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The invention relates to a compressor valve, comprising a valve seating, a catcher and an annular or plate-shaped closure member which is arranged displaceably therebetween and controls through ducts in the valve seating and which is acted upon by closure springs in the direction towards the valve seating and has associated therewith a lifting device acting upon the closure member by lifting fingers through the valve seating, wherein a stop plate is arranged in the valve between the closure member and the catcher, the stop plate being held securely by at least one spring on a stop provided at a distance from the valve seating.

Plate valves having a lifting device of the type described are known in various designs. In this case, the purpose of the lifting device is to keep the valve open against the closure forces acting upon the closure member, so as thereby to regulate the quantity conveyed or to switch the compressor to idling. In the case of the known designs the lifting device comprises a lifting gripper which acts upon the closure member with lifting fingers through the throughflow ducts of the valve seating and is actuated by a setting device which can be driven pneumatically or hydraulically for example.

The lifting fingers of the lifting gripper constrict the free through cross-section of the valve seating in the throughflow ducts of the valve seating, this being disadvantageous in the supply of the compressor and increasing the throughflow resistance thereof. Furthermore, the closure member is additionally stressed mechanically by the gripper, which acts upon the closure member with the gripping fingers at points at a distance from one another. It is therefore generally necessary to make the closure plate thicker than in the case of non-regulated valves in order to prevent deformation by the frequently high closure forces which occur during the reverse flow of the medium, and to withstand the bending stresses which arise.

The disadvantages indicated occur particularly when the closure member of the valve consists of plastics material, for example a plastics plate with slots, since, as is known, plastics material has a lower bending resistance than steel which is otherwise used for the valve parts. In order to avoid excessive stresses of closure members of plastics material it is also known to provide the lifting grippers with more lifting fingers. This, however, results in a further increase in the drawbacks, in particular a corresponding rise in the cost of the lifting grippers and a considerable increase in the throughflow resistance of the valve.

The object of the invention is to improve the previously known valves with a lifting device in such a way that, without it being necessary to increase the number of lifting fingers, the mechanical stressing of the closure member is not increased in a detrimental manner while the valve is forcibly kept open.

This object is attained according to the invention in that the force of the springs pressing the stop plate against the stop is greater than the forces of flow acting upon the closure member in the opening direction, and the stop plate can be displaced towards the catcher by means of the lifting device against the force of the springs acting upon it and can be pressed against the said catcher. In contrast to the damper plates which have long been known in valve design and which are acted upon by their own springs and have the task of catching the closure plate during the opening movement thereof before striking resiliently against the catcher and of braking the movement thereof, the stop plate provided according to the invention in fact forms an end stop for the closure member. When the lifting device is switched off, the closure member performs the reciprocating movement thereof merely between the valve seating and the stop plate. The spring force, which is selected to be of suitable magnitude and which acts upon the stop plate, prevents the stop plate from being moved towards the catcher to an appreciable degree during the normal operation of the valve under full load. If the lifting device is activated, in order to change the compressor to idling for example, the lifting device first presses the closure member against the force of the closure springs onto the stop plate and then pushes the closure plate together with the stop plate against the catcher.

In this way, in the case of the valve according to the invention the stroke of the closure member is increased by the length of the displacement path of the stop plate during idling. This results in a corresponding increase in the throughflow cross-section of the valve in the region of the closure member, so that the flow velocity of the controlled medium in the valve is reduced accordingly. The forces of flow acting upon the closure member, which are known to increase sharply with the flow velocity, are likewise correspondingly small. The closure member is therefore subjected to only slight stresses as a whole, so that, even when it consists of a less strong material, for example plastics material, only a small number of lifting fingers is required.

In a preferred embodiment of the invention at least part of the closure springs acting upon the closure member are supported on the stop plate. In this way, closure springs are provided which act upon the closure member and which are guided and supported on the stop plate as in the case of valves with a conventional catcher, as well as additional stronger springs which hold the stop plate on its stop against the force of the closure springs. Within

the scope of the invention this stop can also comprise a plurality of parts or a plurality of stops for the stop plate can be provided, for example in the centre of the valve, in the peripheral region of the stop plate or in the region lying therebetween.

In the case of a further embodiment of the invention it is provided that the closure springs are supported at least in part on the catcher and act upon the closure member through openings in the stop plate. With this design, closure springs supported on the stop plate are superfluous.

