly drawn or forced in through the inlet. This means that the components are covered by this cushion and protected against the corrosive gasses in the heat exchanger or the like. Hereby, the valve means are protected from corrosion and tests have shown that durability of the exposed components facing the inside of the boiler or the like has been improved significantly. This also means that the components, such as the valve housing, may be produced in a cheap ma-

terial such as cast iron without compromising the durability of the valve means.

[0025] In a second aspect of the invention, there is provided a device comprising a valve assembly, said valve assembly comprising a diaphragm valve including a first and second chamber, said first chamber receiving pressurized air from an air supply, and said second chamber being provided with valve control means and an outlet for release of air in the chamber when activating the diaphragm valve, and a valve outlet connected to the device, wherein flow communication means is provided between the outlet of the second chamber and an inlet of a flow passage of the device.

[0026] In a third aspect of the invention, there is provided a cleaning installation for removing soot or similar inside deposits on the inside of a processing system such as a boiler, heat exchanger, flue gas filter, flow channel or the like, by intermittently blasting a gaseous medium into the processing system, said cleaning installation comprising at least one device, comprising at least one flow passage extending from associated valve means into the processing system, said cleaning installation comprising a pressure vessel that communicates with one or more valve assemblies that are each connected by a flow passage to the processing system, and said cleaning installation comprising means for connecting the device with the at least one valve means and the processing system of the associated flow passage at their respective ends, wherein said at least one flow passage comprises at least one direction means for directing the gaseous medium. In a preferred embodiment, the cleaning installation comprises rotating means for rotatably mounting the said device and/or at least one flow passage to the processing system.

Brief description of the drawings

[0027] The invention is disclosed in more detail with reference to the accompanying drawings, in which:

Fig. 1 is a schematic view of a cleaning installation according to one embodiment of the invention,

Fig. 2 is a perspective view of the device according to one embodiment of the invention,

Fig. 3 is another perspective view of the device in Fig. 2,

Fig. 4 is a perspective view of the device according to another embodiment of the invention,

Fig. 5 is a perspective close up view of the device in Fig. 4, and

Fig. 6 is a perspective close up cut-away view of the device in Fig. 4.

Detailed description of the drawings

[0028] A skilled person would appreciate that for clarity purposes; in different figures, same numerals are used to indicate the same component in the apparatus.

[0029] Fig. 1 shows a cleaning installation for pressurised air blast cleaning for removal of sediments inside a heat exchanger, boiler or similar preferably tubular installation. The installation comprises a number of valve assemblies 1 connected to a vessel 2 of pressurised air. The vessel 2 is in communication with the individual devices 1 through a main line 3 and associated supply lines 4, which lines may comprise a manifold. The devices comprise valves 10 controlled by a control system 11 by which the operating cycle of the individual devices 1 and the cleaning cycle as a whole is commanded. The air blasts are conveyed by flow passages 5 and direction means 21.

[0030] With reference to Fig. 2 and Fig. 3, according to one embodiment of the device, there is provided a valve assembly 1 comprising a flow passage 5 having a tubular member with an end portion having a curved shape 21 for directing the blast, said flow passage 5 extending from a valve 10 being connected to an associated supply line opening 4' for pressurized air and being connected to a control means 11 through a connecting chamber for controlling the valve 10. The valve assembly 1 is rotatably mounted in housing members 22 along with an electric motor 23 provided as a rotation means for rotating the valve assembly 1 by engagement of a gears 24.

[0031] The valve 10 comprises a first and a second chamber separated by a diaphragm or a membrane (not shown). When the valve 10 is activated by moving the diaphragm, pressurized air flows from the first chamber to the valve outlet and into the flow passage 5. The diaphragm is provided with a small aperture through which the pressurized air flows into the second chamber and fills this chamber with air, so that equal pressures are established on both sides of the membrane/diaphragm. The pressure in the second chamber is applied to the entire surface of the membrane whereas only a minor portion of the membrane is subjected to the pressure in the first chamber. This presses the membrane against the valve exit and keeps the valve shut.

[0032] The second chamber is in communication with atmospheric pressure through a ventilation opening in the control valve. In its resting position, a piston of the control valve will keep the ventilation opening shut by retaining pressure in the second chamber and thereby keep the valve shut between the blast-cleaning shuts. When the control valve is activated, the piston is retracted and the pressurized retention air of the second chamber is quickly released out through the ventilation opening 18. The opening 18 is provided with an air flow tube 16 connected to the inlet 8 of the flow passage device 5 at the opposite end. Hereby, an explosion-like sound is avoided from the quick release of air when the valve is activated. Instead, the air is led into the flow passage, whereby the blasting effect of the valve may even be slightly enhanced.

