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(54) **AIR VENTILATION DEVICE FOR DISCHARGING IN SILO TANKS**

(57) A ventilation device (A) used in silo flow systems to prevent material stored in silo tanks (S) from compact-

ing and to ensure that the material moves and flows toward the discharge point.

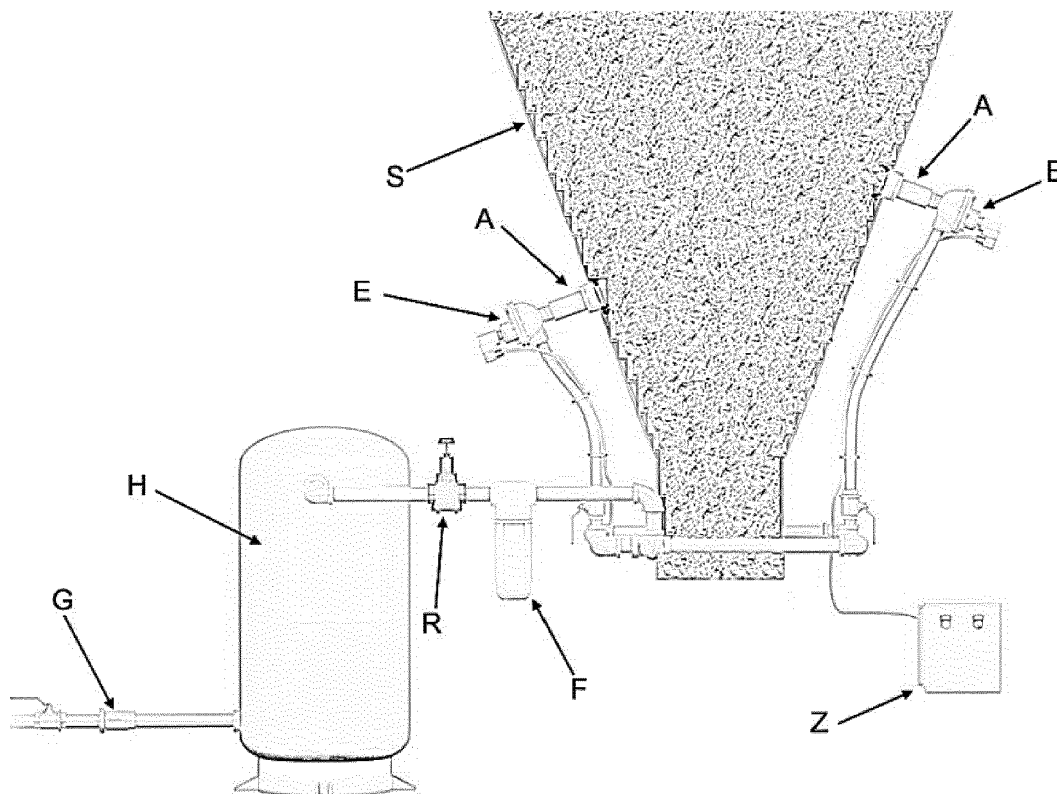


Fig. 4

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Description

Technical Field

[0001] The invention relates to an air ventilation device used in silo flow systems. The invention specifically relates to an air ventilation device that prevents the clustering and compaction of materials stored in conical silo tanks and provides movement to the material for flow toward the discharge point.

Background Art

[0002] A silo is a structure that stores, protects, or preserves bulk materials. It is commonly used for storing materials such as grains, coal, cement, carbon black, food products, manure, and sawdust. Silos have a conical structure toward the discharge point. This conical structure causes the material in the silo to compact and cluster due to the weight on top of it. This clustering prevents the material from flowing out of the silo. The compaction of material in the conical structure causes partial or complete flow stoppage.

[0003] In the current technique, devices operated with compressed air have been developed to prevent flow stoppage in silos due to the conical structure. However, during the use of these devices, the compressed air moves in a circular motion when it is delivered into the silo, and the air outlet is two-dimensional. Therefore, the compressed air moves in two axes along the silo wall. This circumstance hinders the forward movement of compressed air in the silo and results in inefficient discharge.

