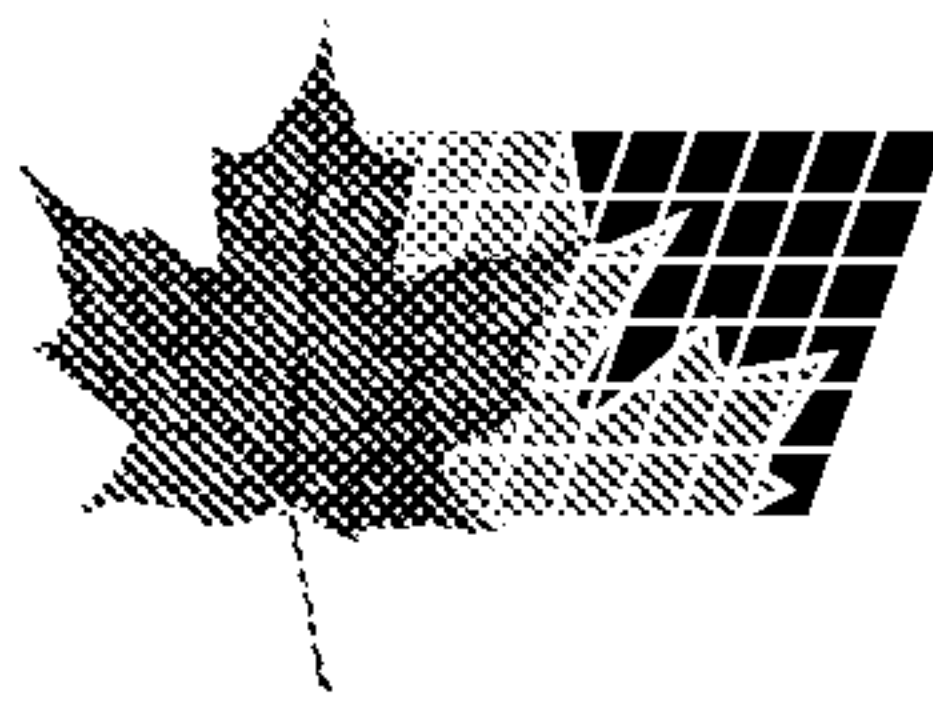




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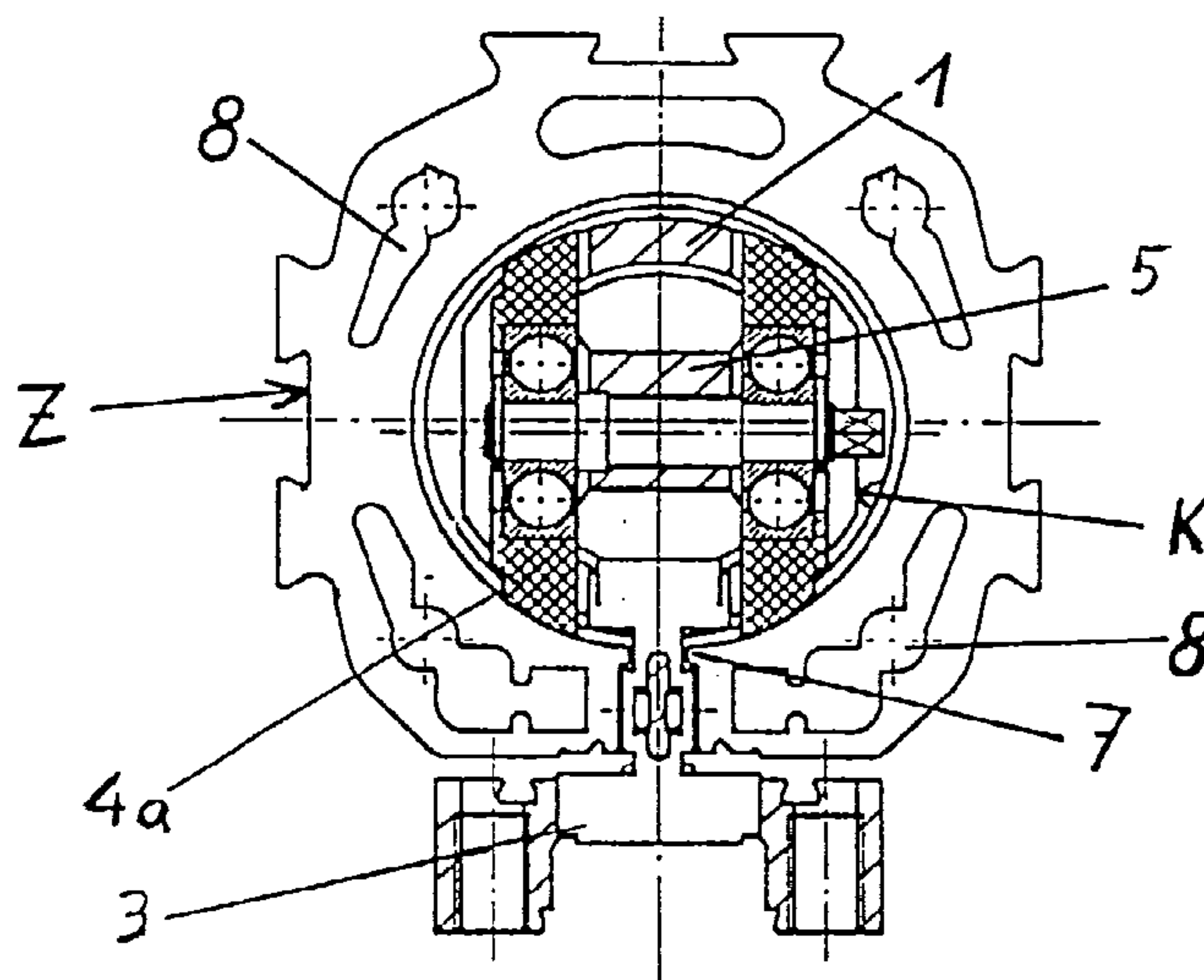
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(54) **SYSTEME D'ACTIONNEMENT ET DE GUIDAGE COMBINES
POUR LE DEPLACEMENT D'UNE CHARGE**

(54) **COMBINED ACTUATING AND GUIDING SYSTEM FOR
MOVING A LOAD**



(57) A combined actuating and guiding system for moving a load comprising a rodless working cylinder, preferably a pneumatic cylinder, into which cylinder body there is at least one piston (K) positioned slidably along its longitudinal axis whereby said piston cooperates with the to-be-moved load through an otherwise sealed elongated slot in the cylinder body. To produce a system of this type with the most possible compactness and simple design as well as easy construction, it is proposed that the rollers (4a, 4b) are located inside the working cylinder (Z) and whereby the inner wall of said working cylinder serves as a track for the rollers (4a, 4b).

Abstract

A combined actuating and guiding system for moving a load comprising a rodless working cylinder, preferably a pneumatic cylinder, into which cylinder body there is at least one piston (K) positioned slidably along its longitudinal axis whereby said piston cooperates with the to-be-moved load through an otherwise sealed elongated slot in the cylinder body. To produce a system of this type with the most possible compactness and simple design as well as easy construction, it is proposed that the rollers (4a, 4b) are located inside the working cylinder (Z) and whereby the inner wall of said working cylinder serves as a track for the rollers (4a, 4b).

The invention relates to a combined actuating and guiding system for moving a load comprising a rodless working cylinder, preferably a pneumatic cylinder, into which cylinder body there is at least one piston positioned slidably along its longitudinal axis whereby said piston cooperates with the to-be-moved load through an otherwise sealed elongated slot in the cylinder body and whereby the load may be moved by rollers in the axial direction of said working cylinder.

A system of this type is known from EP 0 645 544, for example, whereby the guide tracks for the load-carrying rollers are shaped in the same profile as the working cylinder and the area under the working cylinder. A power transmission element protruding through an otherwise sealed elongated slot is attached to the rodless piston in the actual cylinder whereby said power transmission element moves the carriage supported by rollers and whereby the load is attached to said carriage. In contrast to traditional designs, this arrangement is manufactured separately from the working cylinder and has guide tracks for load-carrying rollers mounted during assembly, which makes for a more compact design and a reduction in the number of system components, however; the trade-off is a costly production of the already very massive and heavy combined cylinder tube and guide track profile. The same is principally true for the embodiment of a door actuating device without a piston rod according to WO 94/27017, which discloses the same disadvantages.

