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(54) SPRAY DRYING SYSTEM INCLUDING AN IMPROVED CONNECTION ASSEMBLY AND METHOD OF CLEANING THE SYSTEM

SPRÜHTROCKNUNGSYSTEM MIT VERBESSERTEM VERBINDUNGSAUFBAU UND SYSTEMREINIGUNGSPROZESS

SYSTÈME DE SÉCHAGE PAR PULVÉRISATION COMPRENNANT UNE CONNECTION AMÉLIORÉE ET MÉTHODE DE NÉTOYAGE DU SYSTÈME

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Description

Field of invention

[0001] The present invention relates to a spray drying system comprising a spray dryer with a drying chamber and a process air/gas supply device, at least one powder recovery unit, a conveying line for powdery material such as fines from the powder recovery unit, and means for connecting the conveying line to a cleaning-in-place, CIP, arrangement including a CIP line configured to transport CIP liquid. The invention furthermore relates to a method for cleaning a spray drying system.

Background of the invention

[0002] WO 2008110623 A2 and JP3096611 B2 disclose spray drying systems.

[0003] In the field of spray drying, high demands to the sanitary conditions of the system are present in general. To meet today's strict requirements, drying plants including spray drying systems must satisfy the highest design standards to avoid product degradation and contamination during plant operation. Therefore contamination from the outside to the inside of the system is to be minimized, just as the system must be cleaned thoroughly on a regular basis.

[0004] Cleaning requirements for the drying and powder handling equipment, i.e. the so-called dry areas, can be met by either dry or wet methods, or a combination of both. Dry methods involve manual sweeping of surfaces in contact with the product, or air or gas sweeping by allowing a high velocity air stream to pass over the surfaces in question. Wet methods involve either manual hosing of surfaces or more effectively by use of automated cleaning-in-place systems (CIP systems).

[0005] The very nature of e.g. dairy, pharmaceutical and food products means that the possibility of product deposits formation on the surface of the process equipment is always real. The products' fat, sugar and protein content, gives hygroscopic and sticky characteristics at the temperature and humidity conditions present during processing. For drying plants in general, it is often relevant and profitable to equip the plants with automatic CIP in order to reduce the downtime of the plant. The risk of deposit formation increases with the running time of the plant. Industrial CIP systems can clean individual items or complete process plants, involving integrating cleaning nozzles into the plant components together with their associated pipe work, and instrumentation.

[0006] The CIP operation is typically controlled by a program which controls pump and valve functions, and cleaning sequences are given the optimum timing for efficient cleaning of all parts of the plant. Modern days CIP arrangements are flexible and different washing programs can be selected, just as the program software includes the flexibility to alter and adapt the washing programs according to experience and need when new products are processed, or new operating conditions are applied. Further, individual programs are developed for specific products for which cleaning efficiency, cleaning time or the type and amount of chemicals used can differ.

[0007] In practice, CIP arrangements may e.g. use a three-tank system of a four-tank CIP kitchen (the fourth tank is for cleaning the bag filter). It ensures a minimum of idle time when changing from one cleaning solution to another. The CIP kitchen is designed to reuse and circulate the rinsing water and cleaning liquids, and with direct or indirect heating of the liquids during the cleaning process. That is, the caustic and acid concentration is measured during circulation and supplemented automatically to achieve optimum concentration.

[0008] The CIP supply line is equipped with remote operated valves and CIP supply pumps. The return line is equipped with conductivity probes and remote operated valves for routing the caustic, acid and water to each tank or drain.

[0009] The complex nature of the cleaning regimen is particularly pronounced in spray drying systems comprising conveying lines for transporting powdery material from powdery recovery units such as cyclones and bag filters downstream of the drying chamber to upstream units such as the drying chamber itself or to a finishing treatment unit such as a VIBRO-FLUIDIZER™ or fluid bed for handling the material discharged from the drying chamber. Typically, such conveying lines are configured to transport powdery material in the form of fines (the smallest fraction of a powder product), i.e. a so-called fines return system, during normal operation. In order to clean the powder recovery unit itself, the transfer device connecting the powder recovery unit to the conveying line and the conveying line, the pipe work to the relevant parts is disconnected from the product line, and connected to the CIP arrangement instead to allow the CIP liquid to flush the transfer device, the powder recovery unit itself and adjacent pipe work. In such systems, it is of course vital that the conveying line for the stream of powder is thoroughly dried by air/gas to ensure that the stream of powder in the conveying line is not compromised by any remains of moisture.

[0010] The cleaning regimen for spray drying systems comprising such return conveying lines is often time consuming, as it has hitherto been the practice to manually disconnect some parts of the spray drying system from the production line and to connect these parts to a cleaning system. Further, during the conversion from operation mode to CIP mode, i.e. when connecting and disconnecting the various parts of the system a risk of contamination is present, as cleaned parts will be exposed to the outside surrounding air and environment in the time period between being disconnected from the cleaning system and until being connected to the production line again. The CIP arrangement often also includes flexible hoses to ease the conversion from operation mode to CIP mode and vice versa; however, such flexible hoses involve a risk of sacking leaving an amount of liquid behind in a

non-drainable pocket. Eventually, great care must be shown in order to ensure that the couplings connecting the CIP line with the conveying line portion through the transfer device and/or the powder recovery unit and any accessory equipment are tight such that no leakage of CIP liquids occurs.

Summary of the invention

[0011] With this background, it is therefore an object of the present invention to provide a spray drying system, which reduces the risk of contamination before, during and after a CIP procedure, as well as make the CIP procedure less time consuming and cumbersome.

[0012] It is furthermore an object of the invention to facilitate the overall operational conditions of a spray drying system by devising a more effective CIP procedure.

[0013] In a first aspect of the invention, these and further objects are obtained by a spray drying system of the kind mentioned in the introduction, which is furthermore characterized in that said connecting means comprise a connection assembly including at least one sanitary valve including a first inlet to the conveying line, and a valve member moveable between an open position and a closed position, wherein in the closed position, one part of the valve member seals the conveying line and when in the open position, the valve member is moved to provide communication between the CIP line and the conveying line, thereby allowing CIP liquid to enter or exit the sanitary valve connecting the CIP line and the conveying line via said first inlet.

[0014] The provision of a sanitary valve makes it possible to establish a connection between the CIP line and the conveying line at any time, also in the operation mode of the system. Hence, the CIP procedure may be performed without disconnecting any parts from the spray drying system. Thus, no contaminants can enter from the surrounding environment, in the time periods during conversion from CIP mode and normal operation. Another advantage provided by the sanitary valve is that it reduces the manual labour required by an operator in the traditional systems, where manual disconnection and reconnection of parts of the spray drying system is needed, whenever a CIP procedure is required. As such the spray drying system can be in normal operation for a higher percentage of time, thus resulting in a higher capacity of the spray dryer. The spray drying system is more secure in that no contaminants can enter the conveying line, just as there are no disconnection and reconnection of couplings that could give rise to leakage of CIP liquid. The system may be remote operated or automated, such that an operator is only required to switch between CIP and normal operation. This will reduce the downtime of the process line even further.

[0015] Furthermore it is possible to purge the conveying pipes not in use during production in order to avoid bacterial growth in the pipelines.

[0016] There has previously been a prejudice in the field against having valves between the CIP system and spray drying system, as if not separated in full may mean a risk of contamination of the spray dried product. One reason being that existing valves are designed for either powder or liquid or gas but are not suitable of all three elements.

[0017] The term "sanitary" within the field entails that such sanitary valves are designed to meet the stringent demands of various authorizations in dependence of governing bodies. Thus, by the term "sanitary" is meant that the equipment should comply with relevant regulations, among other AAA (US) and/or EHEDG (EU) guidelines. Typically, the sanitary requirements entail that relevant parts of the valve are designed such and are made from polished, stainless steel or suitable polymers to ensure efficient cleaning and sanitizing, with a very limited risk of residues of material and/or cleaning fluids.

[0018] In the presently preferred embodiment, the sanitary valve is a sanitary plug valve, in which said one part of the valve member is constituted by a plug end to seal the conveying line in the closed position and to be moved by retraction to attain the open position. Use of an ordinary plug valve is well-established within the field and such valves are very reliable in operation. However, the invention uses a sanitary plug valve which is suitable for both powder, liquid and gas.

[0019] Alternatively, other valves may be used instead of the plug valve as long as it is possible to fulfil the sanitary requirements. Examples of suitable valves include ball valve, ball segment valve, butterfly valve, knife valve, and gate valve.

[0020] In an embodiment of the invention, an inner surface of the plug end of the valve member, which engages the conveying line, has the same shape as the conveying line. In a further development of this embodiment, the conveying line has the shape of a cylinder, and as such, the plug end of the valve member has a curvature corresponding to the inner diameter of the cylindrical conveying line. This has the advantage that when the valve is in its closed position, the plug end will substantially form a continuous surface with the inside of the conveying line. Thus there will be less corners, edges, etc. wherein the conveyed material can get stuck. This is especially important when the material has certain hygroscopic and sticky characteristics, in which case, the product quality can decrease, contamination can occur, and the following cleaning becomes more cumbersome.

[0021] In another embodiment, a seal is provided on the plug end of the valve member, such that when the valve is in its closed position, an air/gas tight seal is formed between the valve and the conveying line. This seal ensures that no contamination can enter the system from the outside environment or from the CIP line, during normal operation, when the valve is in its closed position.

[0022] In yet another embodiment of the invention, a gap is formed between a side surface of the plug end of the valve member and the conveying line, where the gap is formed in a position between the conveying line and

the CIP line, when the valve is in its closed position. As such a higher tolerance can be used during manufacturing of the plug end of the valve member, and any edges of the plug end, entering the conveying line, can be avoided when the valve is in the closed position.