[0004] An example of known technique in the literature can be shown as the US6237893 document. The mentioned document relates to a high-pressure air valve. In this invention, a burst valve is mounted at the inlet of the air valve. The air valve operates with compressed air. The burst valve transmits the instantaneous air to the air valve through a shock effect. As the shock air passes through the air valve, it overcomes the spring force and rapidly pushes the head into the closed position at the front. As the head moves forward, the compressed air exits through the gap around the head and moves in a circular direction. The compressed air moves the material inside the circular cross-section by the shock effect it receives. This movement prevents contact between the material inside the circular section and the silo and enables the material to move. However, in the known state of the technique, the air vent valve provides a 2-dimensional compressed air outlet by moving the compressed air in a circular motion. This act causes the compressed air to move in 2 axes along the silo wall, preventing its forward movement inside the silo and causing the discharge to be carried out at a lower efficiency than desired. Therefore, there is a need for a known state-of-the-art device that provides the compressed air with a 3-dimensional movement in the right-left, up-down, and forward directions

(from the inner wall of the silo tank toward the center of the silo tank).

[0005] As a result, the presence of the problems mentioned above and the inadequacy of current solutions have made it necessary to develop a new solution in the relevant technical field.

Summary of Invention

[0006] The invention is related to an air ventilation device for emptying silo tanks that eliminate the disadvantages mentioned above and brings new advantages to the relevant technical field.

[0007] The primary purpose of the invention is to provide a ventilation device for conical silo tanks that prevents the material stored in them from compacting and clustering and allows the material to flow toward the discharge point by giving it movement.

[0008] The invention aims to create a ventilation device that can move compressed air in 3 dimensions (left-right, up-down, forward-backward) within the silo tank using sudden shock, allowing the material stuck in the tank to spread and move toward the bottom of the silo tank.

[0009] Another aim of the invention is to ensure the efficient discharge of materials from silo tanks. The objective of the invention is related to an air ventilation device for emptying silo tanks that eliminate the disadvantages mentioned above and brings new advantages to the relevant technical field.

[0010] In order to fulfill all the purposes that can be inferred from those mentioned earlier and in detailed explanation, the invention relates to an air vent device that is used in silo flow systems, prevents the material stored in silo tanks from compacting and clumping together, and provides movement to the material to enable its flow toward the discharge point. The device comprises a body that is connected to the silo wall with a threaded connection nut at one end and to a burst valve via an intermediate connection piece at the end, where pressurized air is introduced. The body houses a leading head that moves back and forth at the end of the body and enables the pressurized air to move in two dimensions (up-down and left-right) inside the silo tank by advancing toward the interior of the tank due to the sudden shock pressure of the pressurized air that enters the body through the pressurized air inlet. The internal spring of the air vent device enables the leading head to move back and return to the closed position inside the body when the pressurized air is cut off.

[0011] The feature of the invention includes:

- the small leading inner head that moves back and forth inside the leading head and advances toward the inside of the silo tank due to the sudden shock pressure of the pressurized air, enabling the pressurized air to move forward inside the silo,
- the air feed hole located on the leading head, which

allows the sudden shock pressure of the pressurized air to be transmitted to the small leading inner head,

- the adjusting nut that allows the adjustment of the forward movement distance of the small leading inner head toward the inside of the silo tank and the flow rate of the pressurized air exiting from the small leading inner head,
- the external spring that enables the small leading inner head to move back inside the body and return to the closed position when the pressurized air is cut off.

[0012] The structural and characteristic features of the invention and its advantages will be better understood through the detailed description provided below, along with the figures and references to these figures. Therefore, the evaluation should be made by considering both these figures and the detailed description.

Brief Description of Drawings

[0013]

Figure 1: Represents a sectional view of the invention's ventilation device connected to the rupture disc valve.

Figure 2: Represents a sectional view of the invention's ventilation device in its closed state.

Figure 3: Represents a sectional view of the invention's ventilation device in its open state.

Figure 3a: Represents a detailed view of the invention's ventilation device in its open state.

Figure 4: Represents a schematic view of the invention's ventilation device on the silo flow system.

