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Title of the Invention

PARTICLE SUPPLY VALVE FOR USE IN BLASTING APPARATUS

Field of the Invention

The present invention relates to a particle supply valve for performing or terminating the supply of compressed air and particles to a nozzle of a blasting apparatus.

Background of the invention

In general, conventional blasting apparatuses are provided with a particle supply valve which can be opened or closed to respectively perform or terminate the supply of compressed air and particles to a nozzle of a blasting apparatus.

As such a conventional particle supply valve, there is known a valve of the type as shown in Fig. 3.

This type of valve has a main body 21 provided with an inlet port 22 for receiving compressed air and particles, an outlet port 23 to allow compressed air and particles to flow out of the valve, and a control air inlet/outlet port 24 to allow control air to flow into or out of the valve.

Further, in an inside space of the main body 21, there are provided two partition walls 29, 30 which are made of flexible rubber and held by the main body 21 to partition the inside space of the main body 21 into a first chamber 31 and a second chamber 32. In this construction, the inlet port 22 and the outlet port 23 both communicate with the first chamber 31, and the control air inlet/outlet port 24 communicates with the second chamber 32.

Further, a metal pin 27 is passed through the middle portion of each of the two partition walls 29, 30 and is fixed thereto. Fixed to the end of the



metal pin 27 which lies in the first chamber 31 is a rubber closure member 26, and fixed to the other end of the metal pin 27 which lies in the second chamber 32 is a metal cap 28.

Now, when the valve is to stop supplying the nozzle (not shown) with compressed air and particles, control air is passed into the second chamber 32 through the control air inlet/outlet port 24 to pressurize the second chamber 32. This results in an increase in pressure inside the second chamber 32 which causes the flexible partition wall 30 to deform toward the first chamber 31, which in turn causes the closure member 26 to close up the opening 25, thereby closing up the inlet port 22.

Then, when the valve is to be opened to supply the nozzle with compressed air and particles, control air is exhausted out of the second chamber 32 through the control air inlet/outlet port 24 in order to reduce the pressure inside the second chamber 32. As a result, the partition wall 30 is deformed toward the second chamber 32, thus causing the closure member 26 to be retracted from the shutoff position (i.e., it moves to the right side in the drawing). This then allows particles and compressed air to flow into the first chamber 31 through the space created between the opening 25 and the retracted closure member 26. Thereafter, the particles and compressed air flow out of the outlet port 23 and then be supplied to the nozzle.

Further, the second chamber 32 is provided with a bolt shank 33 and a handle 34 fixed to the bolt shank 33 to allow the bolt shank 33 to be rotated. The bolt shank 33 is used to adjust the amount of retraction of the closure member 26 in order to adjust the amount of compressed air and particles to be supplied to the nozzle. For example, when the amount of particles and compressed air flowing through the valve is to be reduced, the bolt shank 33 is rotated to increase its protruding length into the second chamber 32. In this case, the end of the metal cap 28 provided at the middle of the partition wall 30 that has been deformed into the second chamber 32 upon the supply

of the particles comes into contact with the end of the bolt shank 33, to restrict the retraction of the closure member 26. As a result, the amount of the space created between the closure member 26 and the opening 25 is reduced, thereby achieving a reduction in the amount of supply of particles and compressed air flowing through the valve.

However, because the partition walls 29, 30 of the conventional valves are made of rubber, they lose elasticity during the long-term use, and this results in a problem in that leakage of compressed air and particles is liable to be caused. Namely, when control air is supplied to the second chamber 32 to deform the partition wall 30 toward the first chamber 31, it is not possible to obtain a required pressing force that pushes the closure member 26 onto the opening 25 if the partition wall 30 loses its elasticity. Consequently, the closure member 26 is pushed back due to the pressure of the compressed air and particles, thus leading to the leakage thereof.

Furthermore, because the rubber partition walls 29, 30 are flexible, it is not possible to guarantee a horizontal movement of the metal pin 27. Namely, when the supply of particles is terminated, the metal pin 27 is normally moved to the left in the drawings. However, there is a case that the metal pin 27 moves slightly left-downward due to the weight of the closure member 26. In this case, since the closure member 26 which is fixed to the metal pin 27 does not properly engage with the opening 25, there is a case that a space is created between the closure member 26 and the opening 25, thus resulting in a problem in that particles and compressed air are leaked through the space.