[0023] In another embodiment of the invention, the sanitary plug valve comprises both a seal, which in the valves closed position forms an air/gas tight seal between the plug end of the valve member and the conveying line, and a gap, between the plug end of the valve and the conveying line, such that contaminants are prohibited from entering from the outside environment or the CIP system through the sanitary plug valve, but at the same time, any edges of the plug end, entering the conveying line, can be avoided when the valve is in the closed position.

[0024] In a further embodiment, the gap continues through at least a part of the plug end, such that a canal is formed. Thus clean purge air/gas can be blown through the gap, when the valve is in its closed position, such that the material in the conveying line cannot enter said gap. This is achieved by blowing purge air/gas through the canal and gap, at a higher pressure, than the pressure in the conveying line. An advantage of this is that there will be a lower risk of hygroscopic materials sticking to the plug end of the valve member, or of powdered materials of entering the gap between the plug end and the conveying line.

[0025] In a further aspect of the invention, a method for cleaning a spray drying system of the type described above is provided. The method, wherein a sanitary plug valve is in a closed position, when the system is in normal operation, comprises the steps of:

determining that a cleaning process is to be started,
moving the sanitary valve from the closed position to the open position,
supplying CIP liquid through the CIP line to the sanitary valve in the open position,
after cleaning of the system is complete, the CIP liquid is drained from the system,
air/gas is blown through the sanitary valve in order to dry the system, the valve is moved to the closed position,
normal operation is restarted.

[0026] This method ensures that the spray drying system does not have to be disassembled during the process of converting from production to CIP, during the CIP procedure, or during the conversion back to normal operation. This reduces the risk of contamination entering the spray drying system, as parts are not exposed to the dirty outside environment.

[0027] In a further embodiment of the invention, the method comprises blowing purge air/gas through the sanitary plug valve, when the valve is in its closed position, in order to prevent the material in the conveying line to enter the plug valve.

[0028] In another embodiment of the invention, the air/gas used to dry the system after cleaning is supplied from the spray dryer process air/gas supply. During normal operation, this air/gas would be used in the spray dryer system or for the after-drying unit(s). This reduces the costs of the CIP system using the heater and pump systems, which are already included in the spray drying system.

[0029] In yet another embodiment of the invention, the method is automatic when initiated and completed according to the above described embodiments of the invention. The CIP procedure may be initiated or planned based on a response from sensors in the system or from regulatory demands.

Brief description of the drawings

[0030] The invention will be described in more detail below by means of non-limiting examples of presently preferred embodiments and with reference to the schematic drawings, in which:

Fig. 1 shows a schematic view of a prior art spray drying system;
Fig. 2 shows a functional flowchart indicating the flows in operation mode and CIP mode, respectively, of a prior art spray drying system;
Fig. 3a shows a schematic flowchart of a prior art spray drying system when in normal operation mode;
Fig. 3b shows a schematic flowchart of a prior art spray drying system when in CIP mode;
Fig. 4 shows a schematic flowchart of an embodiment of the spray drying system according to the invention;
Fig. 5a shows a schematic flowchart of another prior art spray drying system when in normal operation mode;
Fig. 5b shows a schematic flowchart of another prior art spray drying system when in CIP mode;
Fig. 6 shows a schematic flowchart of another embodiment of the spray drying system according to the invention;
Fig. 7 shows a schematic overview of another embodiment of the spray drying system according to the invention;
Fig. 8 shows a cross-section of a sanitary plug valve in an embodiment according to the invention, in its closed position;
Fig. 9 shows an enlarged portion of a detail of the sanitary plug valve shown in Fig. 8;
Fig. 10 is a view corresponding to Fig. 8, with the sanitary plug valve in its open position;
Fig. 11 is a partial view of a sanitary plug valve of a further embodiment of the spray drying system according to the invention; and
Figs 12 to 14 show views corresponding to Figs 8 to 10, of a still further embodiment of the invention.

Detailed description of embodiments of the invention

[0031] Fig. 1 shows a schematic view of the main components of a spray drying system 1. In a manner known per se, the spray drying system 1 comprises a spray dryer with a drying chamber 2 and a process air/gas supply device 3, typically including an air/gas disperser. It is noted that the term "gas" will be used alongside with the term "air" as "air/gas" and is to be interpreted as encompassing any gas that is suitable as process gas in such a spray drying system. The drying chamber 2 also incorporates atomizing means, such as nozzles and/or an atomizer wheel.

[0032] At the lower end of the drying chamber 2, an outlet 5 for dried material is provided. In the shown spray drying system 1, an after-treatment unit in the form of vibrating or static fluid bed 6 is provided. At one end, the vibrating or static fluid bed 6 receives dried material from the outlet 5 of the drying chamber 2 for further treatment of the material, which is then to be collected at an outlet at the other end of the vibrating or static fluid bed. Further downstream equipment may be present as well, but is not relevant to the present invention.

[0033] Furthermore, the spray drying system 1 comprises at least one powder recovery unit 4, to which spent process air/gas with particles entrained in the process air/gas is conducted via exhaust line 7. The powder recovery units 4 may take the form of cyclones or bag filters, or any combination thereof.

[0034] A conveying line 11 is provided for transporting the powdery material recovered in the powder recovery unit 4 to upstream equipment such as the drying chamber 2 itself, at an arbitrary position, or to the vibrating or static fluid bed 6, likewise to an arbitrary position. Typically, the recovered material is in the form of fines, which are powdery material of satisfying composition but of a size and/or configuration that needs further processing in order to fulfil quality requirements. The position of introduction of the fines return into the upstream units typically depends on the size and/or configuration of the material and of the prevailing operating conditions in the drying chamber 2 and the vibrating fluidizer 6. A divert valve 9 is present in the system as well in order to ensure proper distribution of the returning fines.

[0035] At the lower end of each powder recovery unit 4, a transfer device 70 is provided for providing transfer of the powder from the powder recovery unit 4 to the conveying line 11. In the prior art system, such a transfer device is typically constituted by a rotating valve (i.e. a blow through rotary valve or a drop through rotary valve with a feeding shoe) allowing blow-through of air/gas to ensure transport of the fines in the conveying line.

[0036] When the spray drying system 1 of the prior art is to undergo a CIP procedure according to a specified CIP regimen, the system needs to be switched from the normal operation mode to a CIP mode. In order to allow the system to operate in both the normal operation mode and the CIP mode, means for connecting the powder recovery unit 4 and the conveying line 11 are present. As indicated in Fig. 2, switching between these two modes involves decoupling of couplings 81, 82, 83, 84 forming part of the prior art connecting means from the conveying line 11 to parts of the CIP arrangement 8, shown as the CIP lines 85, 86, 87 in the figure. The conversion from one mode to another is carried out manually, by disconnecting parts of the spray drying system, from the normal operating mode, and connect the CIP arrangement. Once the CIP procedure is completed, a reverse disconnection and connection must also be performed manually.

[0037] In the following, a spray drying system according to the present invention will be described. Elements having the same, analogous, or corresponding function as in the prior art system will be denoted by the same reference numerals as in the description of the prior art spray drying system.

[0038] Referring now in particular to the detailed description of Figs 8 to 10, a connection assembly 10 of the spray drying system 1 according to the invention will be described. It is noted that only those parts of the spray drying system including the CIP arrangement according to the invention that are different from the prior art spray drying system 1 including the CIP arrangement 8 shown in Fig. 2 will be described in detail.

[0039] The connection assembly 10 comprises a sanitary valve of a suitable kind. In the presently preferred embodiment described in the following, the sanitary valve is a sanitary plug valve 20 including a first inlet 12 to the conveying line 11 and a valve member 21 moveable between an open position and a closed position, wherein in the closed position, a plug end 22 of the valve member 21 seals the conveying line 11 and when in the open position, the valve member 21 is retracted to provide communication between the CIP line 15 and the conveying line 11. During the CIP procedure, and as will be described in more detail below, CIP liquid from a CIP supply 16 is allowed to enter the sanitary plug valve 20 through the CIP line 15 and into the conveying line 11 via said first inlet 12, and exit to a CIP drain 17 through the CIP line 15.

[0040] The parts of the sanitary plug valve 20 relevant to the present invention will be described in further detail below. It is to be understood that other elements of the sanitary plug valve 20 are well-know, for instance from the commercially available VARIVENT® Type C valve from GEA Tuchenhagen.

[0041] It is also to be understood that the sanitary valve 20 may be formed and/or used as a two- or three-way valve, or even more ways, having two or more working conditions including an unactuated condition and one or more actuated conditions. Adaptation of the sanitary valve to provide the required number and configuration of ports and passageways lies within the competence of the skilled person.

[0042] In the preferred embodiment, an inner surface 23 of the valve member plug end 22, which engages the

conveying line 11, has the same shape as an inner surface 14 of the conveying line 11. Specifically, the inner surface 23 is formed as a part-cylindrical surface, adapting to the cylinder shape of the conveying line 11.

[0043] In order to ensure that the stream of powder in the conveying line 11 is at all times kept separate from the CIP line 15, a seal 24 is provided between the valve member 21 and the conveying line 11, namely in the embodiment shown between a side surface 26 of the valve member plug end 22 and a wall 18 surrounding the conveying line 11.

[0044] The conveying line 11 itself and the surrounding wall 18 may in principle take any suitable form other than the shown cylindrical conveying line 11 and the rectangular wall 18. One alternative is shown in Fig. 11 in which a drop tube 41 of the powder recovery unit (not shown) is connected to the connection assembly 10. Also in this embodiment, however, the inner surface of the valve member plug end 22 is formed in accordance with an inner surface 44 of the drop tube 41.

[0045] In the embodiment shown, the dimensions of the sanitary plug valve 20 are chosen such that a gap 25 is formed between the side surface 26 of the valve member plug end 22 and the wall 18 surrounding the conveying line 11 when the valve member 21 is in its closed position. At the end of the gap 25 facing the conveying line 11, a second inlet 13 is formed.