The closure springs can be guided in the stop plate. It is then unnecessary to have a guide in the catcher, in which case chafing of the springs with their external diameters in the nests of springs in the catcher is avoided when helical springs are used. In this case an advantageous design consists in that the springs act upon a respective guide pin, which is guided so as to slide in a bore in the stop plate. This pin transmits the spring force to the closure member.

A further substantial advantage of the design according to the invention is that no uncontrolled impact forces are exerted upon the catcher, which can therefore be made considerably thinner and weaker than in the case of conventional valves. The arrangement according to the invention can be used advantageously both in valves with a so-called safety catcher and in designs with a self-supporting catcher. Warping of the closure member is likewise prevented, which is particularly important when it is constructed in the form of a plate.

Further details and advantages of the invention may be seen in the following description of embodiments which are illustrated in the drawing, in which

Fig. 1 is an axial median section through a compressor valve according to the invention with a lifting device;

Fig. 2 is a median section corresponding thereto through another embodiment of the valve according to the invention, and

Fig. 3 is a detail of a further variant.

In all the embodiments the compressor valve according to the invention comprises a valve seating 1 which is provided with through ducts 2 for the medium conveyed by the compressor, the through ducts 2 being controlled by a plate-shaped closure member 3. The valve seating 1 has associated therewith a catcher 4, which is connected to the valve seating 1 by a central bolt 5. A spacer ring 6, through which the central bolt 5 passes, holds the

catcher 4 at a distance from the valve seating 1. Through ducts 7 for the controlled medium are provided in the catcher.

Between the closure member 3 and the catcher 4 a stop plate 8 is guided in the valve so as to be displaceable in the reciprocating direction of the closure member 3. The stop plate 8 is acted upon in the direction towards the valve seating 1 by springs 9 which are supported in nests of springs of the catcher 4. The stop plate 8 is held at a distance from the valve seating 1 by its own stops 10, so that the closure member 3 can perform its reciprocating movement. In the normal operation of the valve the stop plate 8 forms the end stop for the reciprocating movement of the closure member 3. In addition, closure springs 11, which act upon the closure member 3 and can comprise spring plates or helical springs in a manner known *per se*, are supported on the stop plate 8. Damper plates, support-arm plates and other fittings customary in valves can also be provided.

A lifting device 12, which acts upon the closure member 3 by lifting fingers 13 through the through ducts 2 of the valve seat, is associated with the valve illustrated. The lifting device 12 is centred on the central bolt 5 in a conventional manner and in the embodiment according to Fig. 1 is actuated by a pneumatic or hydraulic setting device 14 with a diaphragm. A restoring spring for the lifting device 12 is designated 15.

In the embodiment according to Fig. 1, the closure springs 11 comprise one or more plates which are supported on the stop plate 8, possibly together with damper or cushion plates likewise provided. The stops 10 for the stop plate 8 comprise bodies in the form of pins which are secured to the valve seat 1 and which project towards the stop plate 8. The springs 9 are made relatively strong, so that [they] hold the stop plate 8¹ securely on the stops 10 against the forces of flow which occur during normal valve operation.

In the embodiment according to Fig. 2, the stop plate 8 is also acted upon by springs 9 arranged in the catcher 4. The stops 10, by which the stop plate 8 is held at a distance from the valve seating 1, are formed in this case by claw-shaped projections which protrude radially and axially beyond the stop plate 8 and are supported on the valve seating 1. The closure springs 11 for the closure member 3 are helical springs arranged in the stop plate 8. In addition, a damper plate 16 which is acted upon by its own damper springs 17 is illustrated in Fig. 2. The lifting device 12 is shown only in part. The restoring spring 15 is supported directly on the valve seating 1. Both the closure member 3 constructed in the form of a plate and the damper plate 16 are provided with support arms and are clamped by way

¹ N.B. The German reads *so daß sie die Anschlagplatte 8 ... an den Anschlägen 10 festhält*, literally "so that the stop plate 8 holds them securely on the stops 10 ...", assumed in the translation to be in error for *so daß sie die Anschlagplatte 8 ... an den Anschlägen 10 festhalten*.

of a hub between the spacer ring 6 and the valve seating 1. A centring pin is designated 18, which is secured in the valve seating 1, passes through the closure member 3 and the damper plate 16 and projects into a bore in the stop plate 8.

