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VALVES FOR DESICCANT DRYERS.

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Description

This invention relates to a valve for directing gas in a compressed gas desiccant dryer system having two desiccant beds according to the pre-amble portion of patent claim 1.

Generally, this invention relates to valves used to control the flow of fluids, and, more particularly, to valves used in compressed gas desiccant dryer systems.

As is easily appreciated, there are many uses for compressed gas which are better performed if the gas is clean and dry. For example, moist air used in conjunction with pneumatic instruments, controls and tools can cause corrosion and malfunction; or if moist air is used when spraying paints and coatings, surface blemishes may result. In such applications, it is well known to utilize compressed air drying systems comprising two beds of a desiccant material. One bed absorbs moisture from the compressed gas at operating pressure, while the other bed is in a regeneration phase, usually at atmospheric pressure. The size of the pipe used in high capacity drying systems can be 7.6 cm or more in diameter, with rotating plug-type and ball-type valves being widely used in conjunction with such large drying systems. It will be appreciated that such valves must be quite bulky and expensive to accommodate the flow without undue pressure drops and also require proportionately large and expensive actuators. In addition, the severe conditions, which range from moist, inlet air to very dry and possibly dusty purge and effluent air, have been found to adversely affect the life and operation of such valves.

A valve of the general type of this invention and comprising the elements referred to in the pre-amble portion of claim 1 is already known from US—A—3 102 553. However, in this known valve the cylindrical chamber defined within the support is not isolated from the compressed gas. Rather, according to this document the cylindrical support member and the piston must co-act to define an isolated chamber. Further, the piston constitutes a sliding end wall of said chamber. Consequently, the piston is always disposed at the end of the isolated chamber and is never within the same.

Further, US—A—2 759 699 discloses an anti-back flow motor valve, comprising a cylindrical chamber within a support. However, in this known valve the chamber and its associated piston again are not isolated from the compressed gas, because both the chamber and the piston communicate with the compressed gas via an axial opening in a valve stem on which said piston is mounted. Similarly, US—A—4 014 510 and US—A—3 301 274, also generally relating to the present field of the art do not disclose any isolated cylindrical chamber or chambers according to the inventive solution.

Proceeding on the basis of the prior art according to US—A—3 102 553 it is the object of the present invention to provide improved valves specifically designed for use in desiccant drying systems and being less bulky and expensive.

This object according to the invention is accomplished by means of a valve which, in addition to the features of the pre-characterizing clause of claim 1, comprises the features of the characterizing clause of said claim 1.

It is an advantage of the inventive valve to provide a basis for a family of valves for use in desiccant drying systems wherein each of the different types of valves utilizes common or similar components.

Other objects and advantages of the invention will become apparent upon reading the following detailed description and upon reference to the drawings, in which:

Fig. 1 is a schematic view of a desiccant dryer system in which the valves of the present invention may be utilized;

Fig. 2 is a cross-sectional view of a two-way valve embodying the present invention for use in the drying system of Fig. 1;

Fig. 3 is an end view of the two-way valve of Fig. 2;

Fig. 4 is a view of the poppet edge enlarged to show detail;

Fig. 5 is a cross-sectional view of a three-way valve;

Fig. 6 is an end view of the three-way valve of Fig. 4;

Fig. 7 is a cross-sectional view of an alternate embodiment of a two-way valve;

Fig. 8 is an end view of an alternate embodiment of a three-way valve;

Fig. 9 is an offset sectional view taken substantially along line 9—9 in Fig. 8; and

Fig. 10 is a view of a piston edge enlarged to show detail.

While the invention will be described in connection with certain preferred embodiments, it will be understood that it is not intended to limit the invention to these embodiments. On the contrary, it is intended to cover all alternatives, modifications and equivalents as may be included within the spirit and scope of the invention as defined by the appended claims.

Turning now to Figure 1, there is shown a schematic diagram of an internal heat reactivated compressed air desiccant dryer in which the valves of the instant invention may be utilized. This specific type of dryer has been chosen for illustrative purposes only inasmuch as the valves of the present invention may be advantageously employed with virtually any type of large dryer, including heaterless, external heat reactivated and closed loop systems.

In operation, in the portion of the cycle illustrated in which the left chamber LC is drying and the right chamber RC is being regenerated, wet compressed gas is admitted into the inlet and directed downward through V1, a three-way valve, toward the left chamber LC, which contains desiccant such as activated alumina or silica gel. The wet gas contacts the desiccant and gas drying takes place by the well known adsorption process.
In the system shown, the drying cycle continues until a predetermined moisture loading of the desiccant is attained, as determined, for example, through the use of a capacitance probe.

Drying gas exits the left chamber and passes through three-way valve V2 to the outlet and continues to the application or work area. At the outlet, a portion of the pressurized dried gas is tapped off as purge gas for regeneration purposes. This purge gas is returned to the depressurized regenerating right chamber RC through orifices O1 and O2 and a dual check valve V3. In the illustrated cycle, the dried gas passes through V3 to the right desiccant chamber RC, which has been loaded with moisture in a previous cycle, to regenerate the desiccant. It will be appreciated that this gas flow results as a consequence of the right chamber RC having been depressurized from operating pressure to atmospheric pressure at the beginning of the regeneration cycle by two-way valve V4. The depressurization gas and the purge gas are exhausted to atmosphere through the open valve V4 and the orifice O3.