[0046] In the specific embodiment, the gap 25 extends from the seal 24 up to the second inlet 13 into the conveying line 11.

[0047] In the preferred embodiment of Figs 8 to 10, a flushing valve 30 is connected to the conveying line 11. The flushing valve is provided with an inlet 31 for process air/gas in order to introduce the air/gas into the conveying line 11. The position of the flushing valve 30 is in close proximity to the conveying line 11 in the preferred embodiment. As an alternative, Figs 12 to 14 illustrate a different position of the entry of process air/gas.

[0048] Furthermore, in the embodiment shown, the flushing valve 30 is in fluid connection with the conveying line 11 via the gap 25, i.e. also in the closed condition of the sanitary plug valve 20, when the position of the valve member 21 is as shown in Fig. 8, air/gas may be introduced into the conveying line 11 through the second inlet 13.

[0049] Operation of the spray drying system 1 according to the invention will now be described with particular reference to the schematic flowcharts and system overviews of Figs 4, 6 and 7, to be compared with the respective prior art systems shown in Figs 3a-3b and 5a-5b, respectively. It is noted that the below description is made with specific reference to the presently preferred embodiment of the sanitary valve 20 of the connection assembly 10. Operation of a system having other types of sanitary valves is carried out in a manner corresponding to the specific type of sanitary valve.

[0050] Referring first to Fig. 6, it is noted that a sanitary valve 20 is provided at several positions in the spray drying system 1. While the reading of the drawing including any symbols will be immediately apparent to the person skilled in the art, only four of these sanitary valves are marked by reference numeral 20 to be described in the following (from left to right in Fig. 6):

At a first position, the sanitary valve 20 is a two-way valve which in the unactuated condition is closed, and which when actuated to its open position connects the powder recovery unit 4 with the CIP line 15.
At a second position, the sanitary valve 20 is a three-way valve providing unhindered transport of powder in conveying line 11 in the unactuated condition and which is able to provide connection between the conveying line 11 and the CIP line 15 when actuated, as described in the above.
At a third position, the sanitary valve 20 has a configuration corresponding to the sanitary valve 20 of the second position, but is located downstream of all the powder recovery units 4 of the spray drying system 1 of the embodiment shown in Fig. 6.

[0051] Eventually, at a fourth position, the sanitary valve 20 is a three-way valve, but with another flow path configuration.

[0052] As is apparent from Fig. 6, further sanitary valves may be present as well in the spray drying system.

[0053] Initiation of the CIP procedure will be determined either according to a pre-defined schedule or programmed to start automatically. Up to this point, normal operation proceeds and the sanitary valve 20 is in a closed position.

[0054] Following initiation of the CIP procedure, the sanitary valve 20 is moved from the closed position to the open position. As a consequence of the movement of the valve member 21, communication between the CIP line 15 and the conveying line 11 is provided. Referring to the above-mentioned description of Fig. 6, this corresponds to a sanitary valve as described in relation to the second position.

[0055] CIP liquid is supplied from CIP supply 16 through the CIP line 15 to the sanitary plug valve 20, which is now in the open position. CIP liquid from CIP supply 16 is allowed to enter the sanitary valve 20 and flow into the conveying line 11 via the first inlet 12.

[0056] During the CIP procedure, CIP liquid is also supplied to the powder recovery unit 4 through another line, not shown. Typically, the cyclone, bag filter or other powder recovery unit is supplied with CIP liquid at the top.

[0057] After the CIP procedure is complete, the CIP liquid is drained from the system. Drainage of the conveying line 11 takes place via the first inlet 12 of the sanitary plug valve 20 in that CIP liquid is allowed to exit from the conveying line 11 through CIP line 15 and further to CIP drain 17.

[0058] CIP liquid from the powder recovery unit 4 is drained both through the transfer device 70 and further through the sanitary valve 20 at the second position, and

the sanitary valve 20 at the above-mentioned first position.

[0059] Following drainage of CIP liquid, air/gas is blown through the respective sanitary valve 20 in order to dry the system. The air/gas may be of any suitable composition and temperature, but will typically be heated air/gas.

[0060] Once the relevant parts are sufficiently dry, the sanitary valve is moved to the closed position and as a final step, normal operation is restarted.

[0061] In the embodiments of the spray drying system described in the above, it is also possible to carry out the following additional step during normal operation, namely that purge air/gas is blown through the sanitary valve in order to prevent the material of the conveying line to enter the sanitary valve.

[0062] The air/gas used to dry the system after cleaning is preferably supplied from the process air/gas supply of the spray dryer. As this air/gas would be used to dry out the cyclone or cyclones, or other powder recovery unit(s) in any event, savings on the overall energy are achieved as no separate heating unit for the air/gas to dry the system is needed.

[0063] The process of the inventive method may be carried out automatically from the first to last step.

Claims

1. A spray drying system (1) comprising
a spray dryer with a drying chamber (2) and a process air/gas supply device (3),
at least one powder recovery unit (4),
a conveying line (11) for powdery material such as fines from the powder recovery unit (4), and
means for connecting the conveying line (11) to a cleaning-in-place, CIP, arrangement (8) including a CIP line (15) configured to transport CIP liquid,
characterized in that
said connecting means comprise a connection assembly (10) including at least one sanitary valve (20) including a first inlet (12) to the conveying line (11), and a valve member (21) moveable between an open position and a closed position, wherein in the closed position, one part (22) of the valve member (21) seals the conveying line (11) and when in the open position, the valve member (21) is moved to provide communication between the CIP line (15) and the conveying line (11), thereby allowing CIP liquid to enter or exit the sanitary valve (20) connecting the CIP line (15) and the conveying line (11) via said first inlet (12).

2. A spray drying system according to claim 1, wherein the sanitary valve is a sanitary plug valve (20), in which said one part of the valve member is constituted by a plug end (22) to seal the conveying line (11) in the closed position and to be moved by retraction to attain the open position.

3. A spray drying system according to claim 2, wherein an inner surface (23) of the valve member plug end (22), which engages the conveying line (11), has the same shape as an inner surface (14) of the conveying line (11), preferably in the form of a cylinder surface.

4. A spray drying system according to any of claims 2 and 3, wherein a seal (24) is provided between the valve member (21) and the conveying line (11), preferably between a side surface (26) of the valve member plug end (22) and a wall (18) surrounding the conveying line (11).

5. A spray drying system according to claim 4, wherein a gap (25) is formed between the side surface (26) of the valve member plug end (22) and the wall (18) surrounding the conveying line (11) when the valve member (21) is in its closed position, and wherein a second inlet (13) to the conveying line is provided at the end of the gap (25).

6. A spray drying system according to claim 4 and 5, wherein said gap (25) extends between the seal (24) and the second inlet (13) to the conveying line (11).

7. A spray drying system according to any one of the preceding claims, wherein a flushing valve (30) is connected to the conveying line (11).

8. A spray drying system according to claims 5, 6 and 7, wherein the flushing valve (30) is in fluid connection with the conveying line (11) via said gap (25) for introduction of purge air/gas through the second inlet (13).

9. A method for cleaning a spray drying system according to any one of claims 1 to 8, wherein the sanitary valve is in a closed position when the system is in normal operation, the method comprising the steps of:

determining that a CIP procedure is to be started,
moving the sanitary valve from the closed position to the open position,
supplying CIP liquid through the CIP line to the sanitary valve in the open position,
after the CIP procedure of the system is complete, the CIP liquid is drained from the system,
air/gas is blown through the sanitary valve in order to dry the system,
the sanitary valve is moved to the closed position,
normal operation is restarted.

10. A method for cleaning a spray drying system according to claim 9, wherein during normal operation, purge air/gas is blown through the sanitary valve in order to prevent the material of the conveying line to enter the plug valve.

11. A method according to claim 9 or 10, wherein the air/gas used to dry the system after cleaning is supplied from the process air/gas supply of the spray dryer.

12. A method according to any one of claims 9 to 11, wherein the process from the first to last step is carried out automatically.

Patentansprüche

1. Sprühtrocknungssystem (1), umfassend
einen Sprühtrockner mit einer Trockenkammer (2) und einer Prozessluft-/Gaszufuhrvorrichtung (3),
mindestens eine Pulverrückgewinnungseinheit (4),
eine Förderleitung (11) für pulverförmiges Material, wie beispielsweise Feinstteile aus der Pulverrückgewinnungseinheit (4), und
Mittel zum Verbinden der Förderleitung (11) mit einer Cleaning-in-Place, CIP, -Reinigungsanordnung (8), die eine CIP-Leitung (15) zum Transport von CIP-Flüssigkeit umfasst,
dadurch gekennzeichnet, dass
die Verbindungsmittel eine Verbindungsanordnung (10) umfassen, die mindestens ein Sanitärventil (20) mit einem ersten Einlass (12) zur Förderleitung (11) und ein Ventilelement (21) aufweist, das zwischen einer geöffneten Stellung und einer geschlossenen Stellung beweglich ist, wobei in der geschlossenen Stellung ein Teil (22) des Ventilelements (21) die Förderleitung (11) abdichtet und in der geöffneten Stellung das Ventilelement (21) bewegt wird, um eine Verbindung zwischen der CIP-Leitung (15) und der Förderleitung (11) herzustellen, wodurch die CIP-Flüssigkeit in das Sanitärventil (20), das die CIP-Leitung (15) und die Förderleitung (11) über den ersten Einlass (12) verbindet, eintreten oder austreten kann.

2. Sprühtrocknungssystem nach Anspruch 1, wobei das Sanitärventil ein Sanitärstopfenventil (20) ist, wobei der eine Teil des Ventilelements aus einem Stopfenende (22) besteht, um die Förderleitung (11) in der geschlossenen Stellung abzudichten und durch Einziehen bewegt zu werden, um die geöffnete Stellung zu erreichen.