The object of the present invention was therefore to provide a system of the type described at the beginning, which allows in the most compact way a simple design and at the same time easy construction.

This object is achieved according to the invention in that the rollers are located inside the working cylinder and whereby the inside wall of the working cylinder serves as a track for the rollers. Thereby the outer dimensions of the working cylinder determine exclusively the structural dimensions of the actuating and guiding system, which may be considerably smaller in size than the current systems because of the lack of tracks on the outside of the working cylinder - even if the working cylinder has to be possibly made a

little stronger based on the increased stress of a supporting configuration. In any case, the production of a more solid but single working cylinder tube without outer tracks is essentially more simple, faster and more economical than the production of a combined profile of a cylinder and track, regardless whether it is a one-piece or an assembled design.

When the rollers are attached or mounted on the piston, according to an additional embodiment of the invention, it is a structurally simple and operationally dependable version since the guiding and actuating elements may be installed or taken out all in one piece. However, for certain applications it could be an advantage to attach the load with rollers to a carriage, which would run in front or behind the piston in the working cylinder and which would cause axial movement through direct or indirect influence of the piston on the carriages or the load itself.

An advantageous embodiment of the invention in terms of simple production, assembly and maintenance is the version in which the rollers are located between the sealed end sections of the piston. The pistons and rollers may be installed and possibly exchanged as a single compact component - especially when the rollers are directly attached to the piston itself. This version allows also the best possible utilization of the structural length of the working cylinder relative to the operative stroke of the piston. Of course, other versions are conceivable whereby some or all rollers are located outside the piston.

To avoid excessive stress on the surface of the inner wall of the cylinder and also on the running surface of the rollers, and to utilize in the best possible way the surface available for load bearing, it is proposed that the running surfaces of the rollers are essentially shaped complementary to their contact areas of the inner wall of the working cylinder. This means that the rollers make contact in their entire width against the inner wall of the cylinder and thereby forces are distributed across the largest possible area. A restoring force becomes effective returning pistons or, in general, the component supporting the rollers, back into the center position because of the curvature of the inner wall of the working cylinder.

The roller arrangement is advantageously symmetric to the longitudinal center plane of the working cylinder-load arrangement so that no moments may occur that would change the width of the elongated slot in the cylinder tube. The preferred plane of symmetry (principle plane) of the roller arrangement is the one longitudinal center plane that lies in the direction of force and which force is transmitted to the roller because of the moving load on the rollers. There is a vertical plane through the center of the roller arrangement, especially with a load hanging perpendicular under the working cylinder.

To avoid hindering tilting of the piston inside the cylinder tube, which may easily occur based on the distance between applied forces, it is proposed that the roller arrangement is symmetric to the longitudinal center of the piston.

This advantageous effect may be complemented in that, according to an additional characteristic of the invention, some of the rollers come into contact on top relative to the cross-central plane of the piston and some of the rollers come into contact underneath of the cross-sectional plane against the inner wall of the working cylinder. Thereby the piston or the roller arrangement is positioned exactly axis-parallel to the working cylinder, which is also an advantage in relation to the piston seal.

The innovative system may be used in an especially advantageous manner in a double drive mechanism, for instance in double doors, in a configuration wherein the working cylinder is separated into at least two cylinder chambers by at least one intermediate cover and whereby each cylinder chamber is designed as a system according to at least one of the previous paragraphs.

In the following description the invention is described in more detail with reference to the drawings of preferred embodiments:

Fig. 1 shows a top view of a piston for the innovative actuating and guiding system as seen from the direction of the load.

Fig. 2 shows a side view of the piston depicted in Fig. 1.

Fig. 3 shows a longitudinal sectional views through the piston essentially along a longitudinal center plane at the level of line III-III of Fig. 1.

Fig. 4a and Fig. 4b depict cross-sectional views through the innovative actuating and guiding system with the piston as shown in Fig. 1 through Fig. 3 at the level of lines a-a or b-b of Fig. 3.