When regeneration is complete, the right chamber is repressurized to full operating pressure by closing the two-way valve V4. Gas continues to flow into the chamber until the pressure rises to system pressure. Inlet gas is then switched over to flow through three-way valve V1 to the right chamber to perform the right-chamber-drying/left-chamber-regenerating portion of the cycle which mirrors the portion of the cycle shown.

Such a drying system requires several types of flow control valves. In the embodiment of Fig. 1, these are three-way valves V1 and V2, check valve V3 and two-way valves V4 and V5. According to the present invention, a pneumatically controlled valve of each of these types has been specially designed for use in dryers, with each of the valves being similar in construction to one another. For example, each of the three valves utilizes standard industrial grade pipe sections and fittings for the basic valve housing. These pipe sections require only limited machining to adapt them as valve components. Each valve employs a common oversized flange at its openings to provide an interface between the valve housing and the drying system. The flanges are secured to the valve housing by tie rods which allow relatively quick and easy breakdown of the valve for servicing and maintenance.

Similar internal components including movable discs or poppets carried by axial rods are used in each of the valves. The poppets cooperate with annular seats to create face-to-face, rather than circumferential seals. Thus, no lubricant is needed between the disc and seat members. In general, these and other features of the inventive valves discussed below result in valves which are not only longer lived and easier to maintain and service than the predecessor valves, but are also economical to manufacture.

Turning to Figs. 2 and 3, the two-way valve 10 has a valve housing 12 constructed of a hollow cylindrical member, such as a section of pipe, having flanges 13, 14 held on the opposite open ends by means of tie rod assemblies shown as items 15. Gaskets 15 between the ends of the housing 12 and the flanges 13 and 14 create a seal between the members. The housing 12 is shown with an inside diameter of somewhat greater than inside diameter of the pipe of the drying system into which the valve is incorporated. For example, a section of 10 cm pipe might be employed for a valve which is to be incorporated into a 7.6 cm line. As best seen in Fig. 3, the flanges 13, 14 are generally square in configuration, with the "corners" allowing the tie rods 16 to be spaced sufficiently far apart to allow the valve 10 to mate with standard pipe flanges (shown in phantom in Figs. 2 and 3). It will be appreciated that this arrangement permits the valve to be slidably inserted or removed from the drying system through removal of only one of the four tie rods 16.

Flanges 13, 14 have central openings 18 and 19, respectively, to allow for the passage of gas therethrough. Flange 14 further has a seat 20 disposed therein. In the embodiment shown the seat 20 is threaded into the flange 14. The seat 20 may be provided with holes 22 to facilitate installation with a spanner wrench. The seat extends inwardly of the flange 14 and has a bore therethrough of substantially the same size as the inside diameter of the pipe with which the valve is designed to mate. A rod 23 is axially aligned with the seat 20 and has secured thereto a disc-like sealing member 24. The rod 23 is movable so that the face of the sealing disc 24 can be moved into and out of contact with the inwardly-directed face edge 25 of the seat 20. In the position shown the disc 24 is in contact with the face 25, thereby "closing" the valve. With the disc 24 spaced from the seat 20 (as shown in phantom) the gas is free to pass between the annular opening 26 created between the periphery of the disc and the internal wall of the housing. In order to avoid either excessive pressure drops or excessive expansion, the housing 12 and disc 24 should be sized such that the cross-sectional area of the annular opening 26 approximates that of the seat 20 and the pipe with which the valve 10 is used. In the embodiment shown the inside diameter of the seat 20 decreases slightly at the face 25 to permit the use of a smaller disc 24, to permit the use of a smaller diameter housing 12 that might otherwise be required.

The face of the sealing disc 24 may be provided with a resilient sealing material, such as the O-ring 28 illustrated, to insure positive sealing contact between the disc 24 and the seat 20. In the embodiment shown the O-ring is held in place in an annular groove machined into the face of the disc 24. As illustrated in Fig. 4, if the groove is formed sufficiently close to the edge of the disc 24 the resultant annular lip 29 may be deformed inwardly, with the O-ring 28 in place, as with a spinning operation, to "dove-tail" it in the groove. Other sealing systems might be employed,
including fixing a resilient material to the face 25 of the seat 20.

As illustrated in Fig. 2, a support subassembly 30 is comprised of a main body 32 with an axial bore into which end caps 33 and 34 are sealed and secured with O-rings and snap rings (except these O-rings and snap rings, along with others noted below, are shown but not specifically identified in the Figures. In addition, a partition 35 is sealed and secured centrally in the bore. End cap 33 is blind, while both end cap 34 and partition 35 have axial bores through which the rod 23 passes. O-rings at the bores of both the partition 34 and the end cap 35 create sliding seals. Pistons 36 and 38 are shown sealed and secured to the rod, one on each side of the partition 35. O-rings at the outer peripheries of the pistons 36 and 38 slindingly seal against the bore in the support body 32. The pistons 36 and 38 are located diametrically opposite one another such that they may be selectively pneumatically driven in tandem to move the disc 24 between the position shown in solid lines and that shown in dotted lines in Fig. 2. The tandem operation is effected by interconnecting chamber 39 and 40 with a passageway 42 through the rod 23. Similarly a passageway 43 in the support subassembly body 32 interconnects chamber portions 44 and 45. In this regard plugs 46 and 48 are shown sealing off holes through the body 32 which is contemplated will be generated in forming the passageway 43.