[0033] The tubular pipe 16 is provided with an external supply of cool air through a conduit 17. When the valve is shut and no air is released through the flexible tube

16, external air may still be sucked into or blown into the flow passage through the inlet 8. The external air may either be atmospheric air or any other gaseous air supply.

[0034] Referring now to Fig. 4-6, a second embodiment of the device is shown, wherein the valve assembly 1 has four flow passages 5 with different lengths and associated tubular end portions having a curved shape 21. By intermittently blasting through a pair of flow passages 5 with opposite directed end portions 21, the forces from the recoil are substantially equal and oppositely directed, by which the forces may substantially cancel or cancel to some degree. The flow passages 5 are connected to connecting members 25 comprising circular flanges. Circular reinforcement members 26 connect the flow passages 5. In Fig. 5, four flow passages 5 are shown connected to a first circular flange 27. As shown in Fig. 6, the first circular flange 27 having four circular holes 28, only two shown, is connected to a second circular flange 29 having four curved elongated holes 30, only two shown, such that an overlap between the circular holes 28 and the elongated holes 30 is easily achieved and such that the first and second circular flange 27, 29 may be aligned in several rotational positions against each other while the four elongated holes 30 are still connected to the four circular holes 28. The flow passage is conveyed from the four curved elongated holes 30 by elongated curved adaption members 31 towards the valves 10. In one embodiment, four adaption members are simply provided as four separate quarter annular chambers in a housing having an annulus formed cross section.

[0035] While specific and preferred embodiments of the invention have been shown and described in detail above to illustrate the inventive principles, it will be understood that variants to these embodiments may be provided without departing from the scope of the invention as set forth in the accompanying claims. For instance, the device may be used for removing other substances than soot.

Claims

1. A device for use in a cleaning installation for removing soot or similar inside deposits on the inside of a processing system such as a boiler, heat exchanger, flue gas filter, flow channel or the like, by intermittently blasting a gaseous medium into the processing system, said device comprising at least one flow passage extending from associated valve means into the processing system,
   wherein
   said at least one flow passage comprises at least one direction means for directing the gaseous medium.

2. A device according to claim 1, comprising rotation means for rotatably mounting the said device and/or at least one flow passage to the processing system.

3. A device according to claim 2, wherein the rotating means comprises an electric motor.

4. A device according to any of the preceding claims, wherein the device and/or at least one flow passage is retractably mounted to the processing system.

5. A device according to any of the preceding claims, wherein the at least one flow passage and/or at least one directing means comprises at least one tubular member.

6. A device according to any of the preceding claims, wherein at least one directing means comprises a tubular member having a curved shape.

7. A device according to any of the preceding claims, wherein the at least one flow passage comprises a tubular member, with a tubular member axis, and a directing means extending from the end of the tubular member, said directing means having at least one outlet defining an outlet flow direction with an axis having an angle with respect to the tubular member axis.

8. A device according to claim 7, wherein the angle is 0 - 90 degrees.

9. A device according to claims 7 or 8, wherein the device comprises a plurality of flow passages mounted in pairs wherein each pair comprises
   a first and a second tubular member defining a common tubular member axis, and
   a first and second direction means having a first and second outlet defining first and second outlet flow directions with first and second axes having first and second angles with respect to the common tubular member axis, preferably the first and second angles are equal.

10. A device according to claim 9, wherein the common tubular axis, and the first and the second axes lie substantially in the same plane, whereby the forces, from the recoil produced by intermittently blasting through a pair of flow passages, are substantially equal and oppositely directed.

11. A device according to claims 9 or 10, wherein a plurality of flow passages comprises a plurality of reinforcement members.

12. A device according to any of the preceding claims, comprising a first connection member and a second connection member for at least one flow passage, said first connection member having a first flange with at least one first hole, said first flange adapted

for a plurality of engagements with a second flange of the second connection member, said second flange having at least one second hole, preferably a curved elongated hole, such that the first flange is adapted for a plurality of rotationally defined engagements with the second flange, by which at least one first hole is connected to a second hole.

13. A device according to claim 12, wherein one first hole and one second hole are provided per flow passage.

14. A device according to any of the preceding claims, wherein at least one flow passage is provided with an inlet allowing for a continuous flow of a protective gas around the flow passage into the flow channel in the processing system.