Figure 5: Represents a view of the invention's ventilation device in its open state on the silo flow system.

Figure 6: Represents another view of the invention's ventilation device in its open state on the silo flow system.

Explanation of Part References

[0014]

- 10. Body
- 11. Compressed air inlet
- 20. Front head
- 21. Air supply hole
- 30. Front inner small head
- 40. Internal spring
- 50. Adjustment nut
- 60. External spring

- A. Ventilation device
- B. Silo wall

- C. Wall connection nut
- D. Intermediate connection piece
- E. Bursting valve
- H. Air tank
- G. Check valve
- R. Regulator
- F. Particle filter
- S. Silo tank
- Z. Timer
- y. Up-down direction
- x. Left-right direction
- z. Forward direction

Description of embodiments

[0015] This detailed description explains the preferred alternatives of the subject ventilation device (A) only to better understand the subject matter without creating any restrictive effect.

[0016] Figure 1 shows a sectional view of the ventilation device (A) according to the invention. Accordingly, the ventilation device (A) consists of a body (10) which is connected to the silo wall (B) at one end via the wall connection nut (C) and to the burst valve (E) via the intermediate connector (D) at the end of the pressurized air inlet (11). The front head (20) moves back and forth at the end of the body (10). It moves forward into the silo tank (S) by the effect of the sudden shock of pressurized air entering the body (10) from the pressurized air inlet (11), causing two-dimensional movement of pressurized air in the silo tank (S) in the upward-downward (y) and left-right (x) directions. The front inner small head (30) moves back and forth inside the front head (20) and moves forward into the silo tank (S) by the effect of the sudden shock of pressurized air, allowing the pressurized air to move forward (z) in the silo tank (S). The internal spring (40) causes the front head (20) to move back and enter the closed position inside the body (10) when the pressurized air is cut off. The adjusting nut (50) enables adjustment of the movement distance of the front inner small head (30) and the flow rate of the pressurized air exiting the front inner small head (30). The external spring (60) causes the front inner small head (30) to move back and enter the closed position inside the body (10) when the pressurized air is cut off.

[0017] The subject of the invention is an air vent device (A) with a cylindrical body (10) with a toothed structure on its outer surface. The body (10) is connected to the silo wall (B) through a wall connection nut (C) at one end and to the burst valve (E) through an intermediate connection part (D) at the end of the pressurized air inlet (11). The burst valve (E) transmits the pressurized air coming from the compressor to the body (10) with a sudden shock effect.

[0018] As seen in Figures 2 and 3, there is a movable front head (20) at the end of the body (10) connected to the silo wall (B). The front head (20) moves forward into the silo (S) with the effect of the sudden shock pressure of

the pressurized air entering the body (10) from the pressurized air inlet (11), enabling the pressurized air to move in 2 dimensions (y and x) up and down and left and right in the silo tank (S). To allow the pressurized air to move forward (z) inside the silo tank (S), a small front inner head (30) is placed inside the front head (20), which moves back and forth. The small front inner head (30) moves forward into the silo tank (S) with the effect of the sudden shock pressure of the pressurized air, as seen in Figure 3a, allowing the pressurized air to move forward (z) inside the silo tank (S). Air feeding holes (21) are opened on the front head (20) so that the small front inner head (30) can move with the effect of the sudden shock pressure of the pressurized air. Thus, the sudden shock of pressurized air coming to the front head (20) is transmitted to the small front inner head (30) through the air-feeding holes (21), allowing the small front inner head (30) to move inside the front head (20).

[0019] The forward direction (z) refers to the progression toward the center of the silo tank (S) from the inner wall of the silo tank (S).

[0020] The outer surfaces of the front head (20) and the front inner small head (30) are inclined in structure. The inclination of the front inner small head (20) varies depending on the different silo tank (S) structures. These variable angles determine the direction of the pressurized air moving into the silo tank (S).

[0021] To enable the front head (20) to move to the closed position, an internal spring (40) is placed inside the body (10). This internal spring (40) allows the front head (20) to move back into the closed position inside the body (10) when the pressurized air is cut off. To enable the front inner small head (30) to move to the closed position, an external spring (60) is located outside the body (10). This external spring (60) allows the front inner small head (30) to move back into the closed position inside the body (10) when the pressurized air is cut off.

