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(71) Applicant: **Ningbo Airtac Automatic Industrial Co., Ltd.**
Fenghua, Zhejiang 315500 (CN)

(72) Inventors:
- **Wang, Shi Zhong**
  315500 Fenghua (CN)
- **Cao, Zhou**
  315500 Fenghua (CN)
- **Zhang, Wenbi**
  315500 Fenghua (CN)
- **Meng, Minyan**
  315500 Fenghua (CN)

(74) Representative: **Machtalère, Georges et al**
Office Kirkpatrick S.A.
Avenue Wolfers, 32
1310 La Hulpe (BE)

(54) Cylinder trunnion supporting structure

(57) The present invention discloses a cylinder trunnion supporting structure, comprising trunnion supports (2) separately disposed on two sides of a cylinder body (1). Each of the trunnion supports (2) comprises a main body (2a) and two positioning ends (2b) located at two ends of the main body (2a) and arranged in a same direction. A trunnion (201) is provided on the top of the main body(2a). Clamping block mounting recesses (202), which are parallel to an axial direction of the cylinder body (1), are provided on opposite side faces of the two positioning ends (2b). Clamping blocks (5), which are capable of rotating with respect to the clamping block mounting recesses (202), are provided in the clamping block mounting recesses. Positioning grooves (101) fitted with inner sides of the clamping blocks (5) are provided on the cylinder body (1). Bolts (4) acting on outer sides of the clamping blocks (5) are provided on the trunnion supports (2). One face of each of the clamping blocks (5) protrudes outward to form an outer arc (5a) face that is in line contact with side walls of the clamping block mounting recesses (202).

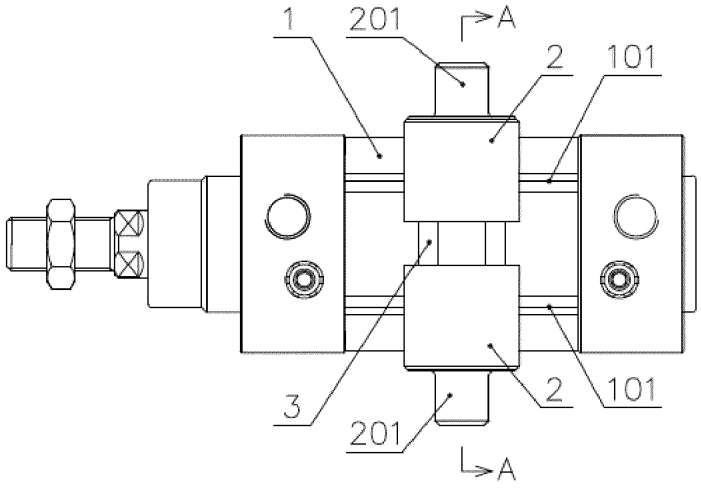

Fig. 1

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Description

Technical Field of the Invention

[0001] The present invention relates to the technical field of cylinder accessories, and particularly to a cylinder trunnion supporting structure.

Background of the Invention

[0002] At present, trunnion supports for cylinders are mostly secured in an encircled manner, that is, trunnions are fastened by using symmetrical supports on two sides of a cylinder body of a cylinder and by securing bolts. For example, Chinese Patent Application CN201412413 disclosed a removable central trunnion, including a main body, four press blocks and screws, where small shafts are provided both above and below the main body, and the main body is fastened to the four press blocks via the screws. However, such a securing structure is likely to become loose due to the impact of the repeated movement of a cylinder piston. As a result, the trunnion supports slide in the cylinder body in the axial direction, the cylinder moves as a whole, and the acting stroke of the piston rod is disabled. Consequently, the failure or discard of equipment or even more severe accidents will be caused, and great loss will be thus caused.

[0003] On the other hand, in order to avoid the movement of a cylinder, a trunnion support is required to exert a larger tightening force onto the cylinder. However, too large tightening force applied by the trunnion support to the cylinder is likely to result in deformation of the cylinder bore in the middle of the cylinder body as the cylinder body of the cylinder is stressed. Thus, the sliding of a piston in the cylinder bore is hindered, and the normal operating of the cylinder is influenced.

Summary of the Invention

[0004] In order to overcome the deficiencies of the prior art, the present invention provides a cylinder trunnion supporting structure which can effectively avoid the axial slip of the trunnion supports with respect to the cylinder body and ensure fixed positions thereof.

[0005] Another objective of the present invention is to provide a cylinder trunnion supporting structure having small influence on a cylinder body, in order to solve the problem in the prior art that a cylinder trunnion support is likely to result in deformation of a cylinder body of a cylinder and thus influences the normal operating of the cylinder.