According to an aspect of the present invention, in the embodiment shown as the same members 50 which secure the support subassembly 30 to the housing 12 also serve as the ports through which pneumatic control signals may be introduced into the chamber portions 39 and 40, on the one hand, and chamber portions 44 and 45, on the other hand. The upper ends 51 of the members 50 are externally threaded, while the lower ends 52 may have a square, hexagonal or other convenient cross section which accommodates direct tightening using a wrench. The transition section 53 between the upper threaded portion 51 and the lower portion 52 is shown to be conical, such that this surface can cooperate with mating recesses in the housing 12 to assure the proper orientation of the support subassembly 30 relative to the housing when the members 50 are tightened.

Internal threads 54 at the lower ends 52, accommodate the connection of pneumatic control lines (not shown), with axial bores 55 through the members 50 communicating with the respective pairs of chambers discussed above. O-rings 56 are provided to create a seal between the three pressure levels which might exist at this location at any given time; viz., the ambient pressure external to the valve, the system pressure of the gas surrounding the support subassembly 30, and the pneumatic control pressures supplied through the members 50.

The various components of the valve disclosed above should be made of materials which will resist corrosion and, where sliding contact occurs, have acceptably low coefficients of friction. Stainless steel has been found suitable for the seat 20, the rod 23, the disc 24, the end caps 33 and 34 and the pistons 36 and 38. The support body 32 may be made of Teflon*-coated carbon steel, with the Teflon serving the dual functions of protecting against corrosion and reducing the sliding friction of the piston O-rings along the pneumatic chamber bore. The rod 23 may also be Teflon-coated to minimize friction between its external surface and the O-rings of the end cap 34 and of the partition 35. In addition, a wiper 58 may be employed near the outer surface of the end cap 34 to wipe the rod 23 free of desiccant dust or other dirt and impurities which may be adhering to it as it is withdrawn into the support 30. It is noted that, while Viton* O-rings have been used successfully throughout in valves which have been tested to date, in those areas where the O-rings are in sliding contact with Teflon surfaces (e.g., at the peripheries of the pistons 36 and 38 and where the rod 23 passes through the end cap 34 and the partition 35), Teflon-impregnated O-rings may be utilized to further reduce friction and wear. Alternatively, a continuous Teflon glide ring 36a, urged outwardly from the periphery of the piston 36 into contact with the wall of the support body 32 by means of an elastomeric O-ring 36b, may be advantageously used (see Fig. 10).

*Teflon and Viton are Trade Marks of Du Pont

From the above discussion of the two-way valve 10 it will be appreciated that tandem piston arrangement effectively doubles the actuation force which a given pneumatic control signal would give as compared with the actuation force achievable with a single piston of the same size. With such an arrangement, for a given pneumatic control pressure, the size of the support subassembly 30 can be smaller relative to the size of the disc 24 than would be possible with a single stage system. For the purposes of illustration, the ratios of the sum of the areas of the pistons 36 and 38 to the area of the disc 24 for an actual valve of the type shown in Fig. 2 designed for use with 7.6 cm pipe has been calculated to be about 1.4:1. The corresponding ratios for similar series of valves designed for use with pipe sizes of 10 to 20 cm ranged between about 1.6:1 to 1.2:1. Given this range of ratios, it will be appreciated that the application of full system pressure as one pneumatic control signal, with the other signal at ambient pressure, will be sufficient to operate the valve with a full system pressure differential across the poppet. This, of course, is the pressure differential against which the valve must operate when employed as an exhaust valve V4 or V5 in Fig. 1. A control system particularly suited for the control of the valves of this present invention in the context of heatless dryers is disclosed in WO 84/02086. The pneumatic supply for such a control system may be tapped off from the outlet line, as shown in Fig. 1, wherein the pneumatic supply passes through shut-off valve V6 and filter F. The pneumatic control signals are shown...
returning to actuators A1, A2, A4 and A5 associated with valves V1, V2, V4 and V5, respectively. The control of valves three-way valves V1 and V2, as well as the absence of a control for V3, are discussed below.

As a final point, it will be appreciated that the two-way valve 10 discussed above may be used in either a "normally open" or a "normally closed" manner depending upon the orientation of the pressure drop across the valve. By way of illustration, if the valve, in the orientation shown in Fig. 2, were used in the position of V4 in Fig. 1, the port 18 would always be at or near ambient, with any pressure in the right chamber RC tending to open the valve. If, on the other hand, the valve 10 were used in the position of V5 in Fig. 1, without changing its orientation from that shown in Fig. 2, any pressure in the left chamber LC would tend to keep the valve closed. With such arrangement, as shown in Fig. 1, only one pneumatic control signal at the appropriate member 50 is required, with the other member 50 being vented to atmosphere.

Turning now to Figs. 5 and 6, a three-way valve 100 according to the invention and suitable for use at either the V1 or V2 location in Fig. 1 is shown. Components similar in configuration or function to components employed in the two-way valve 10 are assigned corresponding numbers in the 100-series. Except where otherwise noted, the construction and materials used may be the same as described above in conjunction with the two-way valve 10. As shown, the valve housing 112 is comprised of a standard tee-section 112a, to the branch of which is welded a conventional weld-neck flange 112b. A seal and poppet arrangement in the valve 100 differs from that of the two-way valve 10 described above primarily in that both the flange 113 and the flange 114 have a seat 120 disposed therein, with a rod 123 carrying a disc 124 at each end. In the embodiment shown a single piston 138 separating first and second isolated portions 139 and 144, respectively, of a cylindrical chamber is secured to the rod 123 at its midpoint and can be selectively driven back and forth with pneumatic signals at the members 150 to close off the opening through one or the other of seats 120. As with the two-way valve 10, a support 130 may be provided with wipers 158 in the end caps 134 wipe to prevent contaminants such as desiccant dust from the rod 123.