[0022] Between the internal spring (40) and the external spring (60), there is at least one adjustment nut (50) that allows for the adjustment of the forward movement distance of the front inner small head (30) into the silo and also the flow rate of the pressurized air leaving the front inner small head (30). As the forward movement distance of the front inner small head (30) into the silo tank (S) increases, the flow rate of the pressurized air moving forward also increases. The adjustment nut (50) adjusts the output air flow rate accordingly. The adjustment nut (50) can ensure that the front inner small head (30) moves 100% forward while also minimizing the output air at that point.

[0023] The working principle of the ventilation device (A) is as follows according to the invention;

[0024] As seen in Figure 4, compressed air (4-8 bar) from the compressor room enters the air tank (H), and the one-way check valve (G) located at the inlet of the air tank (H) prevents the accumulated air in the air tank (H) from flowing back. A regulator (R) at the air tank (H) outlet adjusts the system operating pressure. This setting var-

ies between 2-6 bars. The particulate filter (F) at the regulator's (R) output prevents particles in the air from entering the silo tank (S) by capturing them. Depending on the process, an oil trap filter or carbon filter can be installed before the particulate filter (F) if necessary.

[0025] The air passing through the particulate filter (F) comes to the inlet of the ventilation device (A), which is in contact with both sides of the silo wall (B), up to the bursting valve (E) on each side. There is no compressed air input to the ventilation device (A) since the bursting valve (E) is closed. The bursting valves (E) are sequentially signaled via the system's timer (Z) set. As seen in Figure 5, when a signal is sent to the first ventilation device (A) through the timer (Z), the bursting valve (E) opens, and the compressed air enters the silo through the ventilation device (A) with a shock effect. The sudden shock wave of compressed air pushes the front head (20) inside the body (10) of the ventilation device (A) forward and directs the compressed air up-down (y) and left-right (x) inside the silo tank (S). The sudden shock wave also pushes the small front internal head (30) forward inside the front head (20) and ensures that the compressed air moves forward (z) inside the silo tank (S). Thus, the fluctuation created by the sudden shock wave of compressed air moves three-dimensionally inside the silo tank (S). In this way, the compacted materials in the silo tank (S) are moved, and the spreading of the compacted materials and their movement toward the lower part of the silo tank (S) is ensured. When the signal duration is over, the internal spring (40) and external spring (60) acting on the small front inner head (30) and front head (20) inside the ventilation device (A) close them.

[0026] As seen in Figure 6, the movement is repeated by signaling the second ventilation device (A) according to the cycle times set via the timer (Z).

Claims

1. A ventilation device (A) used in silo flow systems, preventing the material stored in silo tanks (S) from getting stuck and enables the material to flow toward the discharge point by providing movement to the material, comprising a body (10) that is connected to the silo wall (B) through a wall connection nut (C) at one end and to a burst valve (E) through an intermediate connection piece (D) at the end where compressed air enters (11), a front head (20) of the body (10) that moves back and forth and allows the compressed air entering from the compressed air inlet (11) to move the material forward toward the silo tank (S), causing a two-dimensional movement of the compressed air in the up-down (y) and left-right (x) directions within the silo tank (S), containing an internal spring (40) that enables the front head (20) to move back and return to the closed position when the compressed air is cut off, **characterized by** comprising:

- A front inner small head (30) inside the front head (20), which moves back and forth and allows the compressed air to move forward toward the silo tank (S) in the z-direction.
- An air feed hole (21) on the front head (20) that allows the sudden shock compressed air to be transmitted to the front inner small head (30). 5
- An adjusting nut (50) that adjusts the forward movement distance of the front inner small head (30) toward the silo tank (S) and the flow rate of the compressed air released from the front inner small head (30). 10
- An external spring (60) that enables the front inner small head (30) to move back and return to the closed position when the compressed air is cut off. 15