[0006] To achieve the above objectives, the present invention employs the following specific technical solutions: a cylinder trunnion supporting structure is provided, including trunnion supports separately disposed on two sides of a cylinder body; each of the trunnion supports includes a main body and two positioning ends located at two ends of the main body and arranged in a same direction; a trunnion is provided on the top of the main body; clamping block mounting recesses, which are parallel to an axial direction of the cylinder body, are provided on opposite side faces of the two positioning ends; clamping blocks, which are capable of rotating with respect to the clamping block mounting recesses, are provided in the clamping block mounting recesses; positioning grooves fitted with inner sides of the clamping blocks are provided on the cylinder body; bolts acting on outer sides of the clamping blocks are provided on the trunnion supports; and, one face of each of the clamping blocks protrudes outward to form an outer arc face that is in line contact with side walls of the clamping block mounting recesses. In the present invention, the clamping blocks are located in the clamping block mounting recesses, one side of each of the clamping blocks is secured via bolts so that the other side of each of the clamping blocks is snapped in the positioning groove of the cylinder body, in this way the securing and mounting of the cylinder body are completed. On the other hand, in the present invention, due to the leverage of the clamping blocks, the direction of an extrusion force exerted by the clamping blocks to the cylinder body is directed to one side of the trunnions on the trunnion supports. In this way, an acting force exerted by the trunnion supports to the cylinder body in the present invention does not pass through a cylinder bore in the center of the cylinder. Therefore, the trunnion supports in the present invention have no extrusion to the cylinder bore in the center of the cylinder, and the acting force exerted by the trunnion supports to the cylinder focuses on the outer wall of the cylinder body. Consequently, the problem in the prior art that, too large tightening force exerted by the trunnion supports to the cylinder is likely to result in deformation of the cylinder bore in the middle of the cylinder as the cylinder body of the cylinder is stressed and the normal operating of the cylinder is thus influenced, may be solved.

[0007] Preferably, a distance from a contact point of the bolts with the clamping blocks to a contact point of the outer arc faces with the side walls of the clamping block mounting recesses in a horizontal direction may be greater than a distance from the contact point of the outer arc faces with the side walls of the clamping block mounting recesses to a contact point of the clamping blocks with the positioning grooves in the horizontal direction. As described here, the contact point between two components refers to a stress center on the cross section of the cylinder when there is an acting force between the two components. As the arm of force of the acting force of the bolts to the clamping blocks is greater than that of the reacting force of the positioning grooves, the clamping blocks become to serve as labor-saving levers. As a result, a larger acting force may be generated between the clamping blocks and the cylinder body, so that the fixation of the trunnion supports is more reliable. Meanwhile, during fastening the clamping blocks via the bolts, a smaller assembly torque of the bolts is required. This reduces the labor intensity during assembly, and properly

protects the bolts and threads.

[0008] Preferably, an inner concave face may be provided on one side of the main body opposing to the trunnion, and inner arc faces transitioned to the clamping block mounting recesses may be separately provided on two sides of the inner concave face; the cross section of the cylinder body may be rectangular, and fillets fitted with the inner arc faces may be provided in corners of the cylinder body, so that the inner arc faces are closely fitted with the fillets of the cylinder body when the trunnion supports may be secured to the cylinder body of a cylinder; and a depression portion may be provided in the middle of the inner concave face. The inner concave face may be fitted with the outer wall of the cylinder body, and the inner arc surfaces on two sides may be fitted with the corners of the cylinder body, so that it is convenient to position the radially relative positions of the trunnion supports and the cylinder body during mounting. In this way, the radial coaxiality of the trunnion supports with the cylinder body is improved. As the thickness of a middle portion of a side of the cylinder body having a rectangular cross section is relatively thin, the trunnion support is provided with a depression portion at this position, so that a clearance is formed between the assembled trunnion supports and the outer wall of the cylinder body. In doing so, the deformation of the cylinder bore due to the stress of the middle portion of the cylinder body may be avoided. On the other hand, the rectangular cylinder body may allow the acting force exerted by the trunnion supports to the cylinder to focus on four corners of the cylinder body, thereby minimizing the influence of the trunnion supports onto the cylinder body of the cylinder.

[0009] Preferably, clamping faces opposing to the outer arc faces may be designed on the clamping blocks; the clamping blocks may be disposed obliquely, with an included angle between the clamping faces and the end faces of the bolts being of from 25 to 35 degrees; the clamping faces on the inner sides of the clamping blocks may be closely fitted with the side wall of one side of the positioning grooves; and, clamping block protrusion layers may be provided on the clamping faces. In addition, inner arc face protrusion layers may be provided on the inner arc faces. The clamping block protrusion layers and the inner arc face protrusion layers may be protruded particles, toothed stripes or other antiskid structures. Thus, the friction between the clamping faces and the positioning grooves and bolts, as well as the friction between the inner arc faces and the cylinder body, is increased, and the reliability of the trunnion supports clamping the cylinder body is further improved.

[0010] Preferably, the trunnion supports may have opposite positioning holes on the bottoms of the positioning ends, respectively; pillars fitted with the positioning holes may be provided between the trunnion supports on two sides of the cylinder body; and, the positioning holes may be pin holes while the pillars may be positioning pins, and the trunnion supports on the two sides may be connected via the positioning pins. The arrangement of the pillars on the trunnion supports on two sides of the cylinder body, on one hand, improves the overall rigidity of the trunnion supports and decreases the deformation magnitude of the trunnion supports, and on the other hand, may serve for positioning during mounting the trunnion supports to ensure the accuracy of the relative positions of the trunnion supports on two sides of the cylinder body, thus improving the coaxiality of the trunnions on the two trunnion supports.

