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Assersen

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[54] **REMOTE-CONTROLLED VALVE, PREFERABLY FOR PNEUMATIC SAND BLAST UNITS**

[76] Inventor: **Soeren Kristian Assersen,** Mosevangen 210, 5330 Munkebo, Denmark

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[51] **Int. Cl.²** **B24C 7/00**

[58] **Field of Search** 137/596.15; 51/12

[56] **References Cited**

UNITED STATES PATENTS

2,583,185 1/1952 McLeod 137/596.15

2,984,218 5/1961 Christianson 137/596.15

Primary Examiner—Robert G. Nilson

Attorney, Agent, or Firm—Littlepage, Quaintance, Murphy & Dobyns

[57] **ABSTRACT**

A valve for remotely controlling the supply of a pressurized media, adapted for use in sand blasting units, comprising a pair of opposed pistons having piston heads facing a control chamber, the surface area of each piston head being greater than the corresponding surface at the opposite end of each piston, the opposite end of the first piston having a conical valve body facing a valve seat, the opposite end of the second piston facing a flexible diaphragm covering the end of a conduit.

8 Claims, 2 Drawing Figures

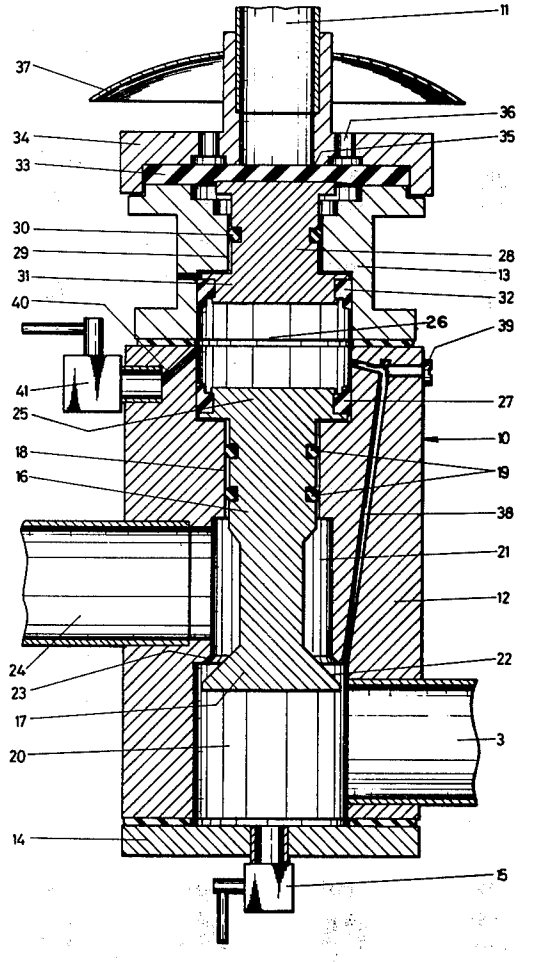


Fig. 1

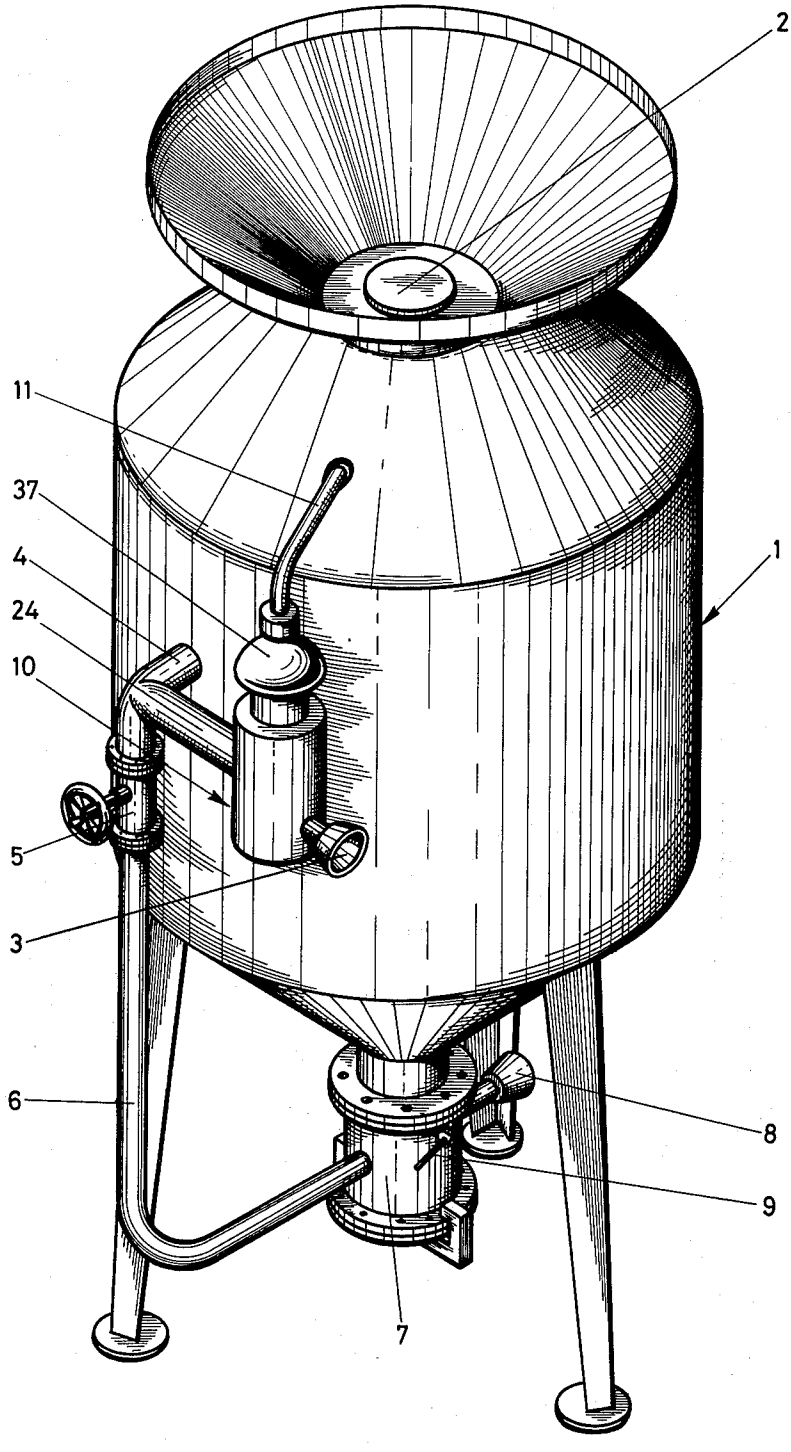
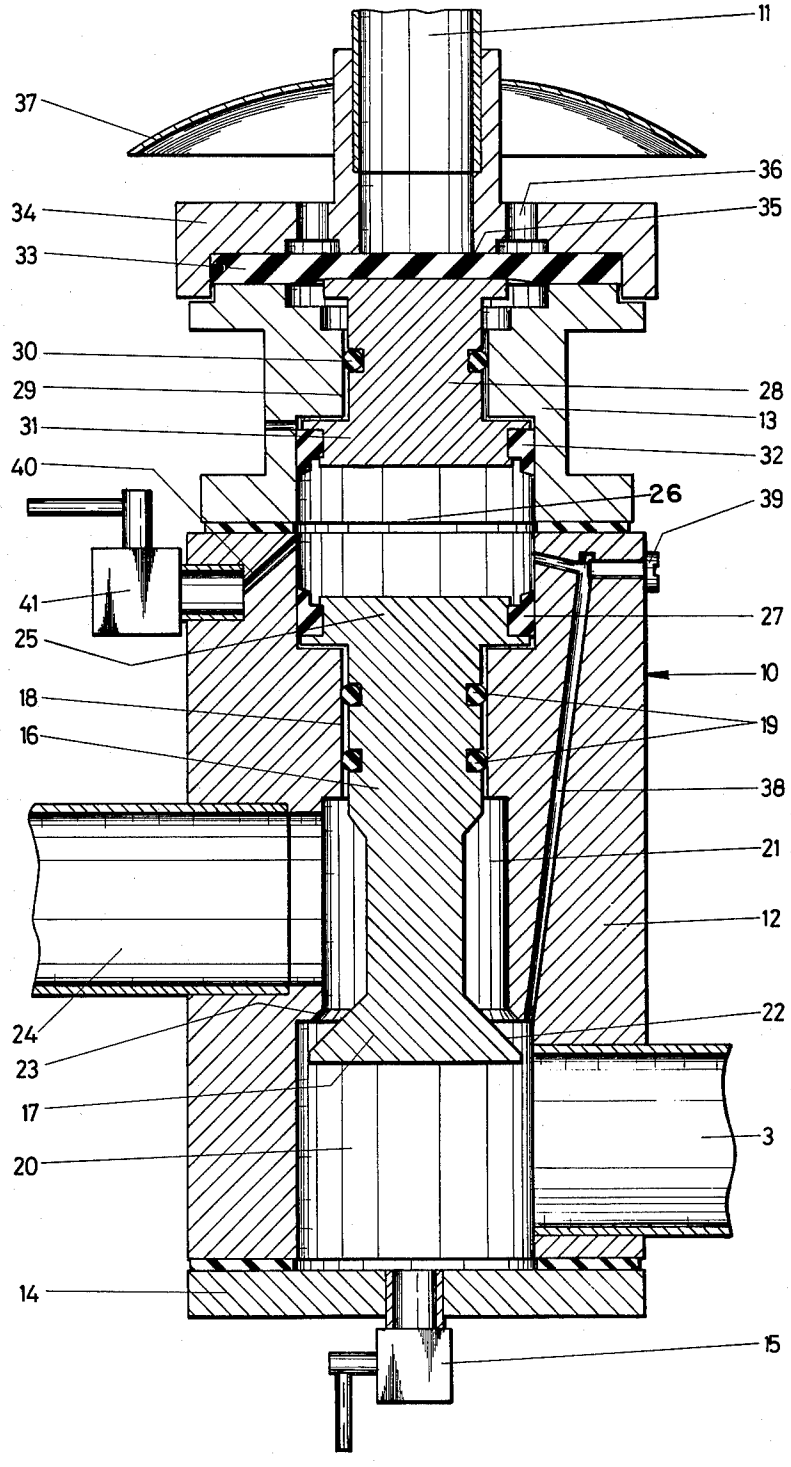