2. A ventilation device (A), according to claim 1, is **characterized in that** the mentioned front inner small head (30) has a variable angle of inclination according to different silo tank (S) structures to determine the direction of the pressurized air moving toward the inside of the silo tank (S). 20

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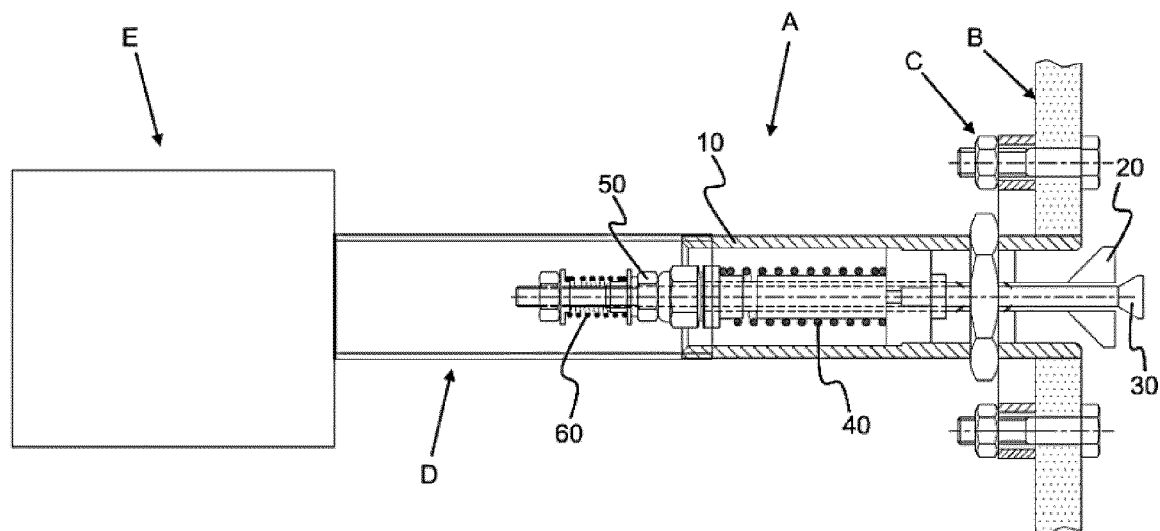