Moreover, if the power source of the blasting apparatus is accidentally shut off during a blasting operation and therefore the flow of control air to the second chamber 32 is suddenly stopped, there is another problem in that particles and compressed air are ejected from the outlet port 23. Namely, in the above condition, the closure member 26 is simply



abutted onto the opening 25 by the restoring force of the partition walls 29, 30, so that they are easily retracted by the pressure of compressed air and particles, thus resulting in leakage of the compressed air and particles.

In view of the above described problems, it is a primary object of the present invention to provide a leakproof particle supply valve for use in a blasting apparatus which uses a piston and a biasing means instead of rubber partition walls to avoid the deterioration of elasticity characteristics, thereby preventing leakage of compressed air and particles.

It is another object of the present invention to provide a particle supply valve equipped with a sliding wall fixed to a sliding member inside a first chamber to allow a seal to be maintained between a first chamber and a second chamber over a long period of time.

It is another object of the present invention to provide a particle supply valve equipped with a bolt adjusting means for restricting the sliding range of the sliding member so as to control the amount of particles and compressed air flowing through the particle supply valve.

It is another object of the present invention to provide a particle supply valve in which the valve main body, partition wall, sliding member, piston, and sliding wall are made of brass so that such elements can maintain their original characteristics over a long period of time.

It is another object of the present invention to provide a particle supply valve having a shock absorber disposed on the wall surface of the partition wall that lies inside the second chamber to absorb the abutting impact of the piston against the partition wall in order to prevent damage to the closure member when the second chamber experiences a sudden rise in pressure.

Disclosure of the Invention

In order to achieve the objects stated above, a particle supply valve



for use in a blasting apparatus according to the present invention is characterized in that the valve comprises a valve body having an inside space; partition walls for defining said inside space of said valve body into a first chamber and a second chamber; a particle inlet port and a particle outlet port both provided in the first chamber; a control air inlet/outlet port provided in the second chamber; a sliding member which passes said partition walls in a slidable manner, said sliding member having a first end portion positioned in the first chamber and a second end portion positioned in the second chamber; a closure member provided at the first end-portion of the sliding member; a piston fixedly mounted to said sliding member in the second chamber; and biasing means for pressing said closure member against said particle inlet port, wherein said biasing means is adapted to push said closure member against said particle inlet port too maintain the condition in which a supply of particles is not carried out even if an air pressure in said second chamber drops to an atmospheric pressure.

Further, the particle supply valve for use in the blasting apparatus according to the present invention is characterized in that a slidable wall is fixed to the sliding member in the first chamber.

Further, the particle supply valve for use in the blasting apparatus according to the present invention is characterized in that a bolt adjusting means is provided for restricting the movable range of the sliding member within the second chamber.

Further, the particle supply valve for use in the blasting apparatus according to the present invention is characterized in that the valve body, partition wall, sliding member, piston and sliding wall are all made of brass.

Further, the particle supply valve for use in the blasting apparatus according to the present invention is characterized in that the partition walls are provided with an absorption material for absorbing abutting impact with said piston.

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In summary, because the particle supply valve according to the present invention does not use partition walls made of rubber, it is possible to avoid structurally the deterioration of elasticity characteristics associated with such construction. As a result, the present invention provides a particle supply valve which prevents leakage of particles and compressed air.

Furthermore, because the partition wall, sliding wall and piston enable the sliding member to maintain its sliding characteristics, it is possible to consistently carry out a proper sliding operation with the sliding member. As a result, the closure member fixed to the sliding member can consistently be brought into contact with the opening at a prescribed position, thus making it possible to prevent particles and compressed air from leaking through the opening.

Moreover, because the biasing means is constantly pushing the sliding member to the left in the particle supply valve according to the present invention, even if the flow of control air which pressurizes the second chamber suddenly stops during the blasting operation, for example, when the power source of the blasting apparatus is accidentally shut off, the closure member is not retracted from the opening. Therefore, even in such a case, it is possible to prevent the compressed air and particles from being ejected from the outlet port.