In the normal course of using the three-way valve 100 of the present invention in the V1 position of Fig. 1, significant pressure drops should not be present across either of the discs 124 at the time valve actuation occurs since both of the desiccant chambers LC and RC should be at or near full system pressure. Similarly, for the same reason in the normal course of using a three-way valve 100 in the V2 position of Fig. 1, significant pressure differentials should not be established across the discs 124. Accordingly, less pressure differential between the pneumatic control signals will be required to actuate the three-way valve 100 when used in either the V1 or V2 position than was the case with the two-way valve 10 described above when employed in either the V4 or V5 position.

Accordingly, a single-stage piston arrangement, as compared to the tandem arrangement of the two-way valve, may be employed. By way of illustration, a valve designed for use in 7.6 cm lines, which employs a 7.6 cm brace, 10 cm run, pipe section 112a, has been calculated to have a piston area to disc area ratio of about .35. The corresponding ratios for valves of similar design for use in lines ranging from 10 to 20 cm have been calculated to range between about .34 and .40. Accordingly, the use of full system pressure as one pneumatic control signal, with the other vented to atmosphere will be adequate to actuate the three-way valves throughout the range of contemplated operating conditions. WO 84/02086 cited above describes a control system suitable for use with heaterless dryers employing the three-way valves of the present invention. As shown schematically in Fig. 1, two pneumatic control signals are required from such a control system, one at each member 150. Inasmuch as valves V1 and V2 act in unison, the corresponding signals to the two valves can be tied together.

Turning now to Fig. 7, an alternative embodiment of a two-way valve 300 according to the invention is shown, with components similar in configuration or function to those valves described above being assigned corresponding 300-series members. In this embodiment, an L-shaped two-way valve is provided in which the support subassembly 330, which carries the sealing poppet 324, is secured to one of the flanges 313, rather than being attached directly to the pipe section 312, as is the case with the two-way valve 10 of Fig. 2. It will be appreciated that this arrangement not only permits a different piping configuration than that required for the valve of Fig. 2, but it also offers certain advantages in manufacturing. When the housing 312 of a large valve is rolled or cast rather than machined, as would typically be the case for larger size valves, the interior of the housing may be relatively rough. In order to properly seat a support subassembly, such as item 30 in Fig. 2, at least a portion of the interior of the housing might have to be machined to provide a smooth, sealable interface concentric with the valve seats. The embodiment of Fig. 7, avoids the need to machine the interior of the valve housing to assure proper alignment of the poppet 324 with the valve seat 320.

Describing the embodiment in Fig. 7 in more detail, the valve housing 312 comprises a standard tee-section 312a, defining an opening 318, to the branch of which is welded a conventional weld-neck flange 312b, with flanges 313, 314 held on opposite sides of the tee-section 312a by means of the rod assemblies 316. Gaskets 315 between the ends of the tee-section 312a and the flanges 313, 314 create a seal between the members. Flange 314 has a central opening 319 and further has a seat 320 disposed therein, while
flange 313 is a blind flange. Consequently, an L-shaped two-way valve is provided, with flow between the opening in the weld-neck 312b and the flange opening 313.

As shown in Fig. 7, the subassembly 330 is comprised of two cylindrical halves 332a, 332b having their axial bores aligned. End cap 334 seals the outer end of cylinder block 332b, while the flange 313 serves to seal the outer end of cylinder block 332a. The end cap 334 may be secured to the support subassembly 330 by means of bolts (not shown) which extend through both cylindrical halves 332a, 332b of the support subassembly 330 and thread into blind holes (not shown) in the flange 313. In this manner, the bolts also serve to securely support the subassembly to the flange. In practice, six of such bolts, received in equally-spaced countersunk holes in the end cap 334, have served to secure together the various components of the subassembly 330 and to adequately support the subassembly 330 within the valve 312. O-rings, not specifically identified, seal between the various components.

Referring again to Fig. 7, in the illustrated subassembly 330 the abutting edges of the cylindrical halves 332a and 332b are relieved at their inside diameters so as to form a seat for the partition 335, such that the partition 335 is sealingly secured in the bore of the support subassembly 330. Extending through central openings in both the partition 335 and the end cap 334 is the reciprocably moveable rod 323. As an alternative to the previously discussed embodiments, the rod 323 comprises two support shaft portions 323a, 323b secured together by a threaded stud shaft 323c. The rod 323 is held within the support subassembly 330 so as to be axially aligned with the seat 320 and has secured thereto the sealing poppet 324, moveable into and out of contact with the edge of the seat 320, and pistons 336, 338, located in the interior of the support subassembly 330 on opposite sides of the partition 335. Again, O-rings are employed throughout to seal between the various chambers.

In the previously described embodiments, the poppets were located and secured on the rod by means of snap rings which forced the poppets into abutting engagement with a shoulder on the end of the rod. As illustrated in Fig. 7, the sealing disc 324 is secured to support shaft 323b by means of a nut 327a threadably received on the end of the support shaft 323b. Previously, the pistons were located on and secured to the rod by sandwiching each piston between two snap rings. In the embodiment of Fig. 7, piston 336 is secured to the support shaft 323a by means of a nut 327b received on the end of the support shaft 323a, while the interior ends of the support shafts 323a, 323b locate the piston 338 on the stud shaft 323c. It will be appreciated that these threading methods of securing the poppets and pistons to the rod and holding them perpendicular may offer certain advantages over the snap ring, and mating groove system employed in the previous embodiments.