Fig. 1

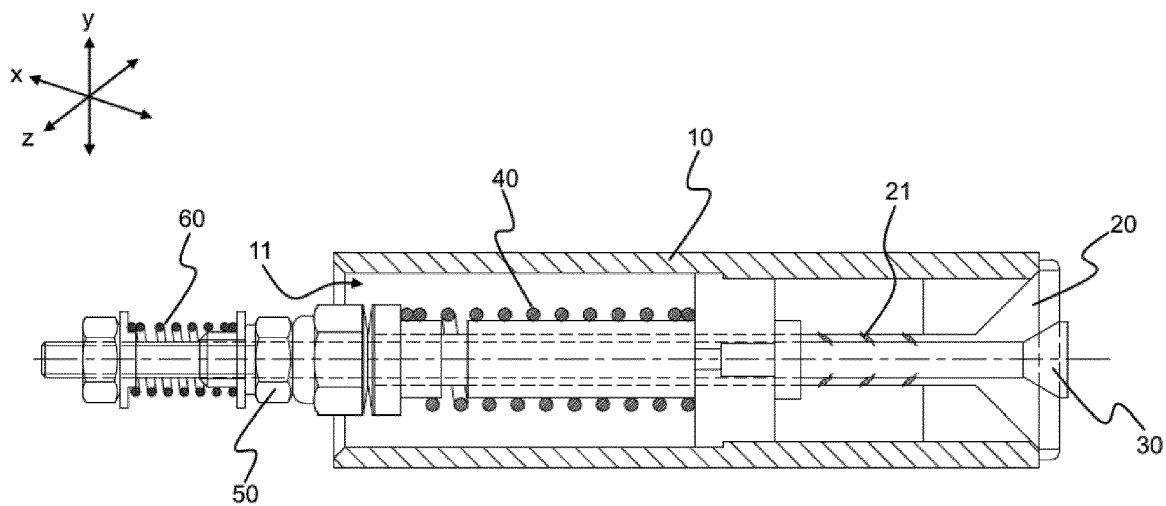


Fig. 2

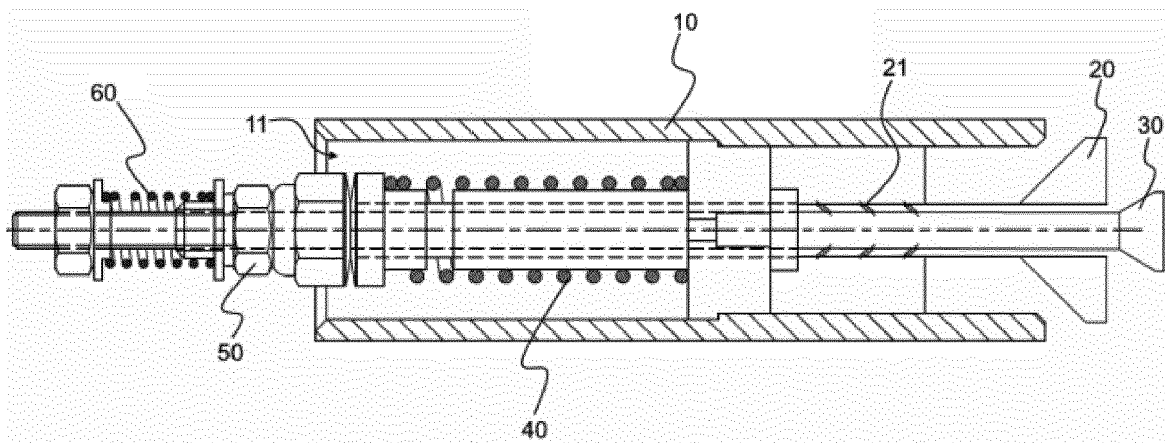


Fig. 3

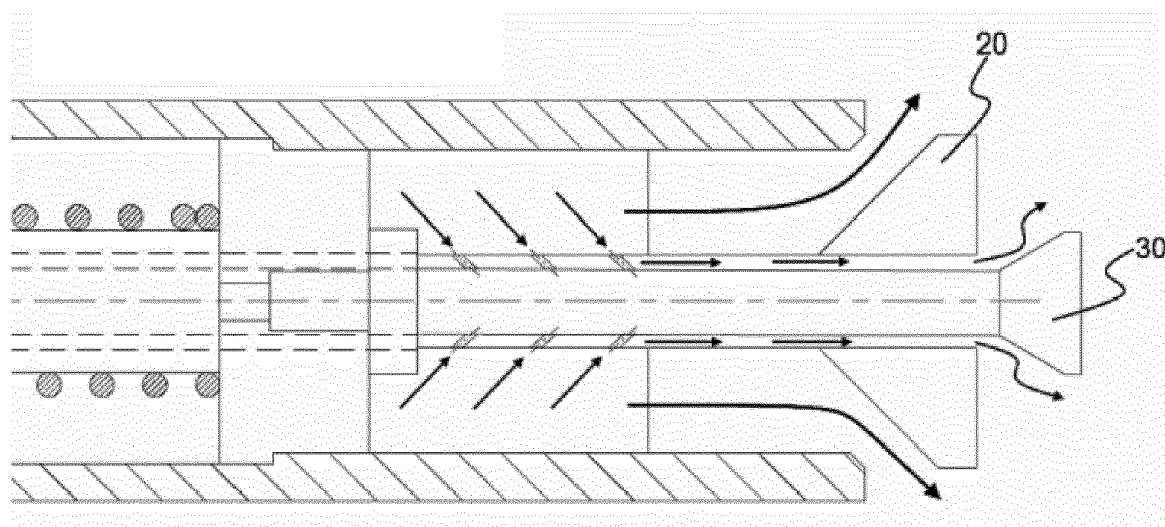


Fig. 3a

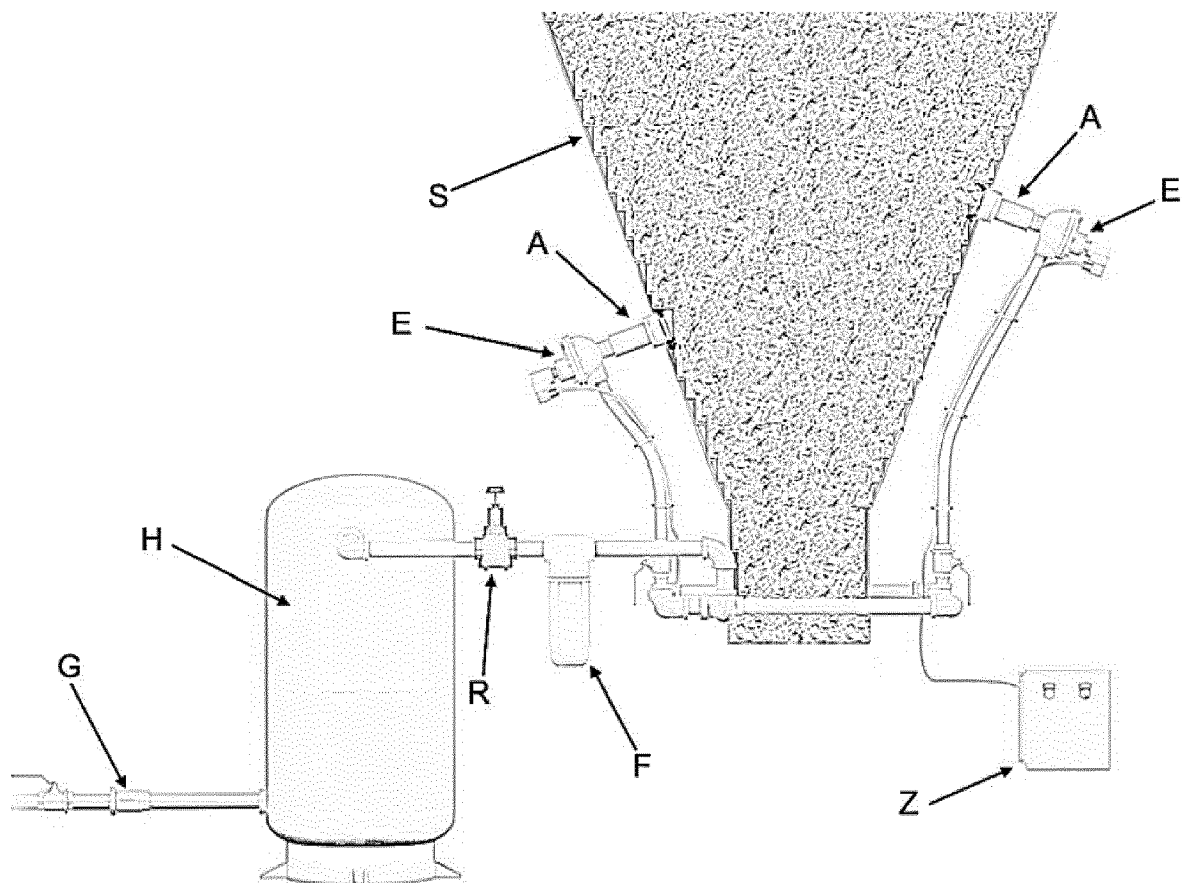


Fig. 4

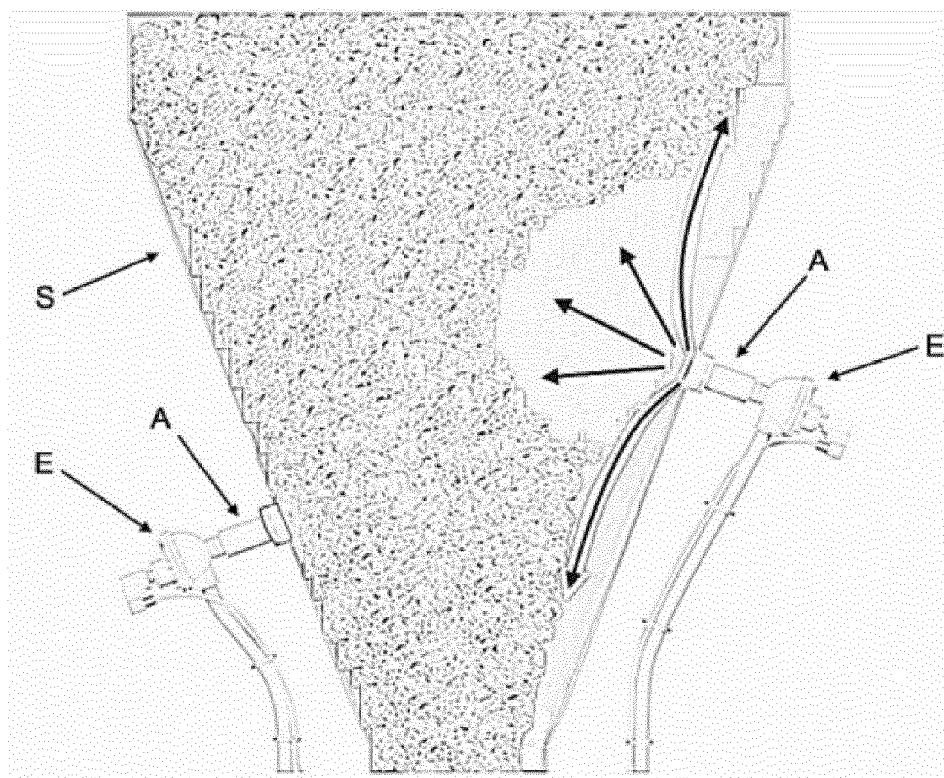


Fig. 5