[0011] Preferably, buffer holes axially extending along the cylinder body may be formed in the corners of the cylinder body, and the shaft axes of the buffer holes and the shaft axes of the fillets may be on a same axis. Two ends of the buffer holes formed in the four corners of the cylinder body may serve as securing holes for a cylinder cover. At the mounting positions of the trunnion supports, as the buffer holes are located between the corners of the cylinder body and the cylinder bore, the influence of the clamping blocks onto the cylinder bore when clamping the cylinder body is reduced due to the presence of the buffer holes, that is, the buffer holes isolate the corners of the cylinder body from the cylinder bore when the clamping blocks extrude the cylinder body, so that the acting force exerted by the clamping blocks mainly focuses on the corners of the cylinder body and the deformation of the cylinder bore is thus avoided.

[0012] Preferably, the cross section of each of the positioning grooves may be triangular; and, a neck may be provided on a side face of the cylinder body, and the neck may be located between the two positioning grooves on the side face of the cylinder body. The neck may be used for securing cylinder accessories.

[0013] Preferably, the cross section of each of the clamping block mounting recesses may be rectangular while the cross section of each of the clamping blocks may be semicircular, the semicircular arc faces of the clamping blocks form the outer arc faces in line contact with the side walls of the clamping block mounting recesses, and planes of the clamping blocks opposing to the semicircular arc faces form the clamping faces. As the arc faces of the clamping blocks having semicircular cross sections are in line contact with the side walls of the clamping block mounting recesses, the arc face structures of the clamping blocks may roll on the side walls of the clamping mounting recesses when the bolts exert a force to the clamping blocks, so that the clamping faces at inside ends of the clamping blocks are closely against the side walls of the positioning grooves.

[0014] Preferably, there may be one to three clamping blocks in the clamping block mounting recesses, and the clamping blocks may be arranged in a length direction of the cylinder body when there are two to three clamping blocks therein; and, corresponding to each of the clamping blocks, there may be one to three bolts, and the bolts may be arranged in the length direction of the cylinder body when there are two to three bolts. In the present invention, the number of the clamping blocks in the clamping block mounting recesses may be one, two or

three, depending upon the length and working condition of the cylinder. When the trunnion support has a large width in the length direction of the cylinder, the use of a plurality of separate clamping blocks is advantageous for the securing of the cylinder. As the cylinder body of the cylinder is made of profiles, the segmented clamping blocks may avoid the problem that the trunnion supports become loose due to overall incompact contact between the clamping blocks and the positioning grooves caused by the defects in a certain part of the profiles. Meanwhile, two ends of the segmented clamping blocks may allow embedding of the cylinder body of the cylinder to some extent, which is advantageous in preventing the trunnion supports from sliding on the cylinder body. Likewise, longer clamping blocks may be fastened by two or three bolts, thereby achieving better securing effects.

[0015] The present invention has the following advantages: first, the leverage of the clamping blocks greatly increases the clamping force exerted by the trunnion supports to the cylinder body and effectively avoids the slipping of the trunnion supports with respect to the cylinder body; second, the tightening torque of the bolts acting on the clamping blocks is reduced, so that the slipping of the bolts is effectively avoided and it is more labor-saving and convenient for mounting and disassembling; third, the coaxiality of the trunnions and the radial coaxiality of the trunnion supports with the cylinder body are greatly improved; fourth, the trunnion supports have no extrusion to the cylinder bore in the center of the cylinder, so that the problem in the prior art that, too large tightening force exerted by the trunnion supports to the cylinder is likely to result in deformation of the cylinder bore in the middle of the cylinder as the cylinder body of the cylinder is stressed and the normal operating of the cylinder is thus influenced, may be solved.

Brief Description of the Drawings

[0016]

Fig. 1 is a structure diagram of the present invention;
Fig. 2 is a sectional view of A-A in Fig. 1 according to the present invention;
Fig. 3 is a structure diagram of a trunnion support according to the present invention;
Fig. 4 is another structure diagram of a trunnion support according to the present invention;
Fig. 5 is a cross-sectional structure diagram of a cylinder body of a cylinder according to the present invention; and
Fig. 6 is a structure diagram of a clamping block according to the present invention;

in the drawings: 1-Cylinder body; 101-Positioning groove; 102-Fillet; 103-Buffer hole; 104-Neck; 105-Outer wall; 106-Cylinder bore; 2-Trunnion support; 2a-Main body; 2b-Positioning end; 201-Trunnion; 202-Clamping block mounting recess; 203-Positioning hole; 204-Inner concave face; 205-Inner arc face; 206-Bolt hole; 207-Depression portion; 3-Pillar; 4-Bolt; 5-Clamping block; 5a-Outer arc face; 5b-Clamping face; and, 5c-Outer plane.

Detailed Description of the Invention

[0017] The present invention will be further described as below with reference to the accompanying drawings by specific implementation ways.