Fig. 5 shows a further developed embodiment of the innovative system for a double door in a longitudinal sectional view.

The piston K illustrated in Fig. 1 in a top view, as seen from the direction of the load, consists essentially of an oblong basic body 1, which is positioned coaxial inside the working cylinder and may be moved longitudinal therein and which is provided at the front or rear end 2 in the assembled condition with at least one raised seal to seal off the working chamber located in front or behind the piston K.

A stud 3 on the piston K protrudes through the sealed elongated slot of the working cylinder to the outside, which means in front and behind the piston K, and it is connected with the load that is to be moved or it may be brought into contact with the same. The device for raising and placing the seal of the elongated slot through the piston k is not explicitly illustrated.

As it is shown in the side view of Fig. 2 of said piston K, the rollers 4a, 4b are preferably attached to the basic body 1 wherein said rollers project past the outside of the basic body K and wherein said rollers come into contact with the inner wall of the working cylinder so that the piston K itself can carry or support the load via stud 3 and whereby said piston may remain freely slidable inside the working cylinder. In the roller arrangement 4a, 4b we are dealing preferably with pairs of rollers, which are symmetric in relation to the center plane of the piston. However, an arrangement of one roller per position would also be conceivable.

This is equally true for hanging as well as for pushed loads whereby preferably a larger amount of rollers 4a distribute forces exerted by the load onto the inner wall of the working cylinder and whereby less supporting and stabilizing rollers 4b are provided. In case of pushing loads, an arrangement would be advantageous wherein the position of the rollers 4a and 4b is switched around. This means that, in addition, the rollers 4a take up the carried load opposite the elongated slot of the cylinder tube and the rollers 4b take on a stabilizing function directly adjacent to the elongated slot. As indicated in the illustrated example, the arrangement of the rollers 4 is symmetric relative to the longitudinal center of the piston K to avoid tilting of the piston K inside the working cylinder. Additionally, there is at least one roller 4a provided at each side of the longitudinal center, which also ensures a sealing effect and prevents excessive stress on the sealing elements. Preferably, the load-carrying rollers 4a are positioned relatively far apart from one another and are at a distance from the longitudinal center of the piston K to counter tilting moments of the piston K. As can be seen also in Fig. 2, it is sufficient in the most simple embodiment that a supporting roller 4b is positioned essentially near the center on the basic body 1 of the piston K, however; because of corresponding available space there are also supporting rollers 4b advantageously mounted before and behind the longitudinal center of the piston.

In the illustrated embodiment example, the axles of the rollers 4a, 4b are parallel to one another and they are normally oriented in the direction of the effective force whereby said rollers are made of non-metallic material, specifically hard rubber. To obtain a guiding

effect along the sides after recovery to the center plane caused by the curvature of the inner wall of the working cylinder and to obtain optimum centering of the piston K inside the working cylinder, at least one roller or preferably two rollers may be positioned symmetric relative to the longitudinal plane of the piston K with its axis normally leading through the axles of the load-carrying rollers 4a. Additional rollers with a different axle orientation would also be possible.

The longitudinal sectional view in Fig. 3 through the piston K shows, in addition to the already mentioned characteristics, that the end sections 2 of the piston K have preferably recesses 2' pointing to the outside, which connect to corresponding end-of-stroke buffers in the working cylinder to cushion the end-of-stroke impact of the piston K.

Furthermore, there is shown in the illustrated arrangement the axial support rail 5, which connects both end sections 2 to one another and said support rail has bearings for the axles of the rollers 4a, 4b. The axial support rail 5 in the illustrated arrangement is made in one piece together with the elements 1 and 3. Finally, there can be seen the slide elements 6 at the end sections 2 over which the raised seal of the elongated slot of the working cylinder make contact. These slide elements 6 have at the same time the function of receiving the piston seal, guiding the seal of the elongated slot of the working cylinder, and receiving the seal for the pneumatic end-of-stroke cushioning. The slide element 6 may also have a supporting function for the outer load whereby, however, the outer load should be supported mainly by the rollers 4a and 4b.