As with the Fig. 2 embodiment, the pistons 336, 338 in the Fig. 7 embodiment are spaced from one another in chambers on opposite sides of the partition 335 such that they may be selectively pneumatically driven in tandem to move the poppet 324 into and out of contact with the seat 320. To this end passage 337a serves to interconnect chambers 344 and 345, while the other passage 337b serves to interconnect chambers 339 and 340. The flange 313 has two ports 350 aligned with the passages 337b through which pneumatic control signals may be introduced into the chamber portions 339, 340 on the one hand, and chamber portions 344, 345 on the other hand.

Turning now to Figs. 8 and 9, an alternative embodiment of a three-way valve 400 according to the invention is shown, with components similar in configuration and function to the valves described above being assigned corresponding 400-series numbers. As illustrated, Fig. 9 is a multiplanar view taken along the section line B—B in Fig. 8, the section line having a 90° break at the centerline of the valve. As an alternative to the embodiment shown in Fig. 5, the three-way valve 400 shown in Figs. 8 and 9 has its support subassembly suspended on rods between the flanges. This arrangement is especially advantageous in the case of large valves, e.g., 20.3 to 30.5 cm (8 to 12) inches and even larger, since it obviates the need for the support subassembly to extend to and be affixed to the sidewall of the valve housing, as in Fig. 6.

As shown in Figs. 8 and 9, the support subassembly 430 is suspended within the valve housing 412 by means of support bars 470 which are secured to the end caps 434 of the subassembly 430 by means of screws 470a. The support bars 470 are, in turn, carried on rods 471 which are seated in blind holes 472 located on the interiors of flanges 413 and 414. To properly locate and orient the support bars 470, and thus the subassembly 430, within the valve housing 412 so that the sealing discs 424 will sealingly contact one of the seats 420 to cover one of the openings 418, 419 being provided in flanges 413 and 414, respectively, and allowing for the ingress and egress of compressed gas, each rod 471 carries three sleeve members 474. The sleeves 474 are sized in length so as to properly locate the support subassembly 430 along the length of the rods 471, with Belleville washers 475, located on the rods 471 in abutting contact with the ends of the sleeves 474 on opposite sides of the support bars 470, thus taking up any slack along the rods 471 between the sleeves 474 due to tolerance differences.

In the embodiment of Figs. 8 and 9, the support subassembly 430 defines a cylindrical chamber which is divided by a piston 436 into first and second isolated portions 437 and 444, respectively. The pneumatic signals for driving the piston 436 back and forth within the subassembly 430 are introduced through tubes 476 extending between fittings 450 at the valve housing 412 and fittings 480, located at any convenient exterior surface of the valve.
Claims

1. A valve (10, 100, 300, 400) for directing gas in a compressed gas desiccant dryer system having two desiccant beds (LC, RC) which are sequentially placed on stream so that one desiccant bed dries the compressed gas while the other desiccant bed is being regenerated wherein the valve includes a housing (12, 112, 312, 412) having at least two openings (18, 19; 118, 119; 318, 319; 418, 419) to allow for the ingress and egress of compressed gas and a seat (20, 120, 320, 420) for at least one of the openings and integral therewith, wherein the valve includes a support (30, 130, 330, 430) with a cylindrical chamber (39, 40; 139; 339, 340; 439) being defined within said support secured within the interior of the housing, and wherein the valve includes an assembly including a piston (36, 38; 136; 336, 338; 436), a rod (23, 123, 323, 423) which is mounted to the piston and is slidably carried by the support so as to be axially aligned with the seat, and at least one disc-like sealing member (124, 124; 324, 424) which is sized larger than the passageway through the support and is disposed on the rod and moveable with respect to the seat between sealing face-to-face contact therewith to prevent flow of gas through the passageway and sufficient distance away from the seat to allow substantially unimpeded flow of gas through the valve, said valve being characterized by said cylindrical chamber (39, 40; 139; 339, 340; 439) being defined within the support being isolated from the compressed gas, the piston being slidably positioned within the isolated cylindrical chamber so as to be isolated from the compressed gas and so as to define a first isolated portion (39, 40; 139; 339, 340; 439) of the chamber on one side thereof and a second isolated portion (44, 45; 144; 344, 345; 444) of the chamber on the other side thereof, and means (42, 43, 50; 150; 350; 480, 476, 450) communicating with each isolated cylindrical chamber portion for introducing fluid to and exhausting fluid from the first and second isolated chamber portions so that, as pressurized fluid is selectively admitted into one isolated chamber portion and exhausted from the other, the piston, rod, and sealing member are selectively moved into the sealing and flow-through positions.

2. The valve of claim 1 wherein the number of openings (18, 19) is two and the number of seats (20) and sealing members (24) is one.

