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(54) Title: BRAKE CYLINDER

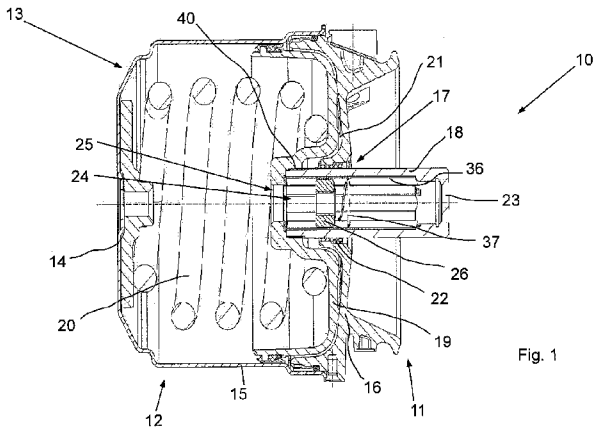

Fig. 1

(57) Abstract: The present invention relates to a spring-type brake cylinder, particularly combined service and parking brake cylinder (10), having a compression spring, a pressure chamber (21) and a dividing wall (19) between compression spring and pressure chamber (21), with a piston (18) in the pressure chamber (21) and an opening (17) in a wall of the pressure chamber (21), the piston (18) extending through the opening (17), wherein the piston (18) is hollow and has an inner wall (36) and a bottom (23), inside the piston (18) a nut (26) is held on a release bolt (27) and the piston (18) has guiding means for guiding the nut (26), such that the nut (26) cannot be rotated in the piston (18) and the nut (26) is moveable in longitudinal direction of the piston (18), and wherein inside the piston (18) is a supporting means for butting against the nut (26) while the release bolt (27) is screwed into the nut (26). According to the invention the piston (18) has at least a first holding means and a second holding means, the first holding means holds the supporting means in an assembly position, and the second holding means holds the supporting means in a drive position, wherein the drive position is closer to the bottom (23) than the assembly position, and wherein the supporting means is moveable from the assembly position to the drive position by a movement of the nut (26) relative to the piston (18).

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Brake cylinder

Description

The present invention relates to spring-type brake cylinders, particularly combined service and parking brake cylinder, especially to spring-type brake cylinders for pneumatic brakes for commercial vehicles. The invention further relates to brakes with a spring-type brake cylinder.

Pneumatic brakes for commercial vehicles are well-known, for example as disc brakes, drum brakes, wedge brakes, cam brakes or other type of brakes. In a pneumatic brake a housing of a brake cylinder is attached to a housing of a brake calliper and applies a brake actuation force through a cylinder plunger to a lever within the housing of calliper.

A spring-type brake cylinder is provided with a compression spring, a pressure chamber and a dividing wall between compression spring and pressure chamber, with a piston in the pressure chamber and an opening in a wall of the pressure chamber, the piston extending through the opening. The piston is hollow, connected to the dividing wall and has an outer wall, an inner wall and a bottom. Inside the piston a nut is held on a release bolt and the piston has guiding means for guiding the nut, such that the nut cannot be rotate in the piston and the nut is moveable in longitudinal direction of the piston. The release bolt further extends through an opening in a head of the brake cylinder and through an opening in the dividing wall. Inside the piston is a supporting means for butting against the nut while the release bolt is screwed into the nut. The supporting means are only needed for the assembly of the brake cylinder. Once the brake cylinder has been completed, particularly when the brake cylinder is operating the supporting means should be inoperative and/or hidden.

It is an object of the invention to provide a brake cylinder with inoperative and/or hidden supporting means when the brake cylinder is operating.

This object is achieved by providing a brake cylinder with the features of claim 1. The piston has at least a first holding means and a second holding means, the first holding means holds the supporting means in an assembly position, and the second holding means holds the supporting means in a drive position. The drive position is closer to the bottom than the assembly position. The supporting means is moveable from the assembly position to the drive position by a movement of the nut relative to the piston. In the drive position the second holding means is holding the supporting means safely.

In a first use of the completed brake cylinder the pressure chamber will be inflated with compressed air, the dividing wall together with the piston will be moved toward the release bolt. Hence the nut provided at the end of the release bolt will push the supporting means from the assembly position into the drive position close to the bottom of piston or at the bottom. Once the pressure chamber has been deflated the supporting means is positioned away from the nut. The supporting means does not affect the function of the compression spring that is acting against the dividing wall. Furthermore the piston could be short since the supporting means does not need much space in its drive position.