The two cross-sectional views of Fig. 4a and Fig. 4b show finally the piston K of Fig. 1 through Fig. 3 in its assembled condition inside the working cylinder Z. The stud 3 of the piston K protrudes past the elongated slot (identified now with the number 7) to be connected to the load or to move this load directly or indirectly. The rollers 4a are positioned advantageously in pairs symmetric to the specific longitudinal plane of the piston K, which is also the direction of force exerted by the load, whereby said rollers utilize the inner wall of the working cylinder Z as a track and transfer the force of the load onto the inner wall. To distribute this force in the most equal fashion and onto the possibly largest surface so that excessive pressure and stress to the surface of the inner

wall is prevented, the running surface of the rollers 4a - and also of the rollers 4b, as shown in Fig. 4b - are designed complementary in their cross section relative to the curvature of the inner wall of the working cylinder Z. This design is advantageous as well as for the illustrated essentially circular cross-section of the piston as also for all other cross-sectional shapes - like oval or flattened (shapes). The piston may also be rectangular or square cross-sectional whereby the rollers may be provided with a flat running surface.

The lines for the pressure medium as well as the lines for signaling and/or control may run through the axial channels 8 in the wall of the working cylinder Z. The outer surface of said working cylinder may be shaped in a manner that allows attachment of additional parts or components and/or easier mounting of the working cylinder Z itself to a supporting element.

For the possible use in double doors, two pistons may be provided in the same working cylinder as described above. Thereby each piston moves in its own cylinder chamber, which is separated by an intermediate cover that is inserted preferably into the inside of the working cylinder. Said cylinder chamber is screwed down from the outside cross-wise to its axial direction and air supply to the two cylinder chambers is provided through internal air channels, which are connected to the cylinder chambers with a bore in the area of the intermediate cover cross-wise to the operating direction whereby, however, said internal air channels are closed-off to the outside.

The actuating and guiding system in Fig. 5 for actuating and guiding both wings Fa and Fb of a double door is provided with a working cylinder Z, which is separated by an intermediate cover 9 into two cylinder chambers 10 and 11 that are located one behind the other. The working cylinder Z is closed at both ends by the cover elements 12 and 13. In each cylinder chamber 10, 11 there are mounted two pistons K1 and K2 or K3 and K4, which are moved by the pressurizing medium and which pistons K1 through K4 are designed as described above and which carry the wings Fa and Fb.

To open the double doors, the wings Fa and Fb must be pushed toward the outer end of the working cylinder Z wherein the pressurizing medium is supplied along both sides of the intermediate cover 9. The working chambers corresponding to the cover elements 12 and 13 are depressurized or exhausted. The middle working chambers are depressurized during closing and the pressurizing medium is transferred through the outer cover elements 12 and 13 so that the wings Fa and Fb are moved again toward the center.

Patent Claims

1. A combined actuating and guiding system for moving a load comprising a rodless working cylinder, preferably a pneumatic cylinder, into which cylinder body there is at least one piston positioned slidably along its longitudinal axis whereby said piston cooperates with the to-be-moved load through an otherwise sealed elongated slot in the cylinder body and whereby the load may be moved by rollers in the axial direction of said working cylinder, characterized in that the rollers (4a, 4b) are located inside the working cylinder (Z) and whereby the inner wall of said working cylinder serves as a track for the rollers.
2. A system according to claim 1, wherein the rollers (4a, 4b) are attached or mounted to the piston (K).
3. A system according to claim 1 or 2, wherein the rollers (4a, 4b) are located between the sealed end sections (2) of the piston (K).
4. A system according to one of the previous claims, wherein the running surfaces of the rollers (4a, 4b) are essentially shaped complementary relative to their contact area on the inner wall of the working cylinder (Z).
5. A system according to one of the previous claims, wherein said roller arrangement is symmetric to the longitudinal center plane of the working cylinder-load arrangement.
6. A system according to one of the previous claims, wherein the roller arrangement (4a, 4b) is symmetric to the longitudinal center of the piston (K).
7. A system according to one of the previous claims, wherein some of the rollers (4a) are positioned above the cross-center plane of the piston and some of the rollers (4b) are below of it against the inner wall of the working cylinder (Z).