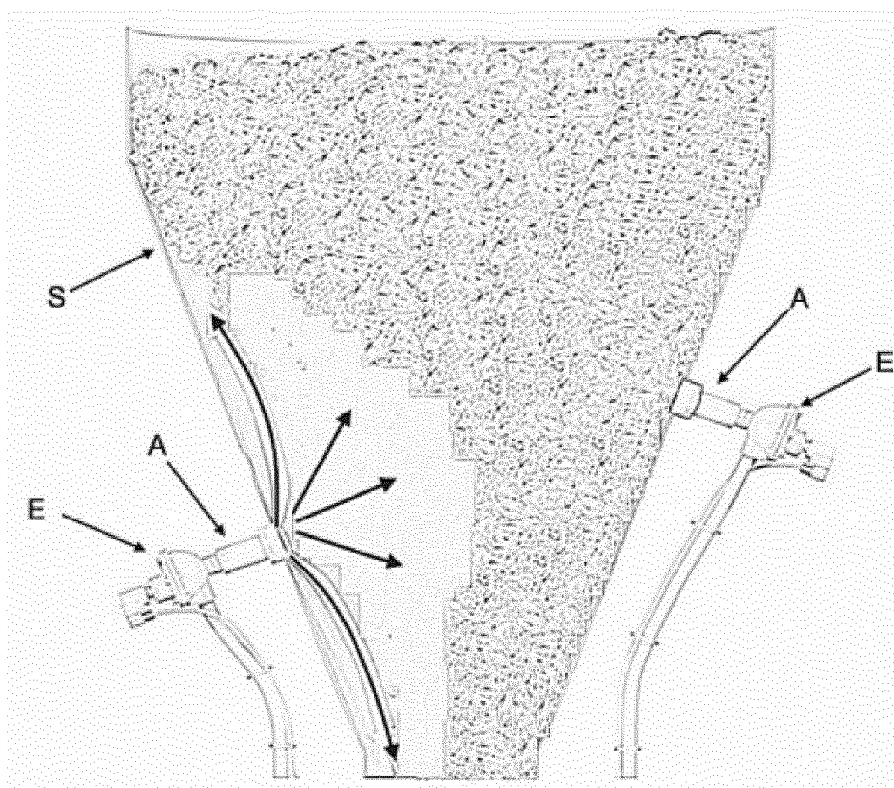


Fig. 6



EUROPEAN SEARCH REPORT

Application Number

EP 23 20 0728

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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
Munich		13 March 2024	Piolat, Olivier
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X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			
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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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