In one aspect of the invention, the piston has on its inner wall a first cavity, at least part of the supporting means is held in the assembly position in the first cavity, and the first cavity is particularly a circumferential groove or a group of grooves. A cavity or groove is easy to manufacture. The first cavity is acting as the first holding means.

In a further aspect of the invention, the cavity, particularly the groove, is provided with a wall butting against the supporting means, the wall is provided obliquely, namely with an obtuse angle between the oblique wall and the

adjoining inner wall of piston. Part of the supporting means is held in the cavity and between the walls of cavity. The oblique wall allows a move of the supporting means into the drive position depending on the angle of the oblique wall and the force acting on the dividing wall by inflating the pressure chamber. The angle should be chosen such that the supporting means still stays in the assembly position when the release bolt is pressed toward the nut while the bolt is screwed into the nut.

In a further aspect of the invention, the piston has on its inner wall a second cavity, at least part of the supporting means is held in the drive position in the second cavity, and the second cavity is particularly a circumferential groove or a goup of grooves. Again, a cavity or groove is easy to manufacture. The second cavity is acting as the second holding means and holds the supporting means in the drive position safely.

In a further aspect of the invention, the drive position is at the bottom of the piston. Hence the length of the piston is fully utilized.

In a further aspect of the invention, the supporting means is elastic, particularly compressible. Forces acting on the supporting means will not destroy the supporting means suddenly and can be calculated carefully. Elastic supporting means could be moved easily from the assembly position to the drive position.

In a further aspect of the invention, the supporting means is plastically deformable. Deformation could help the supporting means to leave the assembly position.

In a further aspect of the invention, the supporting means is a helical spring, a compression spring, a conical spring, a disc, a spring disc, a ring, a snap ring or a washer spring.

The invention also relates to a brake with a brake cylinder as mentioned before.

Further features of the invention will be apparent in the following description and in the claims. Advantageous embodiments of the invention will now be more particularly described with reference to drawings, where

Fig. 1 shows a longitudinal section of one part of a combined brake cylinder in an assembly position,
Fig. 2 shows a detail of Fig. 1 in the assembly position, namely piston and nut for a release bolt and a helical spring as supporting means for the nut,
Fig. 3 shows a longitudinal section according to Fig. 1 in the assembly position but together with an inserted release bolt,
Fig. 4 shows a detail of Fig. 3 in the assembly position, namely the piston and the nut with the release bolt and the helical spring as supporting means for the nut,
Fig. 5 shows a longitudinal section according to Fig. 3 but in a driving position,
Fig. 6 shows a detail of Fig. 5 in the driving position, namely the piston and the nut with the release bolt and the spring as supporting means for the nut,
Fig. 7 shows a detail similar to Fig. 6 in the assembly position, namely the piston and the nut with the release bolt and a spring disc as supporting means for the nut,
Fig. 8 shows a longitudinal section according to Fig. 5 but in a position without pressure in a pressure chamber,
Fig. 9 shows a longitudinal section according to Fig. 8 but in a mechanically released position with partly unscrewed release bolt.

A commercial vehicle has a service brake function and a parking brake function. A pneumatic brake system also needs a brake function in case of pressure loss, namely a pressureless brake or emergency brake. Parking brake could be realized by the pressureless brake function.

Parking brake and service brake can have separate actuators or one combined actuator. Fig. 1 to 9 refers to a combined brake cylinder 10 as an actuator for a pneumatic brake. Of course the actuator could also be provided for a separate

spring brake with a pressureless brake function. The brake cylinder 10 has a service brake part 11 and a parking brake part 12. The parking brake part 12 is on the left side and includes the pressureless brake function. The service brake part 11 is shown incomplete and on the right side of the Figures.

A housing 13 of the parking brake part 12 has a cup-shape with a bottom 14 and a circumferential side wall 15. A cover 16 of the housing 13 is also a bottom of the service brake part 11 and has an opening 17 for a piston 18. Piston 18 is acting as a plunger against a diaphragm (not shown) in the service brake part 11.

In the housing 13 is a cup-shaped dividing wall 19 moveable like a piston from the cover 16, see Fig. 1, to a position close to but still with a distance to the bottom 14, see Fig. 5 and 9. The distance is needed for the volume of a strong helical compression spring, namely a power spring 20.

Between dividing wall 19 and cover 16 a pressure chamber 21 is defined, see Fig. 5,9. Position of dividing wall 19 depends on the pressure in the pressure chamber 21. The pressure acts against the force of the power spring 20.