3. Sprühtrocknungssystem nach Anspruch 2, wobei eine Innenfläche (23) des Ventilelementstopfenendes (22), die in die Förderleitung (11) eingreift, die gleiche Form wie eine Innenfläche (14) der Förderleitung (11), vorzugsweise in Form einer Zylinderfläche, aufweist.

4. Sprühtrocknungssystem nach einem der Ansprüche 2 und 3, wobei eine Dichtung (24) zwischen dem Ventilelement (21) und der Förderleitung (11) vorzugsweise zwischen einer Seitenfläche (26) des Ventilelementstopfenendes (22) und einer die Förderleitung (11) umgebenden Wand (18) vorgesehen ist.

5. Sprühtrocknungssystem nach Anspruch 4, wobei ein Spalt (25) zwischen der Seitenfläche (26) des Ventilelementstopfenendes (22) und der die Förderleitung (11) umgebenden Wand (18) gebildet ist, wenn sich das Ventilelement (21) in seiner geschlossenen Stellung befindet, und wobei am Ende des Spaltes (25) ein zweiter Einlass (13) zur Förderleitung vorgesehen ist.

6. Sprühtrocknungssystem nach Anspruch 4 und 5, wobei sich der Spalt (25) zwischen der Dichtung (24) und dem zweiten Einlass (13) zur Förderleitung (11) erstreckt.

7. Sprühtrocknungssystem nach einem der vorhergehenden Ansprüche, wobei ein Spülventil (30) mit der Förderleitung (11) verbunden ist.

8. Sprühtrocknungssystem nach den Ansprüchen 5, 6 und 7, wobei das Spülventil (30) über den Spalt (25) zum Einleiten von Spülluft/-gas durch den zweiten Einlass (13) strömungstechnisch mit der Förderleitung (11) verbunden ist.

9. Verfahren zum Reinigen eines Sprühtrocknungssystems nach einem der Ansprüche 1 bis 8, wobei sich das Sanitärventil in einer geschlossenen Stellung befindet, wenn sich das System im normalen Betrieb befindet, wobei das Verfahren die folgenden Schritte umfasst:

Bestimmen, ob ein CIP-Verfahren zu beginnen ist,
Bewegen des Sanitärventils aus der geschlossenen Stellung in die geöffnete Stellung,
Zuführen von CIP-Flüssigkeit über die CIP-Leitung zum Sanitärventil in der geöffneten Stellung,
Nachdem der CIP-Vorgang des Systems abgeschlossen ist, wird die CIP-Flüssigkeit aus dem System abgelassen,
Luft/Gas wird durch das Sanitärventil geblasen, um das System zu trocknen,
das Sanitärventil wird in die geschlossene Stellung gebracht,
der normale Betrieb wird wiederaufgenommen.

10. Verfahren zum Reinigen eines Sprühtrocknungssystems nach Anspruch 9, wobei während des normalen Betriebs Spülluft/-gas durch das Sanitärventil geblasen wird, um zu verhindern, dass das Material der Förderleitung in das Stopfenventil gelangt.

11. Verfahren nach Anspruch 9 oder 10, wobei die/das zum Trocknen des Systems nach der Reinigung verwendete Luft/Gas aus der Prozessluft-/Gasversorgung des Sprühtrockners zugeführt wird.

12. Verfahren nach einem der Ansprüche 9 bis 11, wobei der Prozess vom ersten bis zum letzten Schritt automatisch durchgeführt wird.

Revendications

1. Système de séchage par pulvérisation (1), comprenant :

un sécheur par pulvérisation avec une chambre de séchage (2) et un dispositif d'alimentation en air/gaz de traitement (3),
au moins une unité de récupération de poudre (4),
une ligne de transport (11) pour de la matière en poudre telle que des particules fines provenant de l'unité de récupération de poudre (4), et des moyens pour connecter la ligne de transport (11) à un agencement de nettoyage sur place, CIP, (8) incluant une ligne de CIP (15) configurée pour transporter du liquide de CIP,
caractérisé en ce que
lesdits moyens de connexion comprennent un ensemble de connexion (10) comportant au moins une vanne sanitaire (20) incluant une première entrée (12) vers la ligne de transport (11), et un organe de vanne (21) déplaçable entre une position ouverte et une position fermée, où, dans la position fermée, une partie (22) de l'organe de vanne (21) scelle la ligne de transport (11) et dans la position ouverte, l'organe de vanne (21) est déplacé pour assurer la communication entre la ligne de CIP (15) et la ligne de transport (11), pour ainsi permettre à du liquide de CIP d'entrer ou de sortir dans ou hors de la vanne sanitaire (20) reliant la ligne de CIP (15) et la ligne de transport (11) par le biais de ladite première entrée (12).

2. Système de séchage par pulvérisation selon la revendication 1, dans lequel la vanne sanitaire est une vanne à boisseau sanitaire (20) dans laquelle ladite une partie de l'organe de vanne est constituée par une extrémité de boisseau (22) prévue pour sceller la ligne de transport (11) dans la position fermée et pour être déplacée par rétraction afin d'atteindre la position ouverte.

3. Système de séchage par pulvérisation selon la revendication 2, dans lequel une surface interne (23) de l'extrémité de boisseau (22) de l'organe de vanne qui vient en prise avec la ligne de transport (11) a la même forme qu'une surface interne (14) de la ligne de transport (11), de préférence a la forme d'une surface cylindrique.

4. Système de séchage par pulvérisation selon l'une quelconque des revendications 2 et 3, dans lequel un joint (24) est prévu entre l'organe de vanne (21) et la ligne de transport (11), de préférence entre une surface latérale (26) de l'extrémité de boisseau (22) de l'organe de vanne et une paroi (18) entourant la ligne de transport (11).

5. Système de séchage par pulvérisation selon la revendication 4, dans lequel un espace (25) est formé entre la surface latérale (26) de l'extrémité de boisseau (22) de l'organe de vanne et la paroi (18) entourant la ligne de transport (11) lorsque l'organe de vanne (21) est dans sa position fermée, et dans lequel une deuxième entrée (13) vers la ligne de transport est prévue au niveau de l'extrémité de l'espace (25).

6. Système de séchage par pulvérisation selon les revendications 4 et 5, dans lequel ledit espace (25) s'étend entre le joint (24) et la deuxième entrée (13) vers la ligne de transport (11).

7. Système de séchage par pulvérisation selon l'une quelconque des revendications précédentes, dans lequel une vanne de rinçage (30) est connectée à la ligne de transport (11).

8. Système de séchage par pulvérisation selon les revendications 5, 6 et 7, dans lequel la vanne de rinçage (30) est en connexion fluidique avec la ligne de transport (11) par le biais dudit espace (25) pour introduire de l'air/du gaz de purge à travers la deuxième entrée (13).

9. Procédé de nettoyage d'un système de séchage par pulvérisation selon l'une quelconque des revendications 1 à 8, dans lequel la vanne sanitaire est dans une position fermée lorsque le système fonctionne normalement, le procédé comprenant les étapes suivantes :

déterminer qu'une procédure de CIP doit être commencée,
déplacer la vanne sanitaire de la position fermée à la position ouverte,
fournir du liquide de CIP à travers la ligne de CIP jusqu'à la vanne sanitaire dans la position

ouverte,
après l'achèvement de la procédure de CIP du système, le liquide de CIP est drainé du système,
de l'air/du gaz est soufflé à travers la vanne sanitaire afin de sécher le système,
la vanne sanitaire est déplacée dans la position fermée,
le fonctionnement normal reprend.

10. Procédé de nettoyage d'un système de séchage par pulvérisation selon la revendication 9, dans lequel, au cours du fonctionnement normal, de l'air/du gaz de purge est soufflé à travers la vanne sanitaire afin d'empêcher que la matière de la ligne de transport ne pénètre à l'intérieur de la vanne à boisseau.

11. Procédé selon la revendication 9 ou 10, dans lequel l'air/le gaz utilisé pour sécher le système après le nettoyage est fourni à partir de l'alimentation d'air/de gaz de traitement du sécheur par pulvérisation.

12. Procédé selon l'une quelconque des revendications 9 à 11, dans lequel le processus, de la première à la dernière étape, est effectué automatiquement.