3. The valve of claim 2 wherein the support (30) further comprises a second chamber (39, 40) concentric with the rod (23) and wherein the assembly further comprises a second piston (36, 38) mounted to the rod (23) and slidably positioned within the second chamber (39, 40) of the support (30), the second piston (36, 38) isolating a first portion (39, 40; 139; 339, 340; 439) of the second chamber (39, 40) on one side of the second piston (36, 38) and a second portion (44, 45; 144; 344; 345; 444) of the second chamber (39, 40) on the other side of the second piston (36, 38); the valve further comprising means (42, 43, 50) communicating with each second chamber portion (44, 45; 144; 344; 345; 444) for introducing and exhausting fluid from the second chamber portions, so that as pressurized fluid is simultaneously selectively admitted into one chamber portion of both chambers and exhausted from the other portion of both chambers, the pistons (36, 38), rod (23) and sealing member (24) are selectively moved into the sealing and flow-through positions.

4. The valve of claim 1 wherein the number of openings (118, 119) is three and the number of seats (120) and sealing members (124) is two, the seats (120) being axially aligned; the rod (123) being sized to extend through both sides of the support (130) with a sealing member (124) disposed on each end thereof, so that when one sealing member (124) and seat (120) are engaged to prevent flow of compressed gas through one of the openings (118, 119), flow is permitted through the housing (112) through the seat (124) of the other opening (118, 119).

5. The valve of claim 1 wherein a wiper (58; 158) is disposed on the support (30; 130) at the point where it is penetrated by the rod (23; 123) to wipe the rod free of contaminants as it is withdrawn into the support.

6. The valve of claim 1 wherein the housing further comprises flanges (13, 14; 113, 114) at each end, the flanges being removably held in place by tie rods (16; 116) located exterior of the valve housing (12; 112).

7. The valve of claim 1 wherein the means for securing the support within the interior of the valve housing includes threaded members insertable through the valve housing and removable from the exterior of the valve housing.

8. The valve of claim 1 wherein the support is secured to the interior of the valve housing with threaded members insertable through the valve housing and removable from the exterior of the valve housing, the threaded members further comprising the communicating means.

9. The valve of claim 1 wherein the means for securing the support within the interior of the valve housing includes rods (471) located interior of the valve housing (412).

10. The valve of claim 2 wherein the housing (312) is tee shaped and further comprises flanges (313, 314) at opposite ends of the cross of the tee, the flanges being removably held in place by tie rods (316) located exterior of the valve housing, and the support (330) is secured to the interior of the valve housing (312) on one of the flanges (313) thus forming an L-shaped flow path.

Patentansprüche

1. Ventil (10, 100, 300, 400) zum Lenken von Gas in einem dem Trocknen von komprimiertem Gas dienenden Trocknungsmittel-Trocknungs- mit zwei Trocknungsmittelbetten (LC, RC) welcher nacheinander derart in die Strömung eingebracht werden, daß ein Trocknungsmittelbett das kom-
primierte Gas trocknet, während das andere Trocknungsmittelbett regeneriert wird, wobei das Ventil ein Gehäuse (12, 112, 312, 412) mit mindestens zwei Öffnungen (18, 19, 118, 119, 318, 319; 418, 419) umfaßt, um das Eintreten und Austreten von Gas zu ermöglichen, sowie einen Sitz (20, 120, 320, 420) für mindestens eine der Öffnungen und einstündig mit derselben, wobei das Ventil eine in dem Inneren des Gehäuses gesicherte Halterung (30, 130, 330, 430) mit einer zylindri-
scben Kammer (39, 40; 139; 339, 340; 439) umfaßt, die in der Halterung definiert ist, und wobei das Ventil eine Anordnung umfaßt, die einen Kolben (36, 38; 136; 336, 338; 436), eine Stange (23, 123, 323, 423), welche an dem Kolben montiert ist und von der Halterung derart gleitver-
vorsprechend gehalten wird, daß sie bezüglich des Sitzes axial ausgerichtet wird, sowie mindestens ein einebenförmiges Dichtungselement (24, 124, 324, 424) umfaßt, welches größer dimensioniert ist als der Durchlaß durch den Sitz und welches auf der Stange angeordnet und bezüglich des Sitzes beweglich ist zwischen einem dichtenden Kontakt, bei dem es mit seiner Stirnfläche an der Stirnfläche des Sitzes anliegt, um eine Gasström-
ung durch den Durchlaß zu verhindern, und einem ausreichenden Abstand von dem Sitz, um eine ungehinderte Gasströmung durch das Ventil zu ermöglichen, wobei das Ventil dadurch gekennzeichnet ist, daß die zylindrische Kammer (39, 40; 139; 339, 340; 439), die innerhalb der Halterung definiert ist, gegenüber dem komprimierten Gas isoliert ist, wobei der Kolben derart gleitverschieden in der isolierten Kammer ange-
ornt ist, daß er gegenüber dem komprimierten Gas isoliert ist und einen ersten isolierten Teil (39, 40; 139; 339, 340; 439) der Kammer auf seiner einen Seite von einem zweiten isolierten Teil (44, 45; 144, 344, 345, 444) der Kammer auf seiner anderen Seite isoliert und wobei mit jedem isolierten Teile der zylindrischen Kammer Mittel (42, 43, 50; 150; 350; 480, 476, 450) kommunizie-
ren, um dem ersten und dem zweiten isolierten Kammerteil ein Fluid zuzuführen bzw. ein Fluid aus diesen abzulassen, so daß der Kolben, die Stange und das Dichtungselement selektiv in die 
Dichtungposition und die Durchlaßposition bewegt werden, wenn das unter Druck stehende Fluid selektiv einem der isolierten Teile der Kam-
er zugeführt und aus dem anderen abgelassen wird.