Fig. 2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REMOTE-CONTROLLED VALVE, PREFERABLY FOR PNEUMATIC SAND BLAST UNITS

This invention relates to a control valve for remote control of the supply of pressure media, preferably for use in sand blast units.

A typical sand blast unit consists of a sand receiver with compressed air and having an air input from a compressor, said unit provided with a device for mixing the air and the erosive medium, ordinarily sand, and a pressure hose, through which the mixture of air and sand is conveyed to a nozzle outlet activated by and supervised by an operator.

For economic and safety reasons it is necessary in sand blasting apparatus to be able to cut off the mixture stream through the nozzle at the nozzle itself. Use of a valve device directly acting at the nozzle is an unsatisfactory solution due to the fact that such a device would be worn out extremely fast and furthermore, produce a disturbing wave of high pressure air, which would force its way back into the sand reservoir in the receiver.

It is known to mount two manually operated valves at the receiver, one of said valves cutting off the pressure air supply to the receiver while the other of said valves controls an opening in the receiver equalizing the pressure to the atmosphere. However, for example in the case of the operator being indisposed said method is inadvisable and due to the often long distance between the nozzle and the receiver, the method is time consuming and irrational.

Furthermore, it is known to provide the apparatus with electrically controlled valves having a switch at the nozzle. But such switches and valves connected thereto require a separate and expensive power supply with corresponding circuits, said valves inclined to cause difficulties in operation due to the omnipresent fine-grained dust from the sand blasting.

The objective of the present invention is to provide a control valve which performs the desired disconnection in a safe manner and without application of other controlling media than the pressure air already at hand.

The invention as described in the characterizing part of claim 1 provides a control valve having several functions, such as to cut off, to turn on and, if desired, to control one or more pressure media.

A further objective of the invention is to provide a valve of said type, and at the same time of a compact and simple design in order to fulfil requirements both as regards safety and low costs.

The axes of the pistons performing these functions may be arbitrarily placed and oriented, and the function of regulation of the pressure air supply can be obtained by adjusting the pressure of the valve controlling medium in the control chamber of the valve, said adjustment being attained by controlling the rate of flow of said medium from said chamber to the atmosphere.

Furthermore, the controlling medium may pass through a pressure stabilizing accumulator before entering said control chamber in order to minimize any reaction from the regulated medium on to the regulating or controlling medium.

However, the valve according to the invention is mainly to be used in connection with sand blast units, in which the valve is part of, and also controls, two pressure paths, respectively the pressure air inlet to the receiver from for example a compressor and the pressure

air outlet from said receiver to the atmosphere; the valve turns on or cuts off the supply to the receiver and simultaneously cuts off or turns on respectively the emission of pressure air from the receiver to the atmosphere. These simultaneous valve movements are controlled by the pressure in the control chamber, which pressure again is controlled by a button operated valve, preferably located at the nozzle, whereby the button operated valve acts as a dead man's control for the operator.

The valve casing has at one end an inlet for the compressor air into a first chamber, the entrance chamber, in which is placed one end of a valve piston of the form of a conical valve body which turns on or cuts off the air supply to the receiver dependent on the position of said valve piston. A channel connects said entrance chamber with a second chamber, the control chamber, and thereby admits a pressure air flow to said control chamber, the amount of which flow can be regulated by adjusting a screw taking up a larger or smaller part of the channel cross section. The end walls of said control chamber are formed by two piston heads, one of which is the head of the piston mentioned above, and the other piston head is part of a piston controlling the outlet from the receiver to the atmosphere. The wall of the control chamber is provided with a bore which is connected through a pressure hose having a button operated valve. The characteristic features of the two pistons are that the effective areas of the piston heads facing said control chamber are larger than the areas at the other end of these pistons so that the same static pressure at both ends of the pistons results in propelling the pistons from the control chamber which feature will be explained in detail in the following. The other end of the piston controlling the receiver to atmosphere outlet abuts a flexible disc or diaphragm covering the end opening of a pipe leading into the receiver. When this piston moves in direction of the control chamber, the pressure in the receiver releases the diaphragm from the pipe opening, and pressure air flows into the atmosphere. The flexible diaphragm is made of a material offering good resistance to erosion. In using such a flexible diaphragm as a valve disc two essential advantages are obtained. First longer service or operating life time to this part of the valve is obtained due to the fact that certain flexible materials are resistant to erosion which resistance is more than fifty times that of commonly used metals, secondly this design protects against ingression of erosive particles into the remaining part of the control valve due to the good sealing abilities of the diaphragm.

The entrance chamber in the bottom of the control valve may further be equipped with a drain cock for drainage of condensates.

The invention is further described in the following with reference to the drawings in which:

FIG. 1 is a perspective view showing a sand blasting unit of known type equipped with a control valve according to the invention,

FIG. 2 shows a longitudinal section of said control valve in Fig. 1.