Embodiment 1

[0018] In Embodiment 1 as shown in Fig. 1 and Fig. 2, a cylinder trunnion supporting structure is provided, including two trunnion supports 2 separately disposed on two sides of a cylinder body 1. Each of the trunnion supports 2 includes a main body 2a and two positioning ends 2b located at two ends of the main body 2a and symmetrically arranged in a same direction. A trunnion 201 is provided on the top of the main body 2a. Clamping block mounting recesses 202, which are parallel to an axial direction of the cylinder body 1, are provided on opposite side faces of the two positioning ends 2b. The cross section of each of the clamping block mounting recesses 202 is rectangular. A clamping block 5, which is capable of rotating with respect to the clamping block mounting recesses 202, is provided in the clamping block mounting recesses 202. Positioning grooves 101 fitted with inner sides of the clamping blocks 5 are provided on the cylinder body 1. Each of the positioning end 2b of the trunnion support 2 is provided with a bolt hole 206 communicated with the clamping block mounting recesses 202. Bolts 4 acting on outer sides of the clamping blocks 5 are provided in the bolt holes 206. One face of each of the clamping blocks 5 protrudes outward to form an outer arc face 5a that is in line contact with side walls of the clamping block mounting recesses 202. Clamping faces 5b opposing to the outer arc faces 5a are designed on the clamping blocks 5. The clamping blocks 5 are disposed obliquely, with an included angle between the clamping faces 5b and the end faces of the bolts 4 being 25-35 degrees. The clamping faces 5b on the inner sides of the clamping blocks 5 are closely fitted with the side wall of one side of the positioning grooves 101. Clamping block protrusion layers are provided on the clamping faces 5b. A distance from a contact point of the bolts 4 with the clamping blocks 5 to a contact point of the outer arc faces 5a with the side walls of the clamping block mounting recesses 202 in a horizontal direction is greater than a distance from the contact point of the outer arc faces 5a with the side walls of the clamping block mounting recesses 202 to a contact point of the clamping blocks 5 with the positioning grooves 101 in the horizontal direction. An inner concave face 204 is provided on one side of the main body 2a opposing to the trunnion 201, inner arc faces 205 (see Fig. 3) transitioned to the clamping block mounting recesses 202 are separately provided on

two sides of the inner concave face 204, and inner arc face protrusion layers are provided on the inner arc faces 205. The cross section of the cylinder body is rectangular, a cylinder bore 106 is located in the center of the cylinder body, and fillets 102 fitted with the inner arc faces 205 are provided in corners of the cylinder body 1, so that the inner arc faces 205 are closely fitted with the fillets 102 of the cylinder body when the trunnion supports are secured to the cylinder body of a cylinder. A depression portion 207 is provided in the middle of the inner concave face 204. Buffer holes 103 axially extending along the cylinder body are further formed in the corners of the cylinder body 1, and the shaft axes of the buffer holes 103 and the shaft axes of the fillets 102 are on a same axis. Each of the trunnion supports 2 has two parallel positioning holes 203 on the bottom of each of the positioning ends 2b. The positioning holes of the trunnion supports 2 on two sides are opposite to each other. Pillars 3 fitted with the positioning holes 203 are provided on the trunnion supports 2 on two sides of the cylinder body 1. The positioning holes 203 are pin holes while the pillars 3 are positioning pins, and the trunnion supports 2 on the two sides are connected via the positioning pins.

[0019] In this embodiment, the cross section of each of the clamping blocks 5 is semicircular, the semicircular arc faces of the clamping blocks form the outer arc faces 5a in line contact with the side walls of the clamping block mounting recesses 202, planes of the clamping blocks opposing to the semicircular arc faces form the clamping faces 5b, and outer planes 5c parallel to the clamping faces are provided in the middle of the outer arc faces (see Fig. 5).

[0020] In this embodiment, the cross section of each of the positioning grooves 101 is triangular; and, a neck 104 is provided on a side face of the cylinder body 1, and the neck 104 is located between the two positioning grooves 101 on the side face of the cylinder body 1 (see Fig. 6).

Embodiment 2

[0021] In Embodiment 2, there are two clamping blocks in the clamping block mounting recesses, and the clamping blocks are arranged in a length direction of the cylinder body 1; and, corresponding to each of the clamping blocks, there is one bolt (see Fig. 4), and the remaining is the same as Embodiment 1.

[0022] Longer clamping blocks may be fastened by two or three bolts, thereby achieving better securing effects. When there are two or three bolts, the bolts 4 are arranged in the length direction of the cylinder body 1.