15. A device according to any of the preceding claims, comprising a valve assembly, said valve assembly comprising a diaphragm valve including a first and second chamber, said first chamber receiving pressurized air from an air supply, and said second chamber being provided with valve control means and an outlet for release of air in the chamber when activating the diaphragm valve, and a valve outlet connected to the device, wherein flow communication means is provided between the outlet of the second chamber and an inlet of a flow passage of the device.

16. A cleaning installation for removing soot or similar inside deposits on the inside of a processing system such as a boiler, heat exchanger, flue gas filter, flow channel or the like, by intermittently blasting a gaseous medium into the processing system, said cleaning installation comprising at least one device, according to any of the preceding claims, comprising at least one flow passage extending from associated valve means into the processing system, said cleaning installation comprising a pressure vessel that communicates with one or more valve assemblies that are each connected by a flow passage to the processing system, and said cleaning installation comprising means for connecting the device with the at least one valve means and the processing system of the associated flow passage at their respective ends,
wherein
said at least one flow passage comprises at least one direction means for directing the gaseous medium.

17. A cleaning installation according to claim 16, comprising rotating means for rotatably mounting the said device and/or at least one flow passage to the processing system.

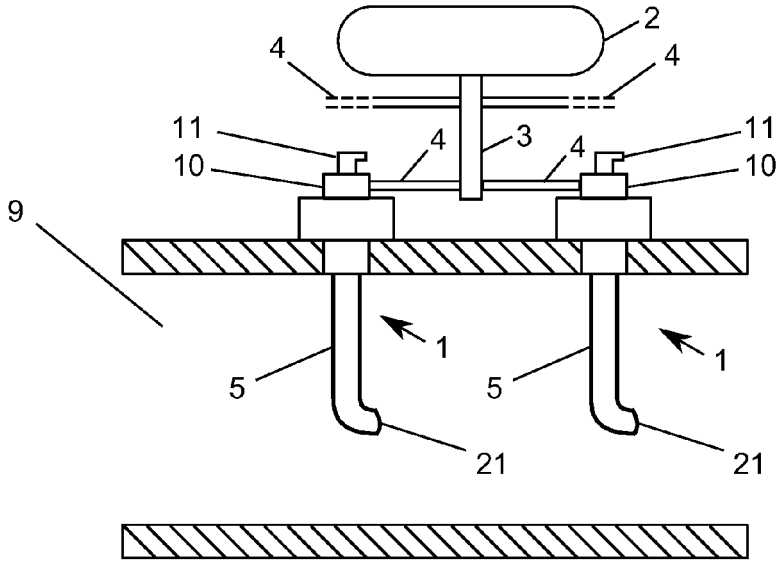

Fig. 1

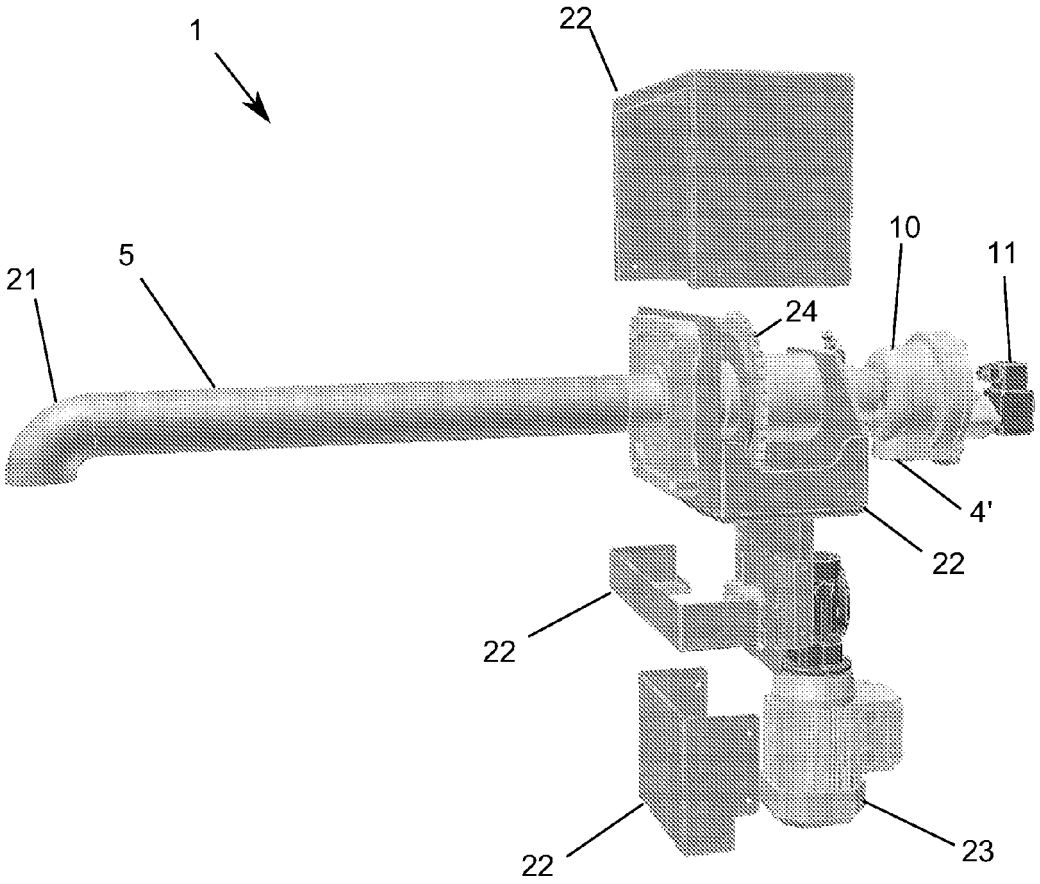