In Fig. 1 is shown a receiver 1 of know type containing erosive material filled in through a funnel on the top of the receiver. The receiver is closed by a cover 2 placed in the lower part of the funnel. Pressure air is supplied to the receiver 1 from for example a compressor through an inlet union 3, from which the air is led into the receiver above the sand surface through a pipe

branch 4 and through a valve 5 and a pipe branch 6 into a pump chamber 7, located beneath the receiver. In said pump chamber 7 the pressure air forces the sand flow downwards from the receiver 1 through an outlet union 8 into a pressure hose connected thereto (not shown) and further on to a sand blasting nozzle (not shown) for discharging. The pump chamber 7 is provided with a device 9 for regulation of the sand flow from the receiver 1 above. The valve 5 is ordinarily turned on, but in case of clogging of the sand supply to the pump chamber 7 said valve may be turned to the cut off position, and a high overpressure is built up inside the receiver 1 compared to the pressure in the pump chamber 7, ordinarily sufficient to clean up obstructions in the flow path of the sand.

In the pressure air conduit before the pipe branches 4 and 6 is inserted a control valve 10 according to the invention. The valve 10 controls the turning on or cutting off of the pressure air flowing into the receiver 1 and to the sand pump chamber 7, and at the same time cuts off or turns on, respectively, the pressure equalizing pipe connection 11 from the receiver to the atmosphere.

This control valve 2 consists of a valve casing with a lower cylindrical casing part 12 and an upper cylindrical casing part 13. The inlet union 3 is mounted on the side of the lower casing 12, the bottom of which consists of an end cover 14 supplied with a drain cock 15. A valve piston 16 with one end formed as a conical valve body 17 is arranged axially movable in a cylindrical bore 18 in the casing 12. Sealing rings 19 prevent leaking through the space between the piston 16 and the bore 18. Between the valve body 17 and the end cover 14 is located an entrance chamber 20, through the sidewall of which a connection to the inlet union 3 is provided. When the piston 16 is in its outermost position (as shown in Fig. 2), a connection is established between the chamber 20 and an outlet chamber 21, situated between the chamber 20 and the bore 18, through an annular gap 22 between the valve body 17 and a matching valve seat 23. The chamber 21 is connected to the receiver 1 through an outlet union 24 and the pipe branch 4 and to the pump chamber through the valve 5 and the pipe branch 6 as shown in Fig. 1. The valve piston 16 has at its upper end a piston head 25 having a larger diameter than that of the valve body 17, and in the control chamber 26 the piston head 25 is supplied with a suitable sealing ring 27. Said larger diameter results in a larger effective pressure area of the piston head 25 facing the control chamber 26 than that of the valve body 17 facing the entrance chamber 20.

In a similar way another piston 28 is arranged within a bore 29 in the upper valve casing part 13, and sealed by a ring 30. The head 31 of the piston 28 facing the control chamber 26 is supplied with an additional suitable sealing ring 32. The other end of piston 28 abuts a flexible diaphragm 33, the periphery of which is fixed between a cover 34 and the upper casing 13. The upper surface of the diaphragm 33 covers the end opening 35 of the pipe 11 and circumferentially placed holes 36 in the cover 34. As in the case mentioned above the piston head 31 facing the control chamber 26 has a larger pressure area than that in the opposite end of the piston 28 determined by the diameter of the opening 35. Said opening 35 is connected through the pipe 11 to the receiver 1, whereas the holes 36 are leading to the atmosphere partly shielded by a bell-shaped plate 37.

As further shown in Fig. 2 a channel 38 provided with an adjusting screw 39 interconnects the entrance chamber 20 and the control chamber 26. Said chamber 26 is equipped with a bore 40, leading to a three-way valve 41 (further details hereinafter) to which a pressure control hose (not shown) is connected; said hose has a button operated valve at the nozzle. Said hose is extending parallel to and ordinarily fixed to the pressure hose leading to the discharge nozzle from the outlet union 8. The button operated valve at the nozzle is so arranged that if the operator presses down slightly and constantly said button, the pressure air path out of the hose is closed, whereas by releasing the button the pressure air in the hose and hence also in the control chamber 26 is discharged to the atmosphere.