[0023] In the present invention, during mounting the trunnion supports, two trunnion supports 2 are disposed on two sides of the cylinder body 1, and the two trunnion supports 2 are initially positioned by the positioning pins; the inner concave faces 204 of the trunnion supports are fitted with the outer side face of the cylinder body, and the inner arc faces 205 of the trunnion supports are fitted with the fillets 102 of the cylinder body; then, the clamping blocks 5 are inserted into the clamping block mounting recesses 202, so that the inner sides of the clamping blocks 5 are snapped in the positioning grooves 101 of the cylinder 1 and the clamping faces 5b of the clamping blocks 5 opposing to the outer arc faces 5a are fitted with the side walls of the positioning grooves 101; and then, the bolts 4 act on the outer sides of the clamping blocks 5, so that the trunnion supports 2, the clamping blocks 5 and the cylinder body 1 are locked. In this moment, the clamping faces 5b are relatively inclined, a distance from a contact position of the bolts 4 with the clamping blocks 5 to a contact position of the outer arc faces 5a with the side walls of the positioning grooves 101 in a horizontal direction is greater than a distance from the contact position of the outer arc faces 5a with the side walls of the positioning grooves 101 to a contact position of the clamping blocks 5 with the positioning grooves 101 in the horizontal direction. That is, the arm of force of the acting force is larger than that of a reacting force, thereby forming a labor-saving lever. By the principle of leverage, the acting force exerted by the bolts 4 to the clamping blocks 5 is increased, so that the cylinder body 1 may be clamped by the clamping blocks 5 more firmly. On the other hand, in the present invention, due to the leverage of the clamping blocks, the direction of an extrusion force exerted by the clamping blocks to the cylinder body is directed to one side of the trunnions on the trunnion supports, In this way, an acting force exerted by the trunnion supports to the cylinder body in the present invention does not pass through a cylinder bore in the center of the cylinder. Therefore, the trunnion supports in the present invention have no extrusion to the cylinder bore in the center of the cylinder, and the acting force exerted by the trunnion supports to the cylinder focuses in four corners of the cylinder body of the cylinder. the problem in the prior art that, too large tightening force exerted by the trunnion supports to the cylinder is likely to result in deformation of the cylinder bore in the middle of the cylinder as the cylinder body of the cylinder is stressed and the normal operating of the cylinder is thus influenced, may be solved. In addition, the clamping block protrusion layers and the inner arc face protrusion layers may be protruded particles, toothed stripes or other antiskid structures. Thus, the friction between the clamping faces 5b and the positioning grooves 101 and bolts 4, as well as the friction between the inner arc faces 205 and the cylinder body 1, is increased, and the clamping reliability of the trunnion supports 2 is further improved.

[0024] In addition to the above embodiments, within the scope disclosed by the claims and description of the present invention, the technical characteristics or technical data of the present invention may be reselected and combined to form new embodiments. Those implementations not described in details in the present invention may be readily realized by those skilled in the art without any creative efforts, so those implementations not described in details shall be regarded as specific embodi-

ments of the present invention to fall into the protection scope of the present invention.

Claims

1. A cylinder trunnion supporting structure, **characterized in that** the cylinder trunnion supporting structure comprises trunnion supports (2) separately disposed on two sides of a cylinder body (1); each of the trunnion supports (2) comprises a main body (2a) and two positioning ends (2b) located at two ends of the main body (2a) and arranged in a same direction; a trunnion (201) is provided on the top of the main body (2a); clamping block mounting recesses (202), which are parallel to an axial direction of the cylinder body (1), are provided on opposite side faces of the two positioning ends (2b); clamping blocks (5), which are capable of rotating with respect to the clamping block mounting recesses (202), are provided in the clamping block mounting recesses (202); positioning grooves (101) fitted with inner sides of the clamping blocks (5) are provided on the cylinder body (1); bolts (4) acting on outer sides of the clamping blocks (5) are provided on the trunnion supports (2); and, one face of each of the clamping blocks (5) protrudes outward to form an outer arc face (5a) that is in line contact with side walls of the clamping block mounting recesses (202).

2. The cylinder trunnion supporting structure according to claim 1, **characterized in that** a distance from a contact point of the bolts (4) with the clamping blocks (5) to a contact point of the outer arc faces (5a) with the side walls of the clamping block mounting recesses (202) in a horizontal direction is greater than a distance from the contact point of the outer arc faces (5a) with the side walls of the clamping block mounting recesses (202) to a contact point of the clamping blocks (5) with the positioning grooves (101) in the horizontal direction.

3. The cylinder trunnion supporting structure according to claim 1 or 2, **characterized in that** an inner concave face (204) is provided on one side of the main body (2a) opposing to the trunnion (201), and inner arc faces (205) transitioned to the clamping block mounting recesses (202) are separately provided on two sides of the inner concave face (204); the cross section of the cylinder body is rectangular, and fillets (102) fitted with the inner arc faces (205) are provided in corners of the cylinder body (1), so that the inner arc faces (205) are closely fitted with the fillets (102) of the cylinder body when the trunnion supports are secured to the cylinder body of a cylinder; and a depression portion (207) is provided in the middle of the inner concave face (204).

4. The cylinder trunnion supporting structure according to claim 1, 2 or 3, **characterized in that** clamping faces (5b) opposing to the outer arc faces (5a) are designed on the clamping blocks (5); the clamping blocks (5) are disposed obliquely with an included angle between the clamping faces (5b) and the end faces of the bolts (4) being of from 25 to 35 degrees; the clamping faces (5b) on the inner sides of the clamping blocks (5) are closely fitted with the side wall of one side of the positioning grooves (101); and, clamping block protrusion layers are provided on the clamping faces (5b).