The piston 18 is mounted on the dividing wall 19 and is moving together with the diving wall 19. A sealing 22 is in the opening 17 and fits with the piston 18. The piston 18 is hollow like a tube but with a closed bottom 23 and an open head 24. The bottom 23 is located in the service brake part 11. The dividing wall 19 has a central opening 25 coaxial and without a gap to the open head 24.

A nut 26 is positioned in the piston 18. The nut 26 is held torque proof but moveable in the longitudinal direction of the piston 18. The piston 18 has a hexagonal inner cross section as a guiding means for the moveable nut 26. The opening 25 is narrower than an outer cross section of the nut 26. As can be seen from Fig. 3 to 9 a release bolt 27 is screwed into the nut 26.

The release bolt 27 has two parts, a thicker part 28 on one hand and a thinner part 29 on the other hand with a length ratio of approximately 3 to 4 (thicker part to thinner part). An external screw thread 30 of the thicker part 28 corresponds to an internal screw thread 31 of a central bore 32 in the bottom 14 of the housing 13 and is screwed into it. An external screw thread 33 of the thinner part 29 corresponds to an internal screw thread 34 of the nut 26. Screw threads 30/31 are counter-rotating to screw threads 33/34. A nut 35 is fixed on the end of thicker part 28, see Fig. 8, 9.

The function of the release bolt 27 will be shown with reference to Fig. 5, 8, 9:

Fig. 5 shows the driving position of the brake cylinder 10. The pressure chamber 21 is inflated with compressed air. Hence the dividing wall 19 compresses the power spring 20 and the piston 18 extends along the pressure chamber 21. The release bolt 27 extends from the bottom 14 far into the piston 18, with the nut 35 on one end outside the bottom 14 and with the moveable nut 26 at the other end of the release bolt 27 inside the piston 18.

Fig. 8 shows a pressureless position of the brake cylinder 10. The pressure chamber 21 is deflated and the power spring 20 is expanded. The dividing wall 19 is moved close to the cover 16 and the piston 18 extends far into the service brake part 11. The parking brake is actuated (not shown).

A mechanically released position is shown in Fig. 9. The release bolt 27 is screwed out of the bottom 14 partially by turning the nut 35 fixed on the bolt 27. As a result and with respect to the counter-rotating screw threads the other nut 26 is moved along the thinner part 29 towards the opening 25 until the nut 26 is butting against edges of the opening 25 and is pushing the dividing wall 19 towards the bottom 14. The power spring 20 is compressed, the piston 18 is moved nearly out of the service brake part 11 into the parking brake part 12 and hence the parking brake has been released.

By assembling the brake cylinder 10 the release bolt 27 and the nut 26 have to bring together. For that reason the nut 26 is positioned in the piston 18 namely in an assembly position according to Fig. 1 and butting against a supporting means. The supporting means is hold at an inner wall 36 of the piston 18. In Fig. 1 to 6 and 8, 9 the supporting means is a conical (helical) compression spring 37, while another supporting means is shown in Fig. 7, namely a spring disc 38. The nut 26 is positioned closer to the opening 25 than to the bottom 23 (of the piston 18) with approximately one quarter of the length of the piston 18 as a distance to the opening 25. The supporting means is held in the piston by first holding means, namely grooves 39 closer to a middle (of length) of the piston 18 than the nut 26. The grooves 39 are provided inside the piston 18 along the hexagonal cross section and define a cross-sectional area or plane. Of course the supporting means have to be placed in the piston 18 before the nut 26 can be moved into the piston 18 since the bottom 23 is closed.

In a next step the piston 18 is fixed on the dividing wall 19, see screw threads 40. Afterwards the release bolt 27 is screwed into the bottom 14 until the thinner part 29 pushes against the nut 26 while the pressure chamber 21 is deflated. An end face 41 of the release bolt 27 nearly flushes with an outer face 42 of the bottom 14. Subsequently the release bolt 27 is screwed out of the bottom 14 for a few turns, and with respect to the counter-rotating screw threads the nut 26 is drawn up on the thinner part 29, see Fig. 3. The pressure chamber 21 is still deflated. The release bolt 27 is screwed out of the bottom 14 until the nut 35 can be fixed at the end of the thicker part 28. The nut 35 is butting against the bottom 14 and the nut 26 is drawn up on the thinner part 29 a little bit more compared to Fig. 3, see Fig. 8. Fig. 8 shows a position after the first actuation of the brake cylinder 10 and during lifetime as well.