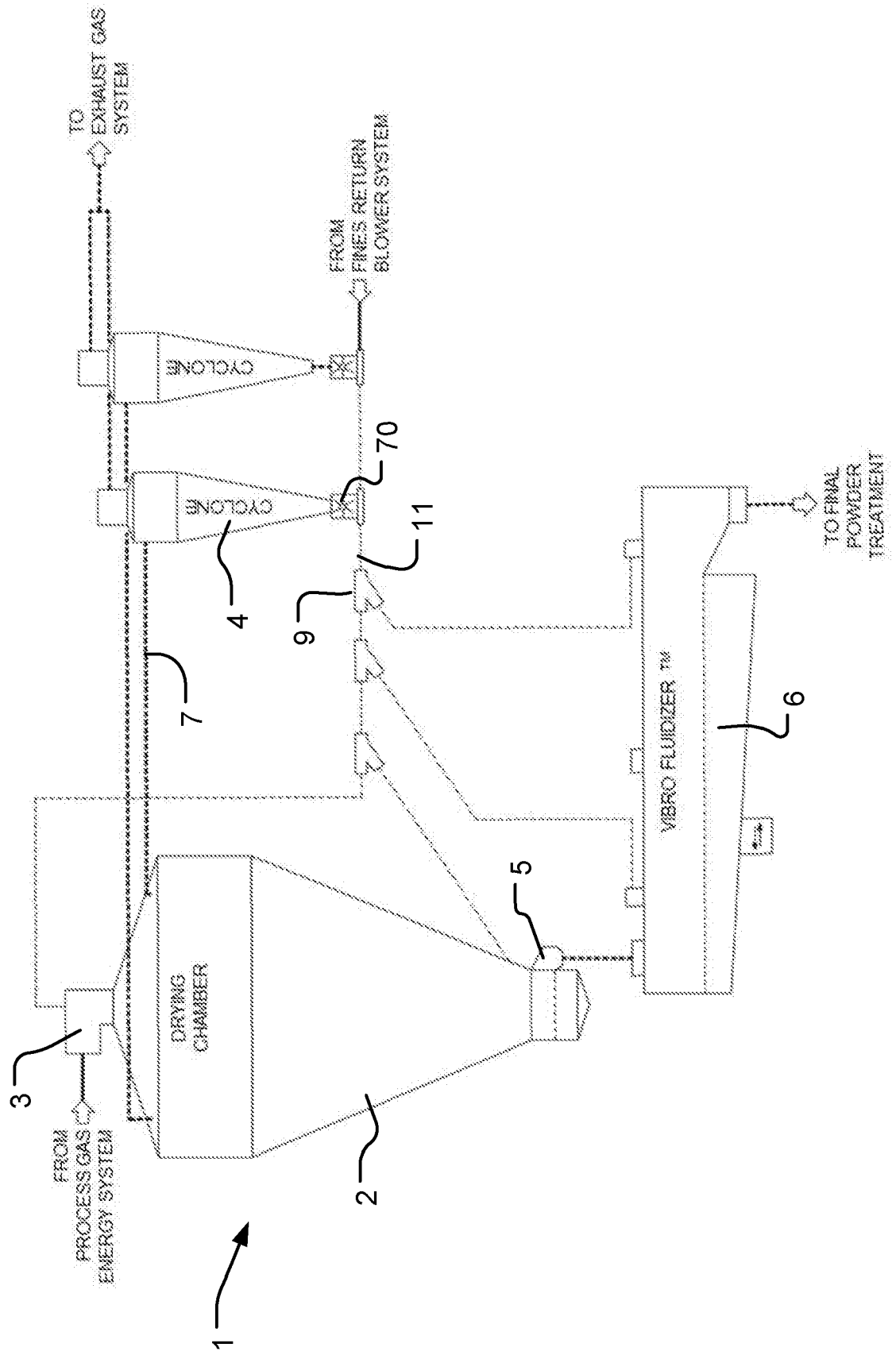


Fig. 1 (PRIOR ART)

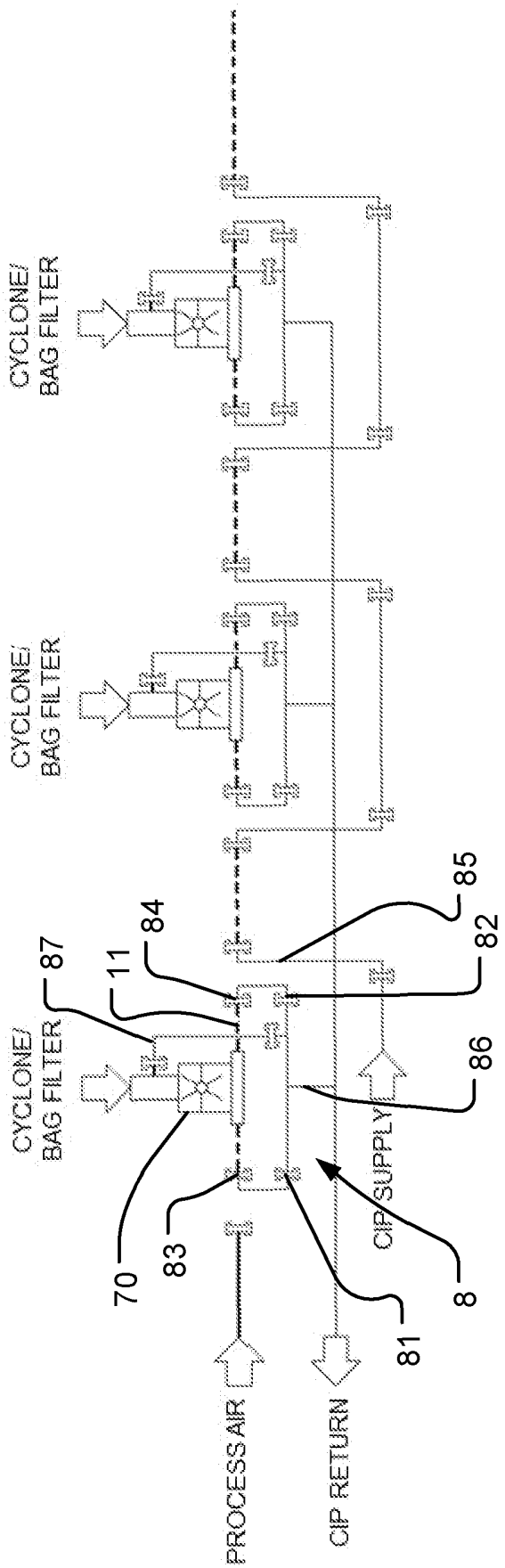


Fig. 2 (PRIOR ART)

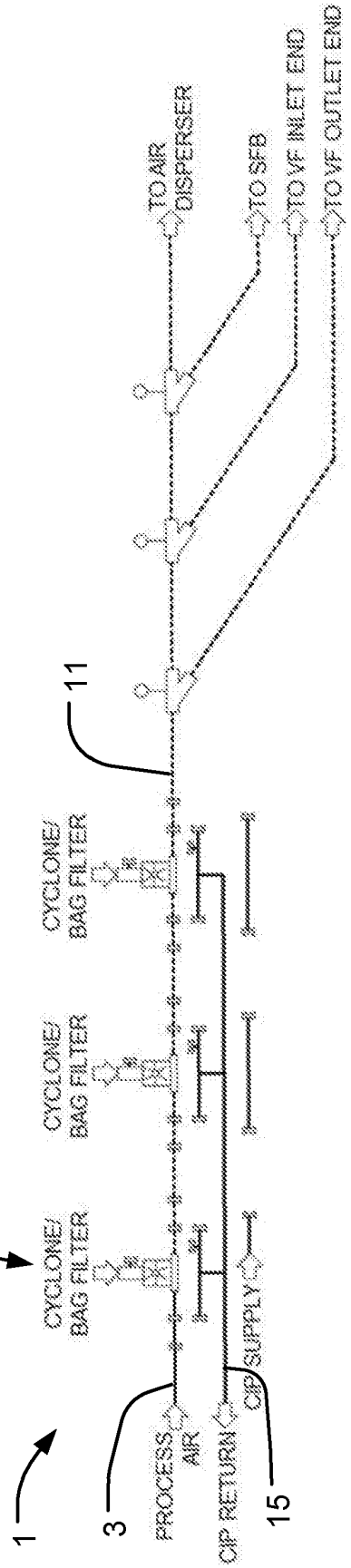
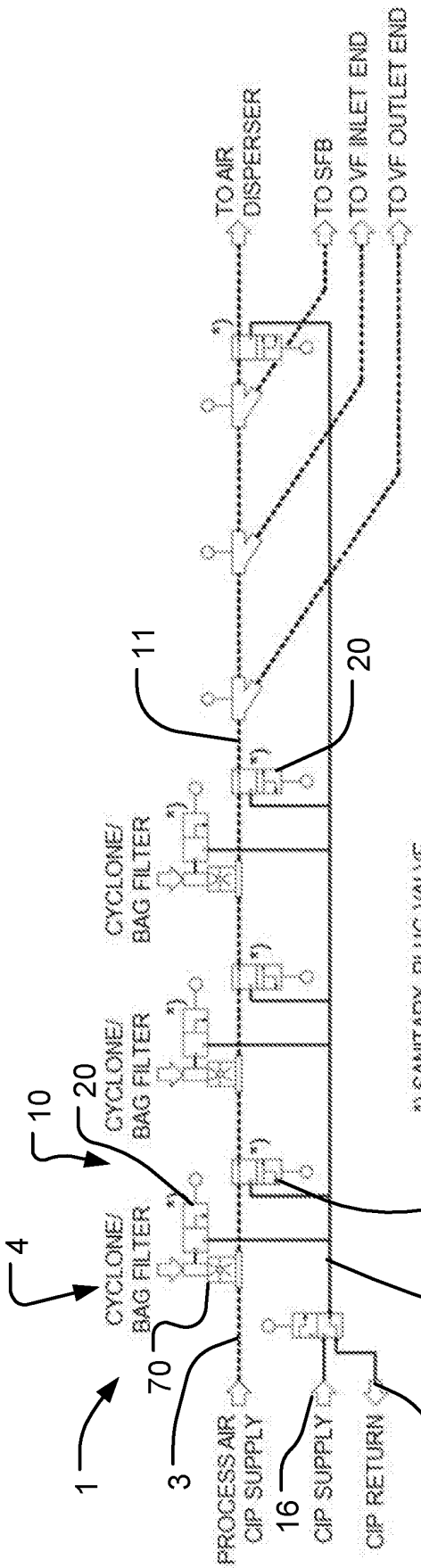


Fig. 3a (PRIOR ART)

Fig. 3b (PRIOR ART)


1
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3
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15
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CYCLONE/
BAG FILTER
CYCLONE/
BAG FILTER
CYCLONE/
BAG FILTER
PROCESS AIR
CIP SUPPLY
CIP SUPPLY
CIP RETURN
TO AIR
DISPERSER
TO SFB
TO VF INLET END
TO VF OUTLET END
*) SANITARY PLUG VALVE