8. A system according to one of the previous claims, wherein the working cylinder (Z) is separated into at least two cylinder chambers (10, 11) by at least one intermediate cover (9) and whereby each cylinder chamber is designed with at least one piston (K1 through K4) as a system according to at least one of the previous claims.

Fig. 1

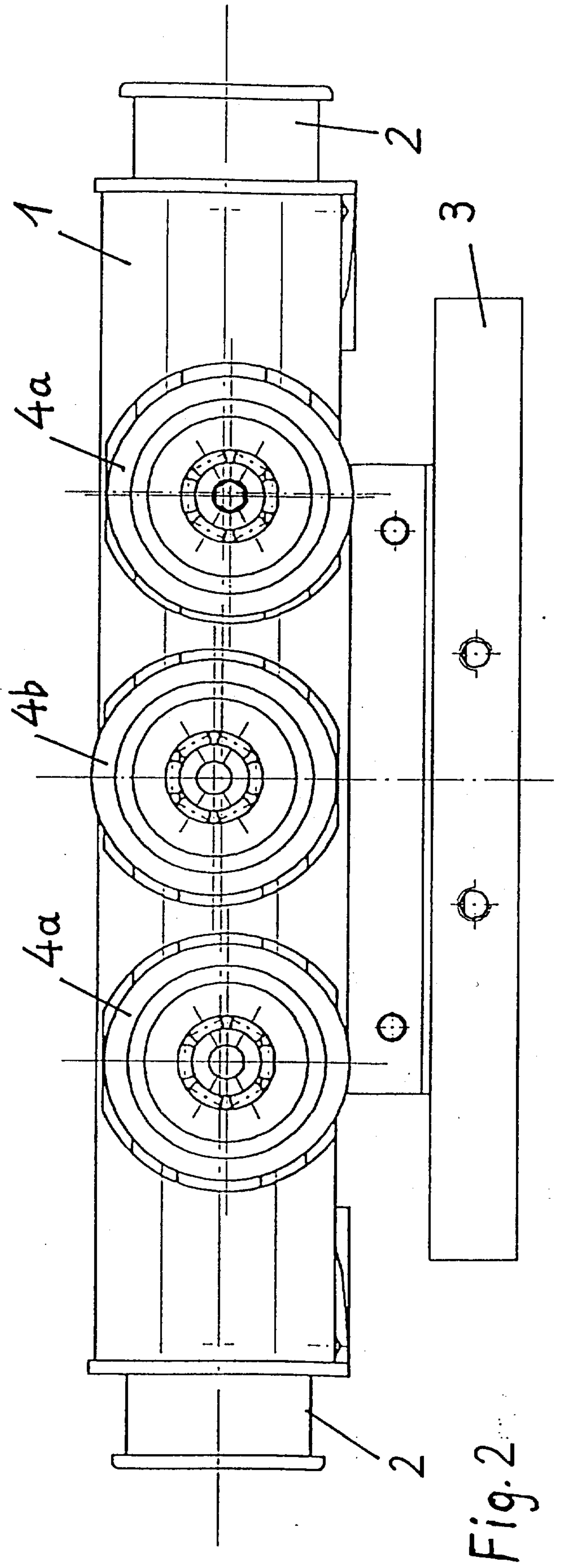
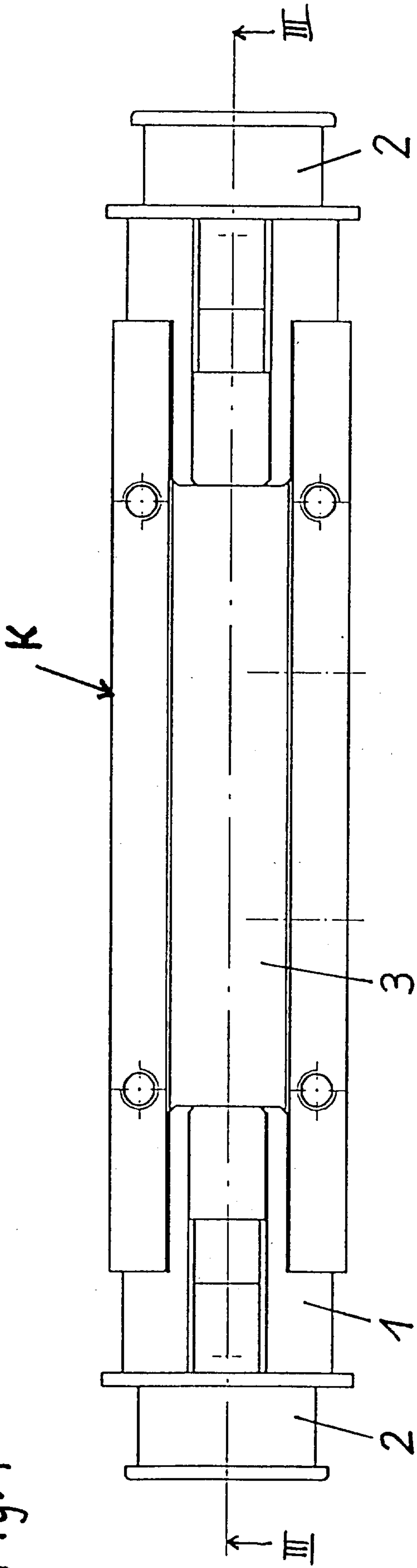