2. Ventil nach Anspruch 1, bei dem die Anzahl der Öffnungen (18, 19) zwei ist und die Anzahl der Sitze (20) und der Dichtungselemente (24) eins ist.

3. Ventil nach Anspruch 2, bei dem die Halte-
 rung (30) ferner eine zu der Stange (23) konzentri-
esche zweite Kammer (39, 40) umfaßt und bei dem die Anordnung ferner einen zweiten, an der Stange (23) montierten Kolben (36, 38) umfaßt, der gleitverschieden in der zweiten Kammer (39, 40) der Halterung (30) angeordnet ist, wobei der zweite Kolben (36, 38) einen ersten Teil (39, 40; 139; 339, 340; 439) der zweiten Kammer (39, 40) auf einer Seite des zweiten Kolbens (36, 38) gegenüber einem zweiten Teil (44, 45; 144; 344; 345; 444) der zweiten Kammer (39, 40) auf der anderen Seite des zweiten Kolbens (36, 38) iso-
liert, wobei das Ventil ferner Mittel (42, 43, 50) umfaßt, die mit jedem der Teile (44, 45; 144; 344; 345; 444) der zweiten Kammer kommunizieren, um den Teilen der zweiten Kammer ein Fluid zuzuführen bzw. um ein Fluid aus diesen abzu-
lassen, derart, daß dann, wenn das unter Druck stehende Fluid gleichzeitig selektiv einem der Teile beider Kammern zugeführt wird und aus dem anderen Teil beider Kammern abgelassen wird, die Kolben (36, 38), die Stange (23) und das Dichtungselement (24) selektiv in die Dichtungs-
position und die Durchlaßposition bewegt werden.

4. Ventil nach Anspruch 1, bei dem die Anzahl der Öffnungen (118, 119) drei beträgt und die Anzahl der Sitze (120) und der Dichtungselemente (124) zwei beträgt, wobei die Stange (120) axial fluchtend angeordnet sind; bei dem die Stange (123) so bemessen ist, daß sie sich durch beide Seiten der Halterung (130) hindurch erstreckt, wobei ein Dichtungselement (124) an jedem ihrer Enden angeordnet ist, so daß dann, wenn ein Dichtungselement (124) und ein Sitz (120) in Eingriff miteinander stehen, um das Hindurch-
strömen von komprimiertem Gas durch eine der Öffnungen (118, 119) zu verhindern, eine Strö-
mung durch das Gehäuse (112) durch den Sitz (124) der anderen Öffnung (118, 119) ermöglicht wird.

5. Ventil nach Anspruch 1, bei dem an der Halterung (30; 130) an dem Punkt, an der sie von der Stange (23; 123) durchstoßen wird, ein Abstreifer (58; 158) angeordnet ist, um Ver-
schmutzungen von der Stange abzuwischen, wenn diese in die Halterung abgezogen wird.

6. Ventil nach Anspruch 1, bei dem das Gehäuse ferner an jedem Ende Flansche (13, 14; 113, 114) umfaßt, wobei die Flansche mittels Spannstangen (16; 116) in ihrer Position gehalten werden, die außerhalb des Ventilgehäuses (12; 112) angeordnet sind.

7. Ventil nach Anspruch 1, bei dem die Mittel zum Sichern der Halterung ineinander des Ventil-
gehäuses Gewindelemente umfassen, welche durch das Ventilgehäuse hindurch einsetzbar und von der Außenseite des Ventilgehäuses her ent-
fernbar sind.

8. Ventil nach Anspruch 1, bei dem die Halte-
rungein den Inneren des Gehäuses mittels Gewindevor-
lenen gesichert ist, die durch das Ventilgehä-
ähne hindurch einsetzbar und von der Außen-
seite des Ventilgehäuses her entfernt sind, wobei die Gewindelemente ferner die Mittel zum Kommunizieren (Zuführen und Ablassen von Fluid) umfassen.

9. Ventil nach Anspruch 1, bei dem die Mittel zum Sichern der Halterung im Inneren des Ventil-
gehäuses Stangen (471) umfassen, die im Inneren des Ventilgehäuses (412) angeordnet sind.

10. Ventil nach Anspruch 2, bei dem das Gehäuse (312) T-förmig ausgebildet ist und ferner an gegenüber liegenden Enden des Quer balkens des "T" Flansche (313, 314) umfaßt, wobei die
Flansche durch Spannringen (316), die auf der Außenseite des Ventilgehäuses angeordnet sind, lösbar in ihrer Lage gehalten werden und wobei die Halterung (330) bezüglich des Inneren des Ventilgehäuses (312) an einem der Flansche (313) gesichert ist und somit einen L-förmigen Stützungspfad bildet.