Fig. 4

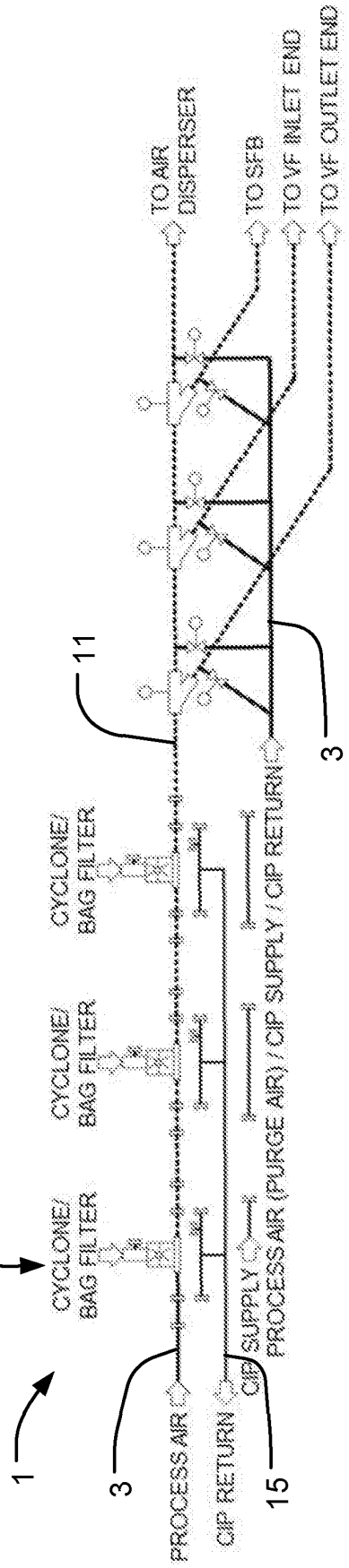


Fig. 5a (PRIOR ART)

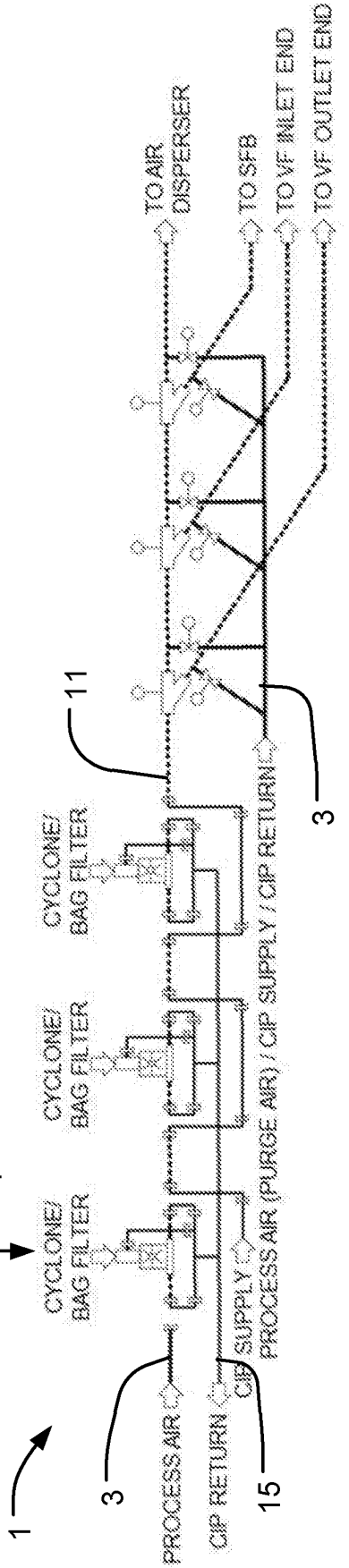
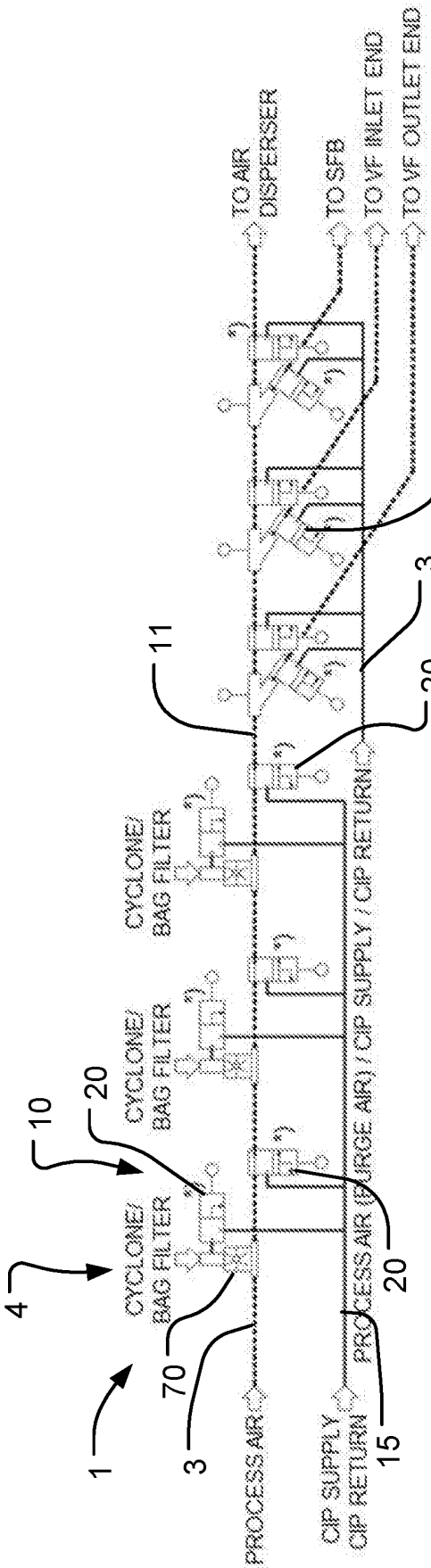


Fig. 5b (PRIOR ART)


1
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3
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CYCLONE/
BAG FILTER
CYCLONE/
BAG FILTER
CYCLONE/
BAG FILTER
PROCESS AIR
CIP SUPPLY
CIP RETURN
PROCESS AIR (PURGE AIR) / CIP SUPPLY / CIP RETURN
TO AIR
DISPERSER
TO SFB
TO VF INLET END
TO VF OUTLET END
*) SANITARY PLUG VALVE

Fig. 6

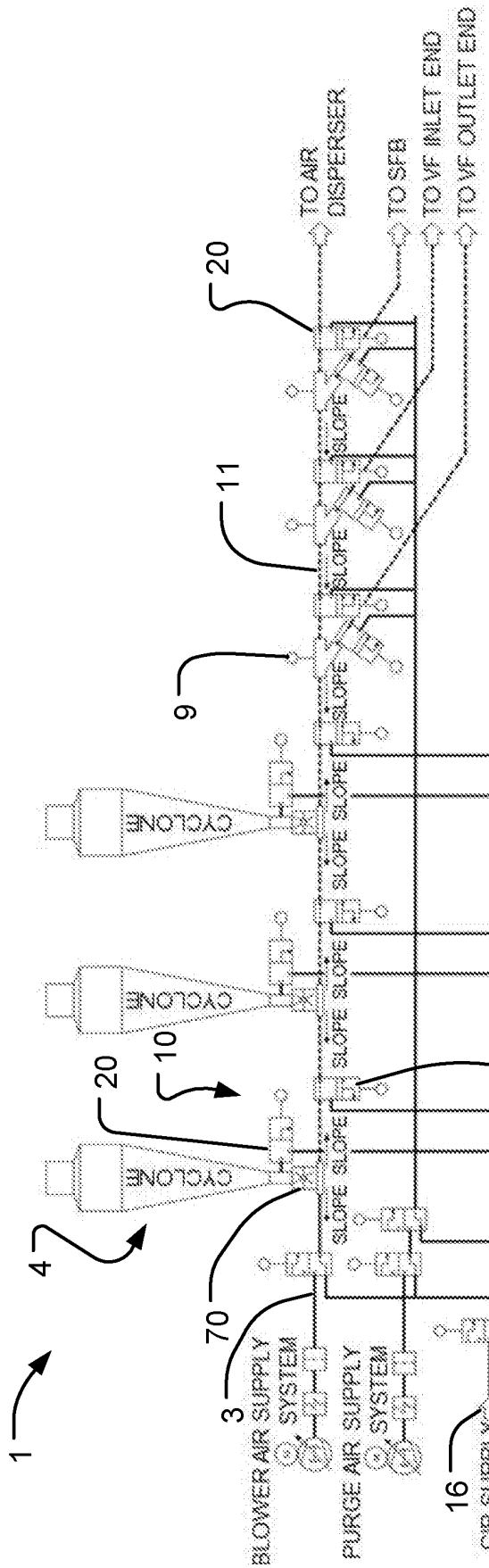
TO AIR DISPERSER
TO SFB
TO VF INLET END
TO VF OUTLET END
20
11
9
SLOPE
CYCLONE
10
20
4
70
3
15
20
1
BLOWER AIR SUPPLY SYSTEM
PURGE AIR SUPPLY SYSTEM
16
CIP SUPPLY
CIP RETURN
17