Moreover, because the sliding wall of the particle supply valve according to the present invention is fixed to the sliding member inside the first chamber, it is possible to prevent particles from entering into the sliding surface between the penetration hole and the sliding member, thus making it possible to maintain an airtight seal between the first chamber and the second chamber over a long period of time.

Moreover, by operating the bolt adjusting means of the particle supply valve according to the present invention, it is possible to adjust the amount



of particles and compressed air being supplied to the nozzle of the blasting apparatus.

Furthermore, because the valve main body, partition wall, sliding member, piston and sliding wall of the particle supply valve according to the present invention are made of brass, it is possible to maintain the original characteristics of the valve over a long period of time.

Moreover, because the partition wall of the particle supply valve according to the present invention is provided with a shock absorber to absorb the impact of the piston against the partition wall, it is possible to prevent the closure member from being damaged when the second chamber experiences a sudden rise in pressure.

Brief Description of the Drawings

Fig. 1 is a cross-sectional view which shows the condition in which an opening of one embodiment of a particle supply valve according to the present invention is closed;

Fig. 2 is a cross-sectional view which shows the condition that the opening of the particle supply valve shown in Fig. 1 is opened; and

Fig. 3 is a cross-sectional view of a conventional particle supply valve.

Detailed Description of the Preferred Embodiment

With reference to the drawings, a detailed description of the preferred embodiment according to the present invention will now be given below.

Fig. 1 is a cross-sectional view of a particle supply valve for use in a blasting apparatus according to this embodiment, in which the valve is shown in a closed state. Fig. 2 is a cross-sectional view of the same valve shown in Fig. 1, in which the valve is shown in an opened state.

As shown in Figs. 1 and 2, the particle supply valve has a main body



1 made of brass. The main body 1 is provided with an inlet port 2 which allows particles and compressed air to pass into the valve, an outlet port 3 which allows particles and compressed air to pass out of the valve, and a control air inlet/outlet port 4 which allows control air to be supplied to and released from the valve.

Further, a brass partition wall 10 is provided inside the main body 1 as an integral part thereof to partition the space inside the main body 1 into a first chamber 15 and a second chamber 16. The inlet port 2 and the outlet port 3 both communicate with the first chamber 15, and the control air inlet/outlet port 4 communicates with the second chamber 16.

Further, a sliding member 7 which is also made of brass is slidably inserted through a penetration hole 11 formed in the central portion of the partition wall 10. Provided on the tip end of the left side portion of the sliding member 7 is a hard rubber closure member 6. The hard rubber closure member 6 is formed in the shape of a half sphere. The closure member 6 fixed to the sliding member 7 can be brought into contact with an opening 5 of the inlet port 2 in order to shut off the supply of particles and compressed air flowing into the first chamber 15 of the valve. To accomplish this function, the closure member 6 is preferably formed to have a diameter that is larger than the diameter of the opening 5.

Also, provided in the first chamber 15 is a brass sliding wall 9 which is fixed to the sliding member 7. The sliding wall 9 is formed such that the outer circumferential surface thereof is in sliding contact with the inner circumferential wall surface of the first chamber 15. As a result, the sliding wall 9 makes it possible to separate the first chamber 15 into a first space which receives particles and compressed air and a second space which is kept free of particles and compressed air.

Provided in the second chamber 16 is a brass piston 8 which is fixed to the sliding member 7. The outer circumferential surface of the piston 8



is in sliding contact with the inner circumferential surface of the second chamber 16. The outer circumferential surface of the piston 8 is widened to stabilize the sliding movement of the sliding member 7 and to provide a highly effective airtight seal against the control air pressure in the second chamber 16. Further, a hard rubber shock absorber 17 is provided on the wall surface of the partition wall 10 in the second chamber 16.

Further, a biasing means 12 comprised of a metal spring is provided in the second chamber 16 between a protruding portion formed at an end portion of the sliding member 7 which lies in the second chamber 16 and the inner wall surface of the second chamber 16 which directly faces the protruding portion of the sliding member 7. In particular, one end of the biasing means 12 is secured around the protruding portion of the sliding member 7 and the other end of the biasing means 12 is secured inside an annular fixing member 13 provided on the inner wall surface of the second chamber 16. Further, a bolt 14 is inserted through the valve main body 1 in a manner that allows an end portion thereof to be screwed into the second chamber 16. Moreover, the bolt 14 has a head portion lying outside the valve main body 1 which can be turned to adjust the length of the end portion thereof protruding within the second chamber 16.