Revendications

1. Vanne (10, 100, 300, 400) pour diriger du gaz dans un système de séchage du type à desséchant et à gaz comprimé comportant deux lits de desséchant (LC, RC), qui sont placés successivement lors de la mise en service de manière à ce qu'un lit de desséchant sèche le gaz comprimé tandis que l'autre lit de desséchant est en cours de régénération, qui comprend une carter (12, 112, 312, 412) comportant au moins deux ouvertures (18, 19; 118, 119; 318, 319; 418, 419) pour permettre l'entrée et la sortie de gaz comprimé et un siège (20, 120, 320, 420) pour au moins l'une des ouvertures et solidaire de celle-ci, et qui comprend un support (30, 130, 330, 430) avec une chambre cylindrique (39, 40; 139; 339, 340; 439) définie à l'intérieur de ce support, fixé à l'intérieur du carter, et qui comprend un assemblage comportant un piston (36, 38; 136; 336, 338; 436), une tige (23, 123, 323, 423) qui est fixée au piston et supportée de façon coulissante par le support de manière à être dans l'alignement axial du siège, et au moins un organe de scellage en forme de disque (24, 124, 324, 424) qui est de taille plus grande que le passage dans le siège et qui est agencé sur la tige et peut se déplacer par rapport au siège entre un contact face à face de scellage avec celui-ci pour emprêcher la circulation du gaz dans le passage et une distance suffisante du siège pour permettre une circulation de gaz essentiellement non perturbée à travers la vanne, cette vanne étant caractérisée en ce que la chambre cylindrique (39, 40; 139; 339, 340; 439) est définie à l'intérieur du support isolé du gaz comprimé, le piston étant positionné de façon coulissante à l'intérieur de la chambre cylindrique isolée de manière à être isolé du gaz comprimé et de manière à définir une première partie isolée (39, 40; 139; 339, 340; 439) de la chambre d'un côté de celle-ci et une seconde partie isolée (44, 45; 144, 344, 345; 444) de la chambre de l'autre côté de celle-ci, et des moyens (42, 43, 50; 150; 350; 480, 476, 450) communiquant avec chaque partie de chambre cylindrique isolée pour l'introductio de fluide et l'évacuation de fluide des première et seconde parties de chambre isolées de telle sorte que, lorsque du gaz pressurisé est admis sélectivement dans une partie de chambre isolée et évacué de l'autre, le piston, la tige et l'organe de scellage soient sélectivement déplacés dans les positions de scellage et de circulation.

2. Vanne suivant la revendication 1, caractérisée en ce que le nombre d'ouvertures (18, 19) est de deux et le nombre de sièges (20) et d'organes de scellage (24) est de un.

3. Vanne suivant la revendication 2, caractérisée en ce que le support (30) comprend en outre une seconde chambre (39, 40) concentrique à la tige (23) et en ce que l'assemblage comprend en outre un second piston (36, 38) fixé à la tige (23) et positionné de façon coulissante dans la seconde chambre (39, 40) du support (30), le second piston (36, 38) isolant une première partie (39, 40; 139; 339, 340; 439) de la seconde chambre (39, 40) d'un côté du second piston (36, 38) et une seconde partie (44, 45; 144; 344; 345; 444) de la seconde chambre (39, 40) de l'autre côté du second piston (36, 38), la vanne comprenant en outre des moyens (42, 43, 50) communiquant avec chaque seconde partie de chambre (44, 45; 144; 344; 345; 444) pour l'introduction et l'évacuation de fluide des secondes parties de chambre, de telle sorte que lorsque du fluide pressurisé est simultanément et sélectivement admis dans une partie de chambre des deux chambres et évacué de l'autre partie des deux chambres, les pistons (36, 38), la tige (23) et l'organe de scellage (24) soient sélectivement amenés dans les positions de scellage et de circulation.

4. Vanne suivant la revendication 1, caractérisée en ce que le nombre d'ouvertures (118, 119) est de trois et le nombre de sièges (120) et d'organes de scellage (124) est de deux, les sièges (120) étant alignés axialement, la tige (123) étant dimensionnée de manière à s'étendre des deux côtés du support (130) avec un organe de scellage (124) disposé à chaque extrémité de celui-ci, de telle sorte que lorsqu'un organe de scellage (124) et un siège (120) sont engagés pour empêcher la circulation du gaz comprimé par l'une des ouvertures (118, 119), la circulation est permise dans le carter (112) par le siège (124) de l'autre ouverture (118, 119).

5. Vanne suivant la revendication 1, caractérisée en ce qu'un essuyeur (58; 158) est disposé sur le support (30; 130) à l'emplacement où il est pénétré par la tige (23; 123) pour essuyer la tige et la dégager de toutes souillures lorsqu'elle est extraite dans le support.

6. Vanne suivant la revendication 1, caractérisée en ce que le carter comprend en outre des brides (13, 14; 113, 114) à chaque extrémité, les brides étant maintenues en place de façon amovible par des tiges de fixation (16; 116) disposées à l'extérieur du carter de vanne (12; 112).

7. Vanne suivant la revendication 1, caractérisée en ce que les moyens pour fixer le support à l'intérieur du carter de vanne comprennent des organes filetés insérables dans le carter de vanne et enlevables de l'extérieur du carter de vanne.

8. Vanne suivant la revendication 1, caractérisée en ce que le support est fixé à l'intérieur du carter de vanne par des organes filetés insérables dans le carter de vanne et enlevables de l'extérieur du carter de vanne, les organes filetés comprenant en outre les moyens de communication.

9. Vanne suivant la revendication 1, caractérisée en ce que les moyens pour fixer le support à l'intérieur du carter de vanne comprennent des...
tiges (471) disposées à l'intérieur du carter de vanne (412).

10. Vanne suivant la revendication 2, caractérisée en ce que le carter (312) est en forme de té et comprend en outre des brides (313, 314) à des extrémités opposées de la croix du té, les brides étant maintenues en place de façon amovible par des tiges de fixation (316) agencées à l'extérieur du carter de vanne, et le support (330) est fixé à l'intérieur du carter de vanne (312) sur l'une des brides (313), en formant ainsi un chemin de circulation en forme de L.