Fig. 7

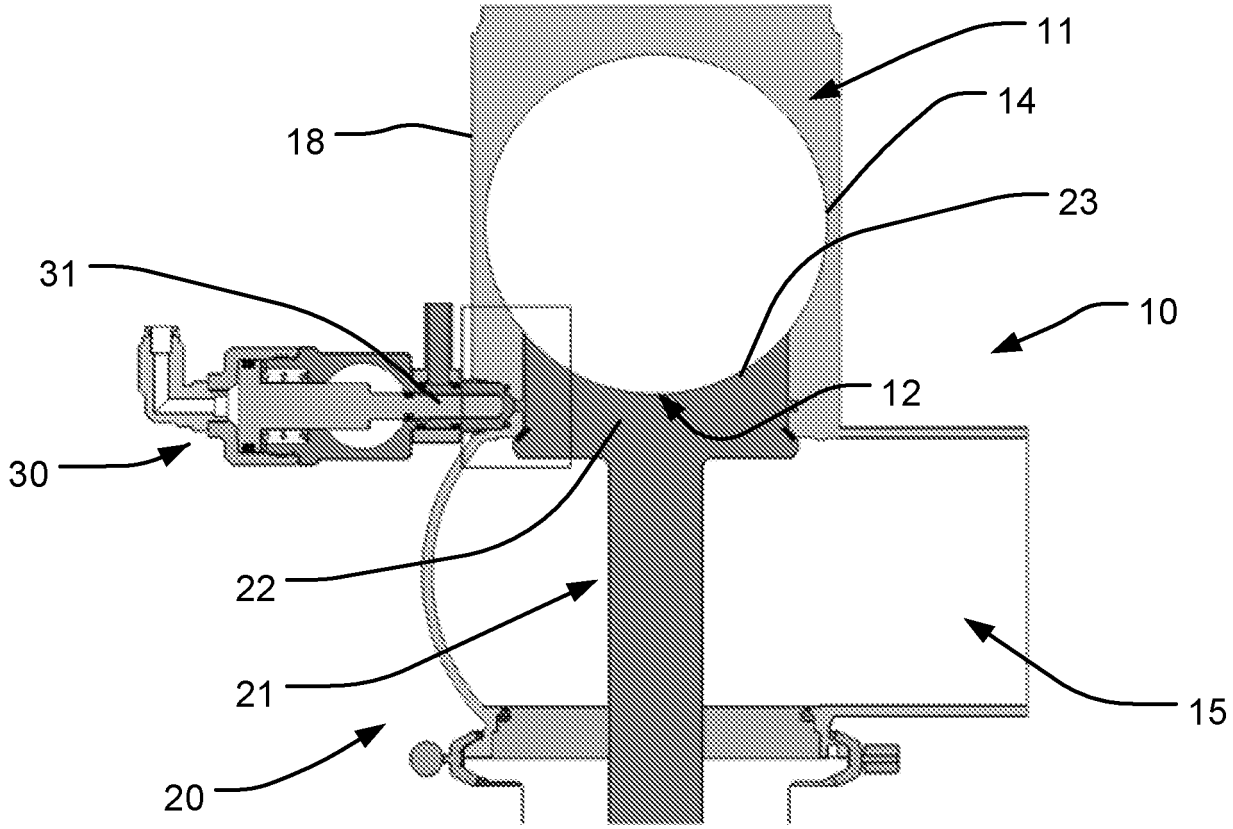

Fig. 8

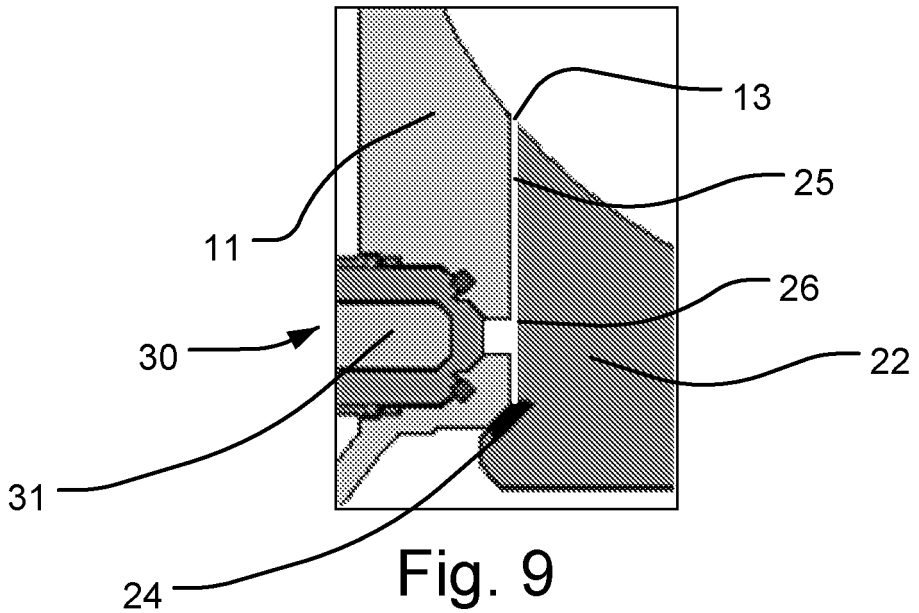

Fig. 9

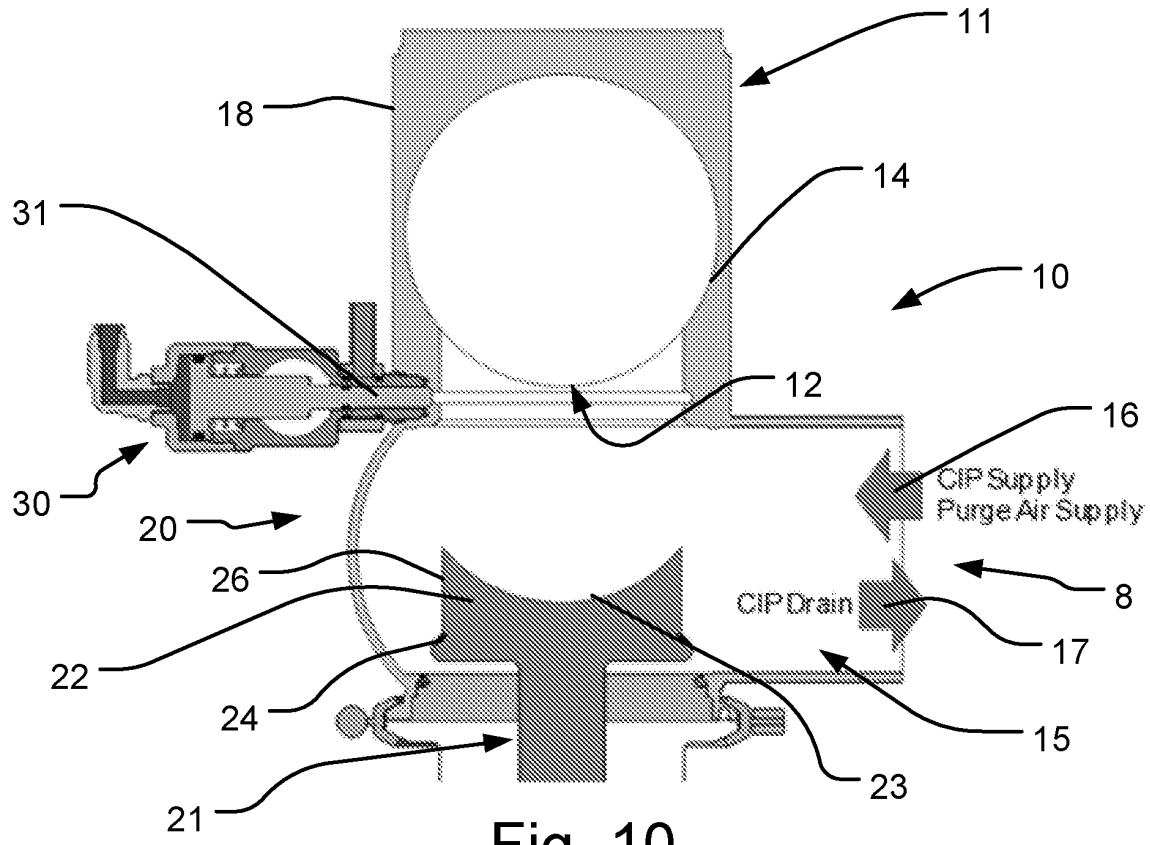
11
18
14
31
10
12
16
CIP Supply
Purge Air Supply
30
20
26
8
CIP Drain
17
22
24
15
23
21

Fig. 10

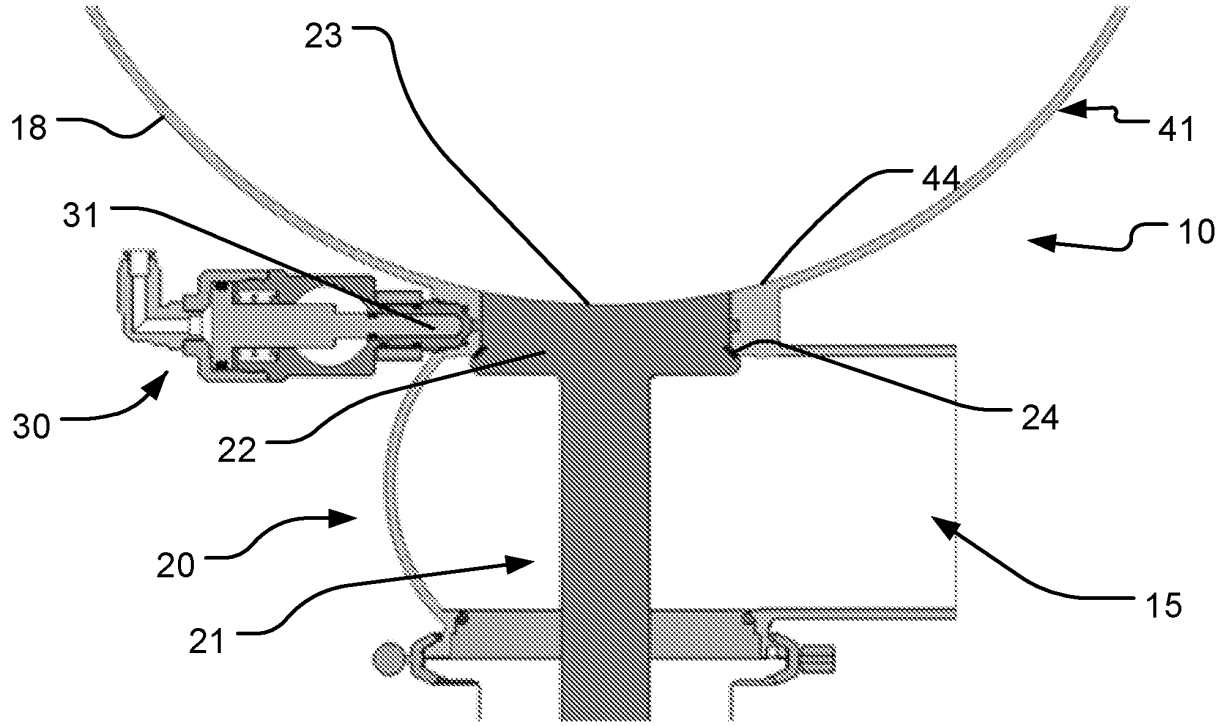
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Fig. 11