Now, when the supply of particles and compressed air to a nozzle (not shown) is to be shut off, as shown in Fig. 1, control air is passed into the second chamber 16 through the control air inlet/outlet port 4 to pressurize the second chamber 16, thereby causing the piston 8 to be pushed toward the first chamber 15, and this in turn causes the sliding member 7 to slide to the left direction, whereby the closure member 6 is forced into the opening 5 to seal off the inlet port 2.

On the other hand, when particles and compressed air are to be supplied to the nozzle, the control air in the second chamber 16 is released through the inlet/outlet port 4 to depressurize the second chamber 16,



thereby causing the piston 8 to retract in a direction toward the second chamber 16, and this in turn causes the sliding member 7 to slide to the right direction, whereby the closure member 6 is pulled out of the opening 5 (i.e., the closure member 6 moves to the right direction in Fig. 2). As a result, particles and compressed air first flow into the first chamber 15 from the inlet port 2 through the space created between the opening 5 and the closure member 6, and then flow out through the outlet port 3 to be supplied to the nozzle.

In this connection, because the sliding wall 9 separates the first chamber 15 into a first space which receives particles and compressed air and a second space which is kept free of particles and compressed air, it is possible to prevent particles from entering into the sliding surface between the penetration hole 11 and the sliding member 7. As a result, it is possible to prevent the sliding surface from being abraded by the particles. Further, by turning the bolt 14 in the clockwise direction to increase the protruding length of the end portion thereof inside the second chamber 16, it is possible to reduce the distance between the left end of the bolt 14 and the right end of the sliding member 7, and this distance defines the retraction distance of the closure member 6. Namely, as shown in Fig. 2, when particles and compressed air are being supplied to the nozzle, the left end of the bolt 14 is in contact with the right end of the sliding member 7 to restrict further the movement of the sliding member 7. Consequently, it is possible to control the amount of particles and compressed air being supplied to the nozzle by turning the bolt 14 to adjust the protruding length of the end portion thereof inside the second chamber 16.

Furthermore, because the valve main body 1, partition wall 10, sliding member 7, piston 8 and sliding wall 9 are made of brass, they have a higher hardness than the particles. As a result, the valve is imparted with excellent antiabrasion characteristics.

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Moreover, because the wall surface of the partition wall 10 that lies inside the second chamber 16 is provided with the hard rubber shock absorber 17, it is possible to absorb the impact of the piston 8 against the partition wall 10, and this makes it possible to prevent the closure member 6 from being damaged when the second chamber 16 experiences a sudden rise in pressure.

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What is Claimed is:

1. A particle supply valve for use in a blasting apparatus, comprising:

a valve main body having an inside space;

partition walls for defining said inside space of said valve body into a first chamber and a second chamber;

a particle inlet port and a particle outlet port both provided in said first chamber;

a control air inlet/outlet port provided in said second chamber;

a sliding member which passes said partition wall in a slidable manner, said sliding member having a first end portion positioned in first chamber and a second end portion positioned in said second chamber;

a closure member provided at the first end portion of said sliding member;

a piston fixedly mounted to said sliding member in the second chamber; and

biasing means for pressing said closure member against said particle inlet port, wherein said biasing means is adapted to push said closure member against said particle inlet port to maintain the condition in which a supply of particles is not carried out even if an air pressure in said second chamber drops to an atmospheric pressure.

2. The particle supply valve for use in the blasting apparatus as claimed in claim 1, wherein a sliding wall is fixed to said sliding member in said first chamber.

3. The particle supply valve for use in the blasting apparatus as claimed in claim 1 or 2, wherein a bolt

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adjusting means is further provided for restricting the movable range of said sliding member within the second chamber.

4. The particle supply valve for use in the blasting apparatus as claimed in any one of claims 1 to 3, wherein said valve body, partition walls, sliding member, piston and sliding wall are all formed of brass.
5. The particle supply valve for use in the blasting apparatus as claimed in any one of claims 1 to 4, wherein said partition walls are provided with an absorption material for absorbing abutting impact with said piston.

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