5. The cylinder trunnion supporting structure according to claim 3 or 4, **characterized in that** inner arc face protrusion layers are provided on the inner arc faces (205).

6. The cylinder trunnion supporting structure according to any of claims 1 to 5, **characterized in that** the trunnion supports (2) have opposite positioning holes (203) on the bottoms of the positioning ends (2b), respectively; pillars (3) fitted with the positioning holes (203) are provided on the trunnion supports (2) on two sides of the cylinder body (1); and, the positioning holes (203) are pin holes while the pillars (3) are positioning pins, and the trunnion supports (2) on the two sides are connected via the positioning pins.

7. The cylinder trunnion supporting structure according to any of claims 3 to 6, **characterized in that** buffer holes (103) axially extending along the cylinder body (1) are formed in the corners of the cylinder body (1), and the shaft axes of the buffer holes (103) and the shaft axes of the fillets (102) are on a same axis.

8. The cylinder trunnion supporting structure according to any of claims 1 to 7, **characterized in that** the cross section of each of the positioning grooves (101) is triangular; and, a neck (104) is provided on a side face of the cylinder body (1), and the neck (104) is located between the two positioning grooves (101) on the side face of the cylinder body (1).

9. The cylinder trunnion supporting structure according to any of claims 1 to 8, **characterized in that** the cross section of each of the clamping block mounting recesses (202) is rectangular while the cross section of each of the clamping blocks (5) is semicircular, the semicircular arc faces of the clamping blocks form the outer arc faces (5a) in line contact with the side walls of the clamping block mounting recesses (202), and planes of the clamping blocks opposing to the semicircular arc faces form the clamping faces (5b).

10. The cylinder trunnion supporting structure according

to any of claims 1 to 9, **characterized in that** there are one to three clamping blocks (5) in the clamping block mounting recesses (202), and the clamping blocks (5) are arranged in a length direction of the cylinder body (1) when there are two to three clamping blocks (5) therein; and, corresponding to each of the clamping blocks, there are one to three bolts (4), and the bolts (4) are arranged in the length direction of the cylinder body (1) when there are two to three bolts (4).