The process is as follows:

To start the sand blasting, for example in the morning, when the sand blast unit is assumed to have atmospheric pressure, pressure air is supplied to the entrance chamber 20 in the control valve 10 through the inlet 3. The piston 16 is therefore moved in the direction to close the opening 23 whereby the air supply to the receiver 1 is cut off. However, simultaneously, the pressure air flows through the channel 38 passing the adjusting screw 39 to the control chamber 26. If the button operated valve at the blast nozzle is kept in a closed position, the control chamber and the control hose from a closed cavity which attains the static pressure of the supplied compressed air relatively fast. This causes the two pistons 16, 28 to move away from the control chamber 26, which again results in establishment of an air supply path to the receiver 1 by opening the valve body 17, and also in closing the air-connection between the receiver 1 and the atmosphere by means of the flexible disc 33 closing the opening 35 of the pipe 11. When the operating pressure level is built up in the receiver, the sand pump starts, and pressure air carrying sand is streaming to the blast nozzle.

However, if the button operated valve is released, beause the operator wants to stop the discharging or because of indisposition of the operator, the pressure air in the control chamber 26 escapes through the hose. Then the failing pressure in the control chamber 26 causes the two pistons 16, 28 to move in direction of said chamber 26. The pressure air supply to the receiver 1 is cut off by the valve body 17 abutting the valve seat 23, while the diaphragm 33 no longer activated is pressed away from the pipe opening 35 causing a pressure equilization of the receiver 1 through the holes 36 whereby the sand blasting process stops.

The three-way valve 41 is designed to connect the control chamber 26 to the control hose or to the atmosphere. The latter position resulting in immediate process stop. A pressure controlled safety valve may be connected to the control chamber so that when the pressure in the control chamber exceeds a predetermined level, said safety valve opens to the atmosphere and thereby stops the process as described above.

What we claim is:

1. A valve for remotely controlling the supply of a pressure media to a receiver comprising:
   - a valve casing containing a control chamber vented to the atmosphere via a bore,
   - a cover fixed to one end of the valve casing and fixed to a pipe leading to said receiver,
   - a first piston and a second piston, each contained within the valve casing, each having a piston head facing the control chamber, each piston head hav-

ing a surface area greater than a corresponding surface at the opposite end of each piston, the first piston opposite end positioned between a pressure entrance chamber, connected to said control chamber by a channel, and a pressure outlet chamber connected to said receiver, the second piston opposite end facing said cover and pipe, and

a flexible diaphragm positioned between said pipe and said second piston opposite end.

2. The valve according to claim **1** wherein said first and second pistons are coaxial, opposed pistons, the head of each piston constituting a wall of said control chamber.

3. The valve according to claim **1** wherein the first piston opposite end further comprises a conical valve body adapted to sealingly engage a valve seat positioned between said pressure entrance chamber and said pressure outlet chamber for preventing said pressure media from entering said receiver.

4. The valve according to claim **1** wherein said channel connecting said pressure entrance chamber to said control chamber is regulated with regard to flow area by an adjustable screw.

5. A valve according to claim **1** wherein said cover contains a plurality of holes circumferentially surrounding said pipe.

6. A valve according to claim **1** wherein the periphery of said flexible diaphragm is fixed between said cover and said valve casing and a central portion of said flexible diaphragm is urged to abut and seal said pipe by said second piston opposite end.

7. A valve according to claim **1** further comprising a three-way valve connected to said control chamber via said bore, said three-way valve adapteed to be in a first position connected directly to the surrounding atmosphere, in a second position connected to a hose with a controlling button valve and in a third position connected to a pressure controlled safety valve.

8. A valve according to claim **7** wherein the head of the second piston has an area of about 10 times that of the opposite end thereof, and that the pressure medium to the control chamber is supplied from a pressure stabilized supply source and is without connection to the supply inlet for the regulated pressure medium, and that, besides the controlling button valve, there is a regulating valve for the exhaust of the controlling medium to the atmosphere, and furthermore the system is dimensioned in such a way that a constant static pressure of a magnitude of 10 to 100 per cent of the regulated pressure of the medium is maintained in the control chamber.

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