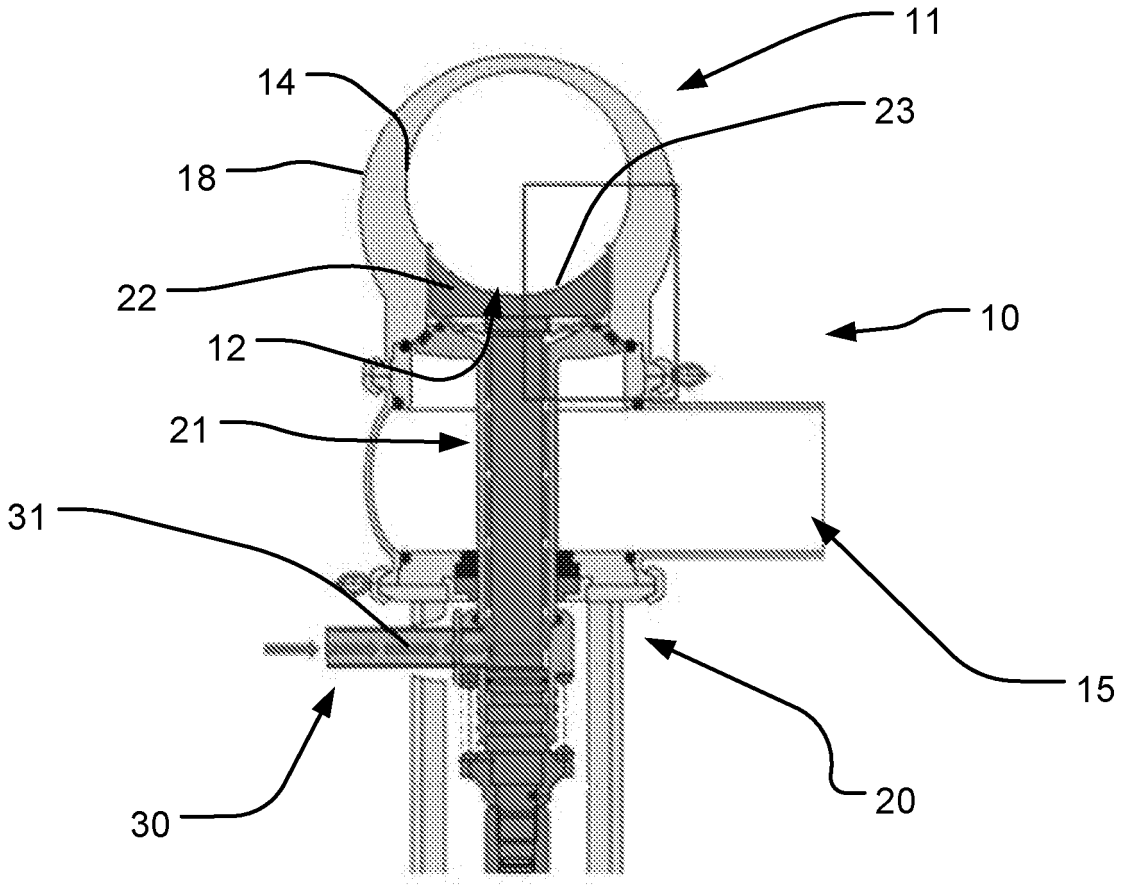

Fig. 12

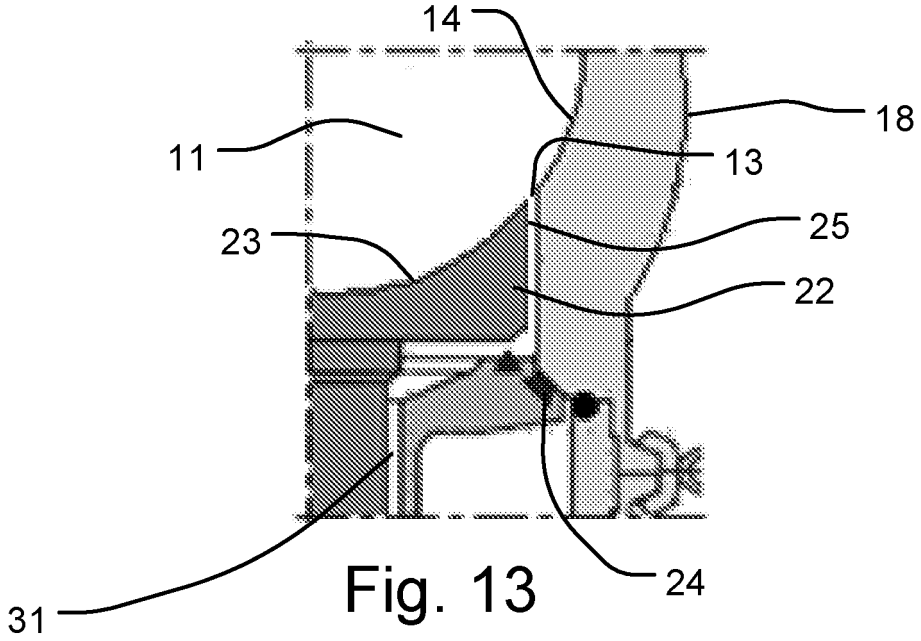

Fig. 13

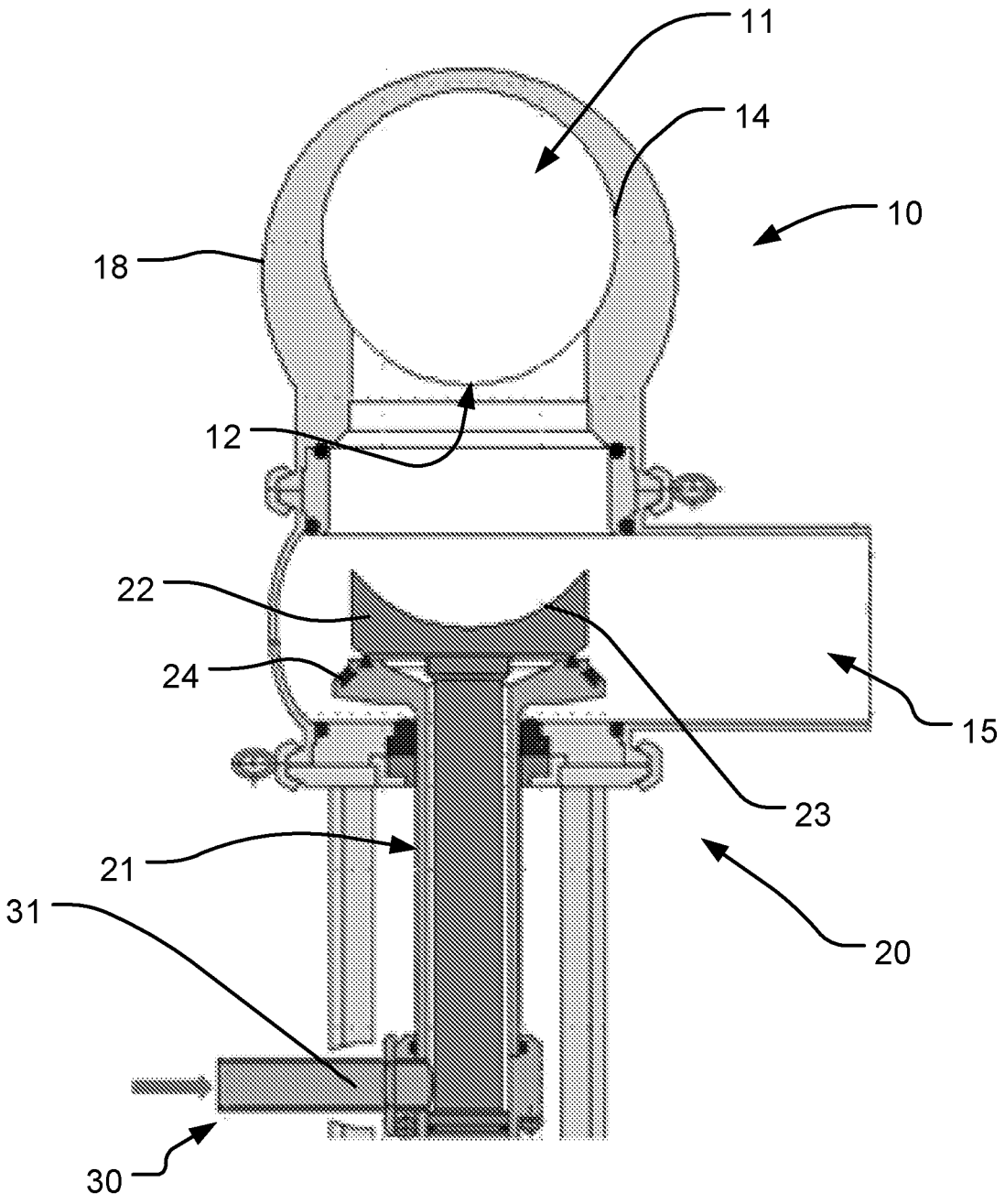

Fig. 14

REFERENCES CITED IN THE DESCRIPTION

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