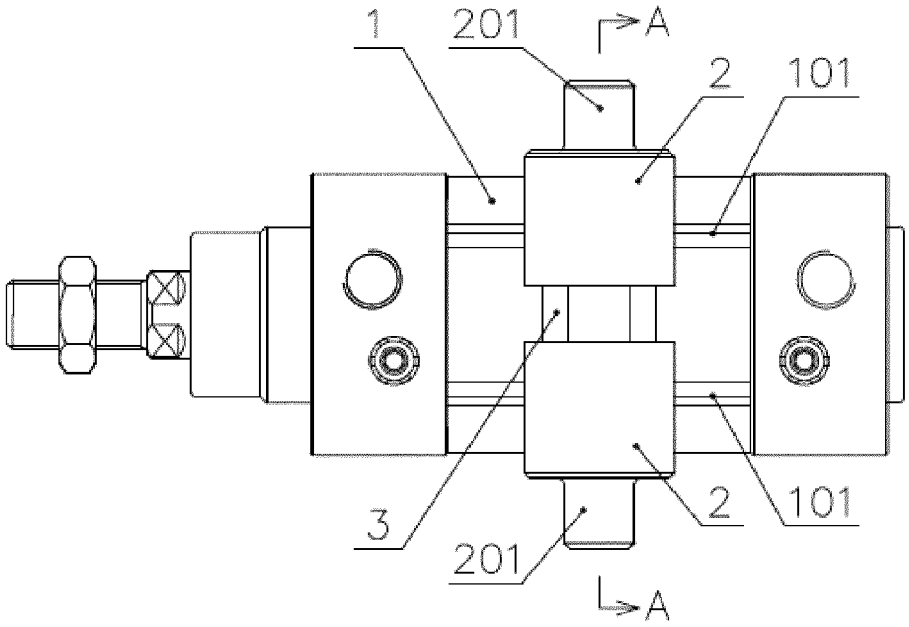
1
201
A
2
101
3
2
101
201
A

Fig. 1

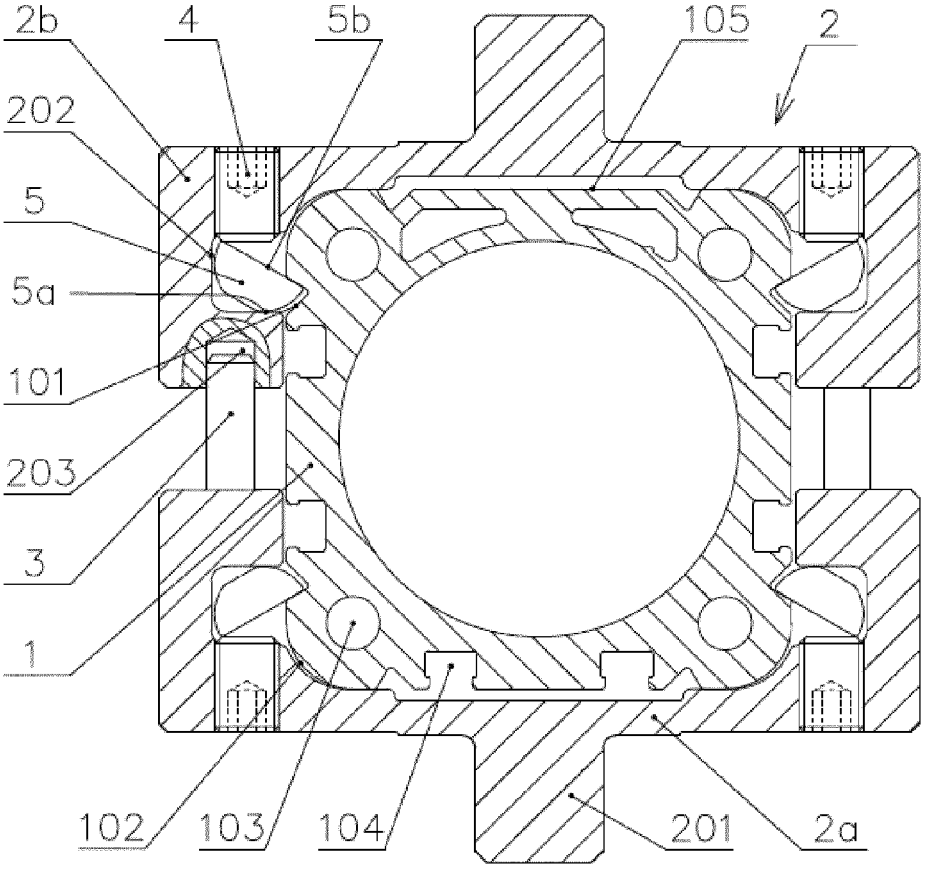
2b
4
5b
105
2
202
5
5a
101
203
3
1
102
103
104
201
2a