Fig. 2

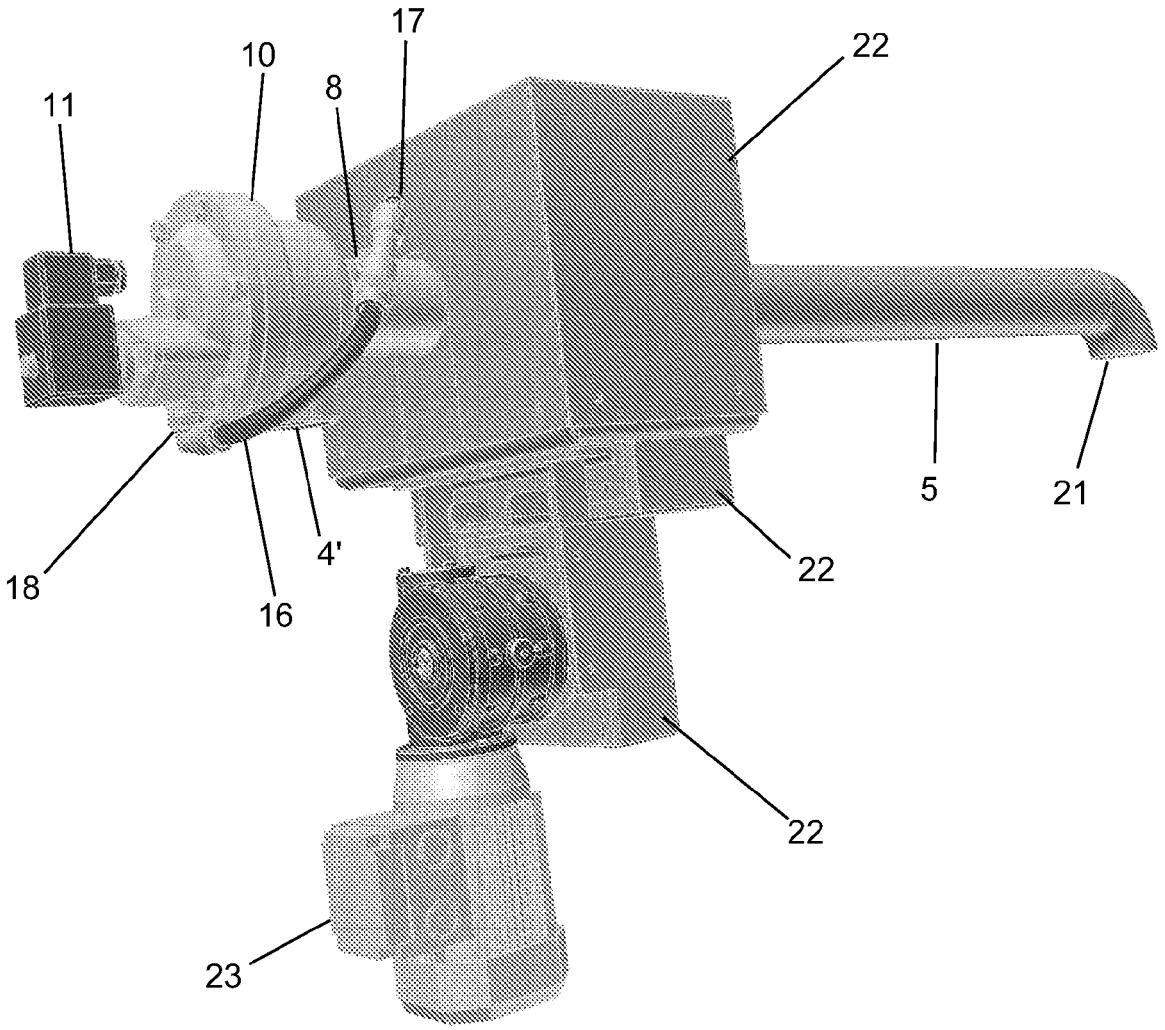

Fig. 3

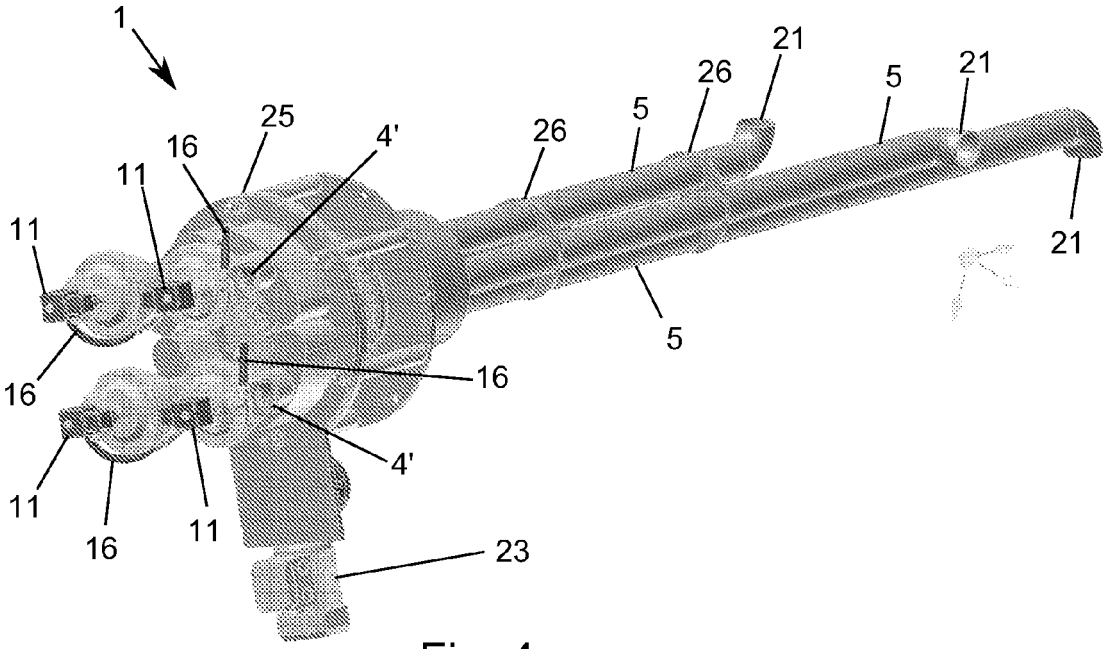

Fig. 4

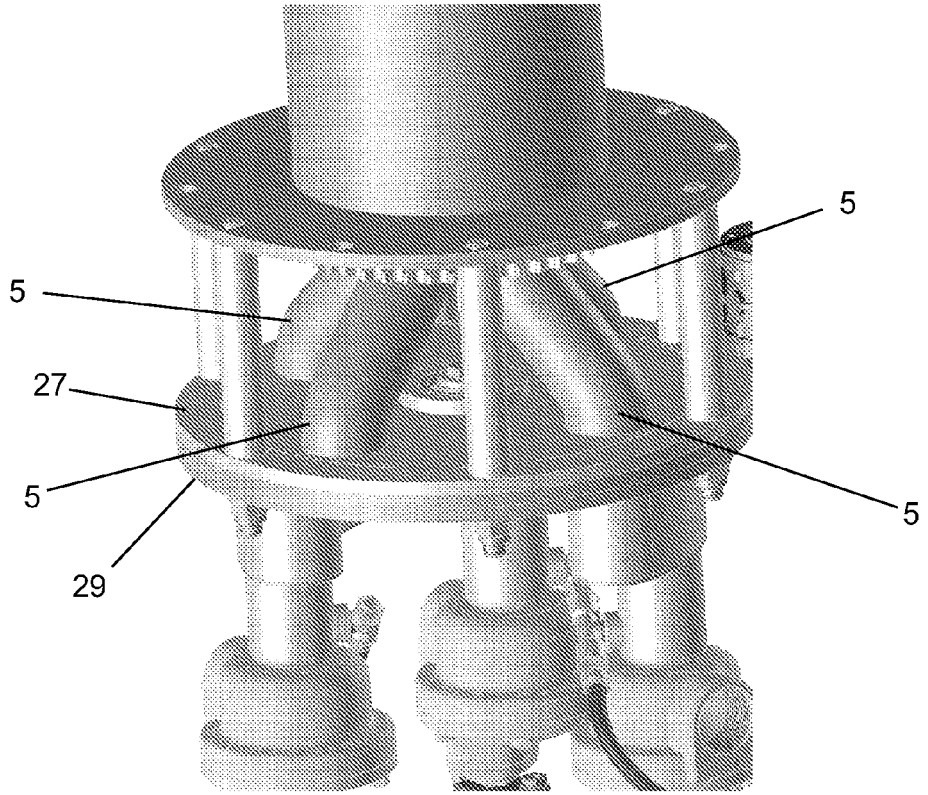

Fig. 5

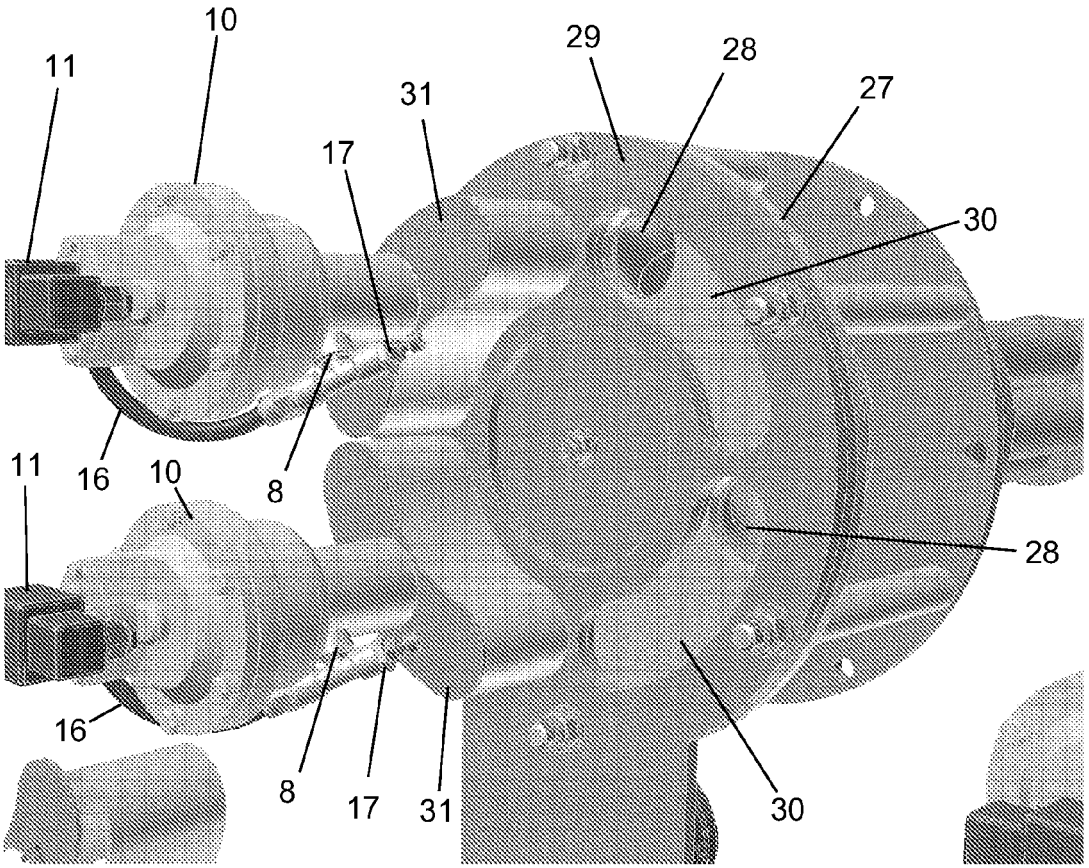

Fig. 6

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EUROPEAN SEARCH REPORT

Application Number
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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
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CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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