In the case of the variant illustrated in Fig. 3 the stop 10 for the stop plate 8 is formed by a shoulder on the spacer ring 6. The stop plate 8 is held securely on the stop 10 against the forces of flow by springs 9 also provided in this case. In this embodiment, the closure springs 11 for the closure member 3 are likewise supported on the catcher 4 itself. They act upon a guide pin 19 which passes through the stop plate 8, is guided in a bore 20 therein and acts upon the closure member 3 with its end. In this embodiment, the lifting device is indicated only by a lifting finger 13, which acts upon the closure member 3 through a through duct 2 in the valve seating 1. In addition, the catcher 4 is made self-supporting, as in the case of the embodiment according to Fig. 1, whereas according to Fig. 2 a so-called safety catcher 4 is provided, which is gripped at its edge by the valve seating 1.

The operation of the valves illustrated is the same in all the embodiments. During the normal supply of the compressor, i.e. when the lifting fingers 13 are drawn back from the closure member 3 by the restoring spring 15 of the lifting device 12, as illustrated in the drawings, the closure member 3 can perform its reciprocating movements freely, in which case the stop plate 8 acts as an end stop. In order to change the compressor over to idling the lifting device 12 is actuated, for example the setting device 14 illustrated in Fig. 1 is acted upon with a pressure medium, after which the lifting fingers 13 first press the closure member 3 onto the stop plate 8 against the force of the restoring spring 15 and as a result also lift the stop plate 8 off its stops 10 and press it onto the catcher 4 against the force of the springs 9.

When the closure member 3 is raised, the medium drawn in by the compressor can flow freely in both directions through the valve which is then open. In this case the stroke of the closure member 3 is increased by the length of the displacement path of the stop plate 8, as a result of which the free through cross-section through the valve in this area is also correspondingly large, which results in a reduction in the flow velocity of the medium. If the valve is forcibly held open the forces of flow acting upon the closure member 3 are thus substantially reduced, so that the stressing of the closure member 3 is also reduced to the same degree. A detrimental warping of the plate-shaped closure member 3 is thereby prevented.

In addition, even with a closure member 3 consisting of a material less strong than steel, for example plastics material, a relatively small number of lifting fingers 13 is sufficient

to support the closure member 3 securely and to keep its stressing by the forces of flow adequately low. Some components of the valve, in particular the spacer ring 6 which in the embodiments according to Figs. 1 and 3 also acts as a guide ring for the sliding guide of the closure member 3 and other valve parts provided, and also for the displaceable stop plate 8, can also consist of ceramic material. The valve according to the invention has the further advantage that the lifting fingers 13 present in only a relatively small number do not constrict the throughflow cross-section in the through ducts 2 of the valve seating 1 excessively, so that the compressor valve according to the invention has as a whole a relatively large through cross-section and accordingly a relatively small throughflow resistance.



Claims:

1. A compressor valve, comprising a valve seating (1), a catcher (4) and an annular or plate-shaped closure member (3) which is arranged displaceably therebetween and controls through ducts (2) in the valve seating (1) and which is acted upon by closure springs (11) in the direction towards the valve seating (1) and has associated therewith a lifting device (12) acting upon the closure member (3) by lifting fingers (13) through the valve seating (1), wherein a stop plate (8) is arranged in the valve between the closure member (3) and the catcher (4), the stop plate (8) being held securely by at least one spring (9) on a stop (10) provided at a distance from the valve seating (1), **characterized in that** the force of the springs (9) pressing the stop plate (8) against the stop (10) is greater than the forces of flow acting upon the closure member (3) in the opening direction, and the stop plate (8) can be displaced towards the catcher (4) by means of the lifting device (12) against the force of the springs (9) acting upon it and can be pressed against the said catcher (4).
2. A compressor valve according to Claim 1, **characterized in that** at least part of the closure springs (11) acting upon the closure member (3) are supported on the stop plate (8).
3. A compressor valve according to Claim 1, **characterized in that** the closure springs (11) are supported at least in part on the catcher (4) and act upon the closure member (3) through openings in the stop plate (8).
4. A compressor valve according to Claim 3, **characterized in that** the closure springs (11) are guided in the stop plate (8).
5. A compressor valve according to Claim 4, **characterized in that** the closure springs (11) act upon a respective guide pin (19), guided in a bore (20) in the stop plate (8).