Fig.2

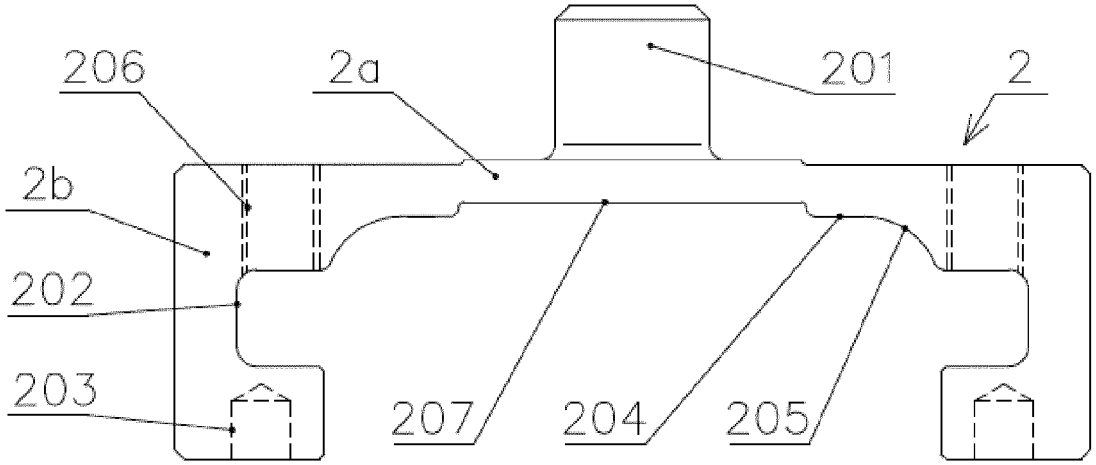

Fig. 3

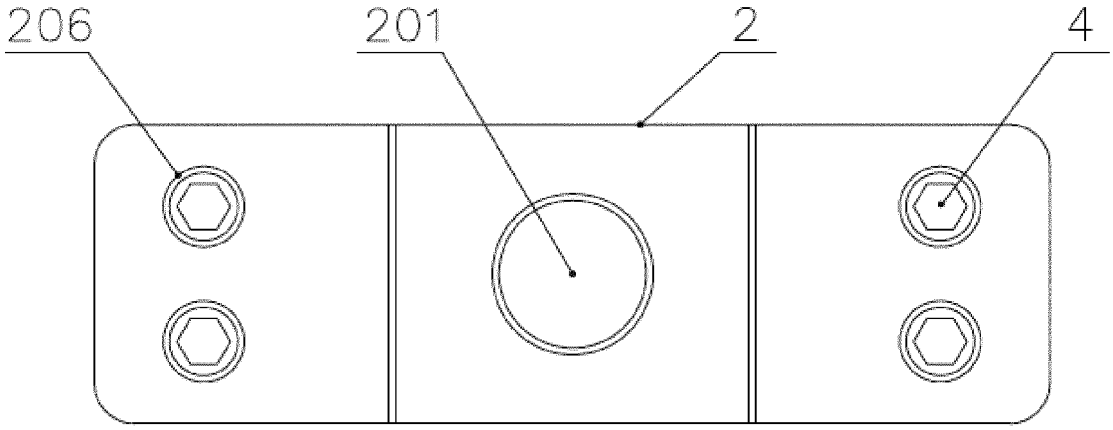

Fig. 4

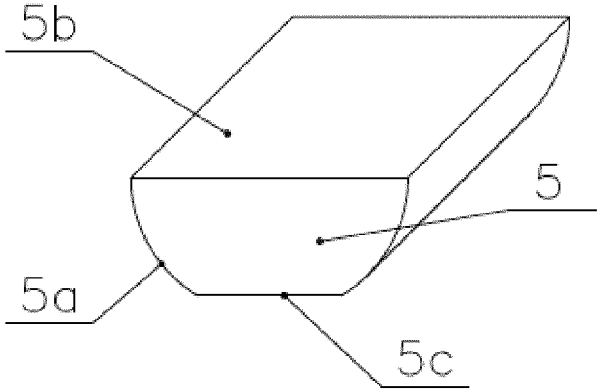

Fig. 5

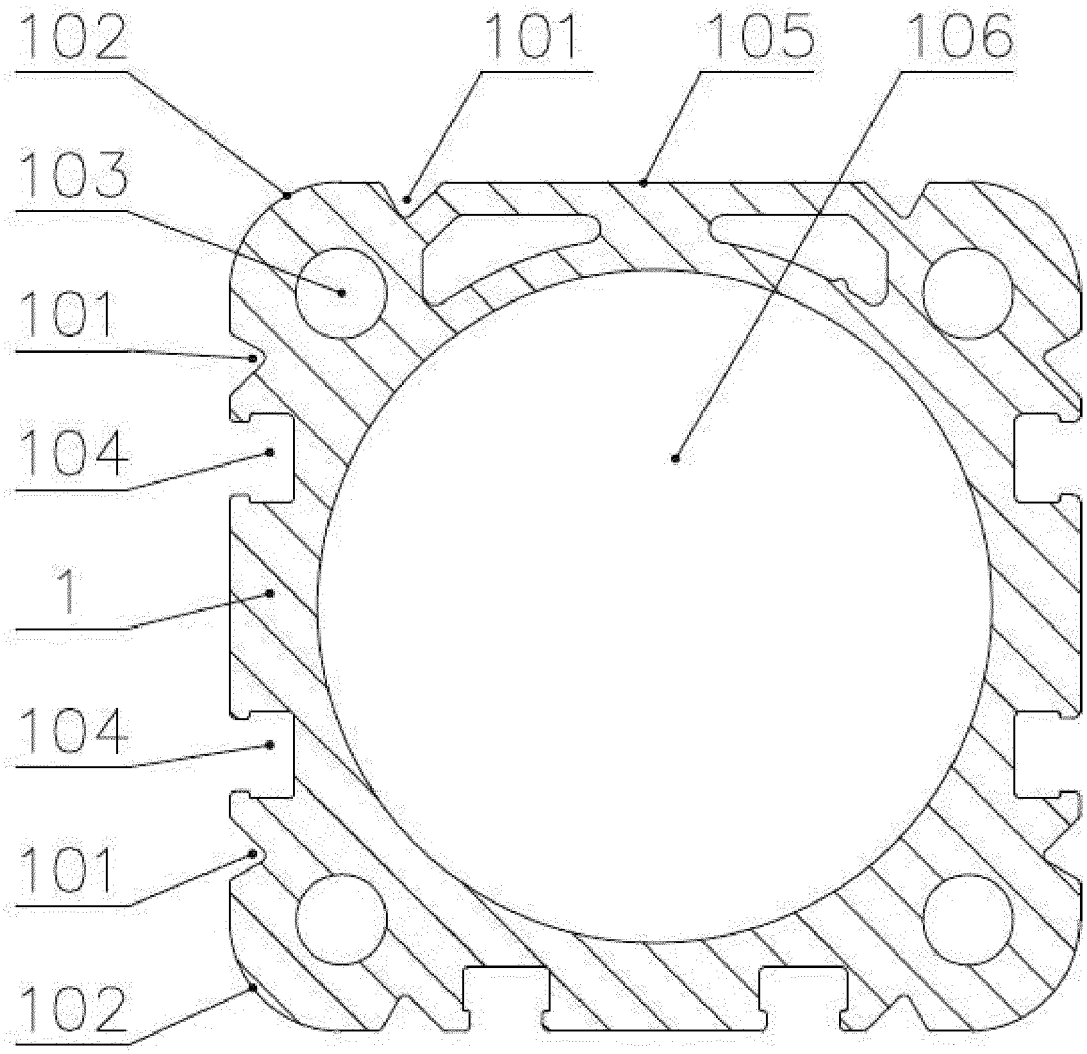

Fig. 6

Europäisches Patentamt
European Patent Office
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EUROPEAN SEARCH REPORT

Application Number
EP 14 18 9497

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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Place of search	Date of completion of the search	Examiner
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