Fig. 3

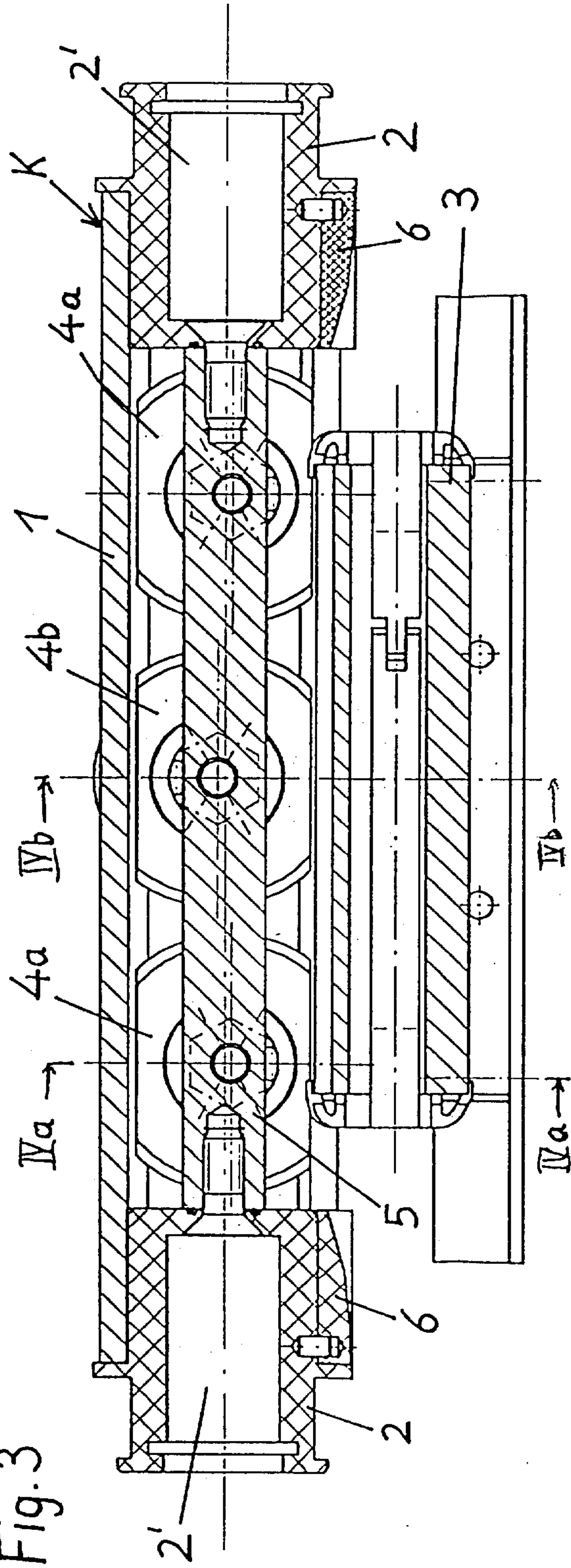


Fig. 4a

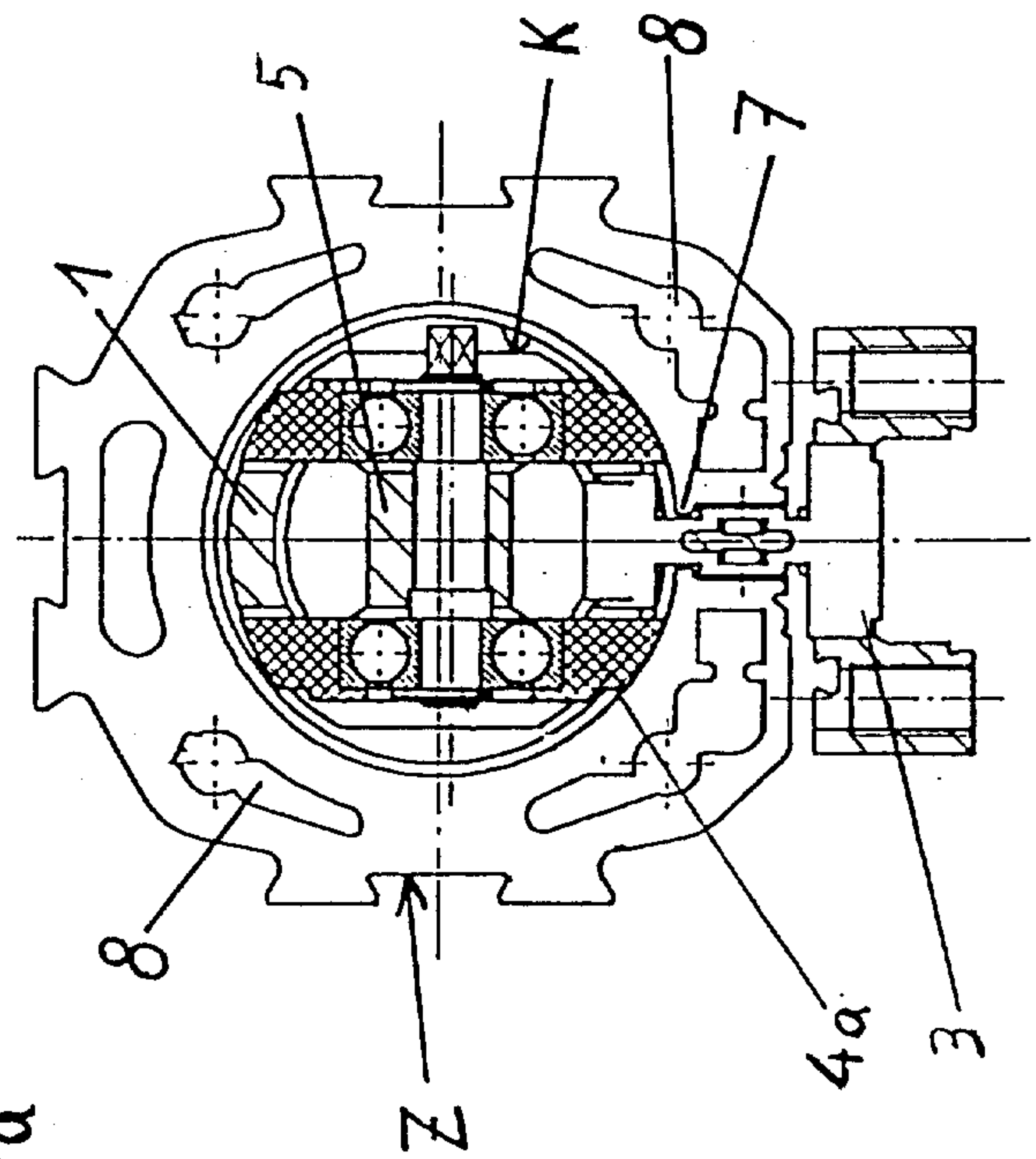


Fig. 4b