By inflating the pressure chamber 21 for the first time the piston 18 is moved towards the bottom 14 and the nut 26 and/or the release bolt 27 pushes the supporting means - the compression spring 37 - from the first holding means into a second holding means at the bottom 23 of piston 18. The second holding

means can be the same as the first holding means or a similar one. In this embodiment the second holding means is a circumferential groove 43 in the inner wall 36 of the piston 18 where the cross section of the piston is circular. Since the supporting means are now held in the second holding means the nut 26 and the release bolt 27 can be moved in axial direction nearly totally without being under pressure of the supporting means.

To allow the movement of the supporting means from the first holding means to the second holding means, the grooves 39 are defined by walls 44 crosswise to the axial direction (and to the inner wall 36) on one hand and oblique walls 45 on the other hand so that the compression spring 37 can slide out of the grooves 39 under pressure of the release bolt 27 or the nut 26 and towards the bottom 23. Oblique walls 45 are closer to the bottom 23 than the crosswise walls 44. Between the oblique walls 45 and the adjoining inner wall 36 is provided an obtuse angle of particularly 100° to 135°. The groove 43 has only crosswise oriented walls to keep the compression spring 37 safely.

The axial length of the compression spring 37 can be very short since the grooves 39 and 43 are far away from each other. The shorter the spring 37 or any other supporting means in axial direction is, the shorter the piston 18 and the brake cylinder 10 can be. A shorter brake cylinder 10 is always advantageous, has less volume, needs less volume around, is stiffer and has less vibrations.

List of designations:

10	Combined brake clinder
11	Service brake part
12	Parking brake part
13	Housing
14	Bottom (of housing)
15	Side wall
16	Cover
17	Opening
18	Piston
19	Dividing Wall
20	Power spring
21	Pressure chamber
22	Sealing
23	Bottom (of Piston)
24	Head
25	Opening
26	Nut (moveable)
27	Release bolt
28	Thicker part
29	Thinner part
30	External screw thread (of thicker part)
31	Internal screw thread (of bottom 14)
32	Central bore
33	External screw thread (of thinner part)
34	Internal screw thread (of nut 26)
35	Nut (fixed on release bolt)
36	Inner wall (of piston)
37	Compression spring
38	Spring disc

39 Grooves
40 Screw threads
41 End face
42 Outer face
43 Groove
44 Crosswise walls
45 Oblique walls

Claims

1. Spring-type brake cylinder, particularly combined service and parking brake cylinder (10),
having a compression spring, a pressure chamber (21) and a dividing wall (19) between compression spring and pressure chamber (21),
with a piston (18) in the pressure chamber (21) and an opening (17) in a wall of the pressure chamber (21), the piston (18) extending through the opening (17),
wherein the piston (18) is hollow and has an inner wall (36) and a bottom (23),
inside the piston (18) a nut (26) is held on a release bolt (27) and the piston (18) has guiding means for guiding the nut (26), such that the nut (26) cannot be rotate in the piston (18), and the nut (26) is moveable in longitudinal direction of the piston (18),
and wherein inside the piston (18) is a supporting means for butting against the nut (26) while the release bolt (27) is screwed into the nut (26),
characterized in that the piston (18) has at least a first holding means and a second holding means, the first holding means holds the supporting means in an assembly position, and the second holding means holds the supporting means in a drive position,
wherein the drive position is closer to the bottom than the assembly position, and wherein the supporting means is moveable from the assembly position to the drive position by a movement of the nut (26) relative to the piston (18).

2. Brake cylinder according to claim 1, characterized in that the piston (18) has on its inner wall (36) a first cavity, at least part of the supporting means is held in the assembly position in the first cavity, and the first cavity is particularly a circumferential groove or a group of grooves (39).

3. Brake cylinder according to claim 2, characterized in that the cavity, particularly the grooves (39), is provided with a wall (45) butting against the supporting means, the wall (45) is provided obliquely, namely with an obtuse

angle between the oblique wall (45) and the adjoining inner wall (36) of piston (18).

4. Brake cylinder according to claim 1 or a further claim, characterized in that the piston (18) has on its inner wall (36) a second cavity, at least part of the supporting means is held in the drive position in the second cavity, and the second cavity is particularly a circumferential groove or a group of grooves (43).

5. Brake cylinder according to claim 1 or a further claim, characterized in that the drive position is at the bottom (23) of the piston.

6. Brake cylinder according to claim 1 or a further claim, characterized in that the supporting means is elastic, particularly compressible.

7. Brake cylinder according to claim 1 or a further claim, characterized in that the supporting means is plastically deformable.

8. Brake cylinder according to claim 1 or a further claim, characterized in that the supporting means is a helical spring, a compression spring (37), a conical spring, a disc, a spring disc (38), a ring, a snap ring or a washer spring.

9. Brake with a brake cylinder (10) according to claim 1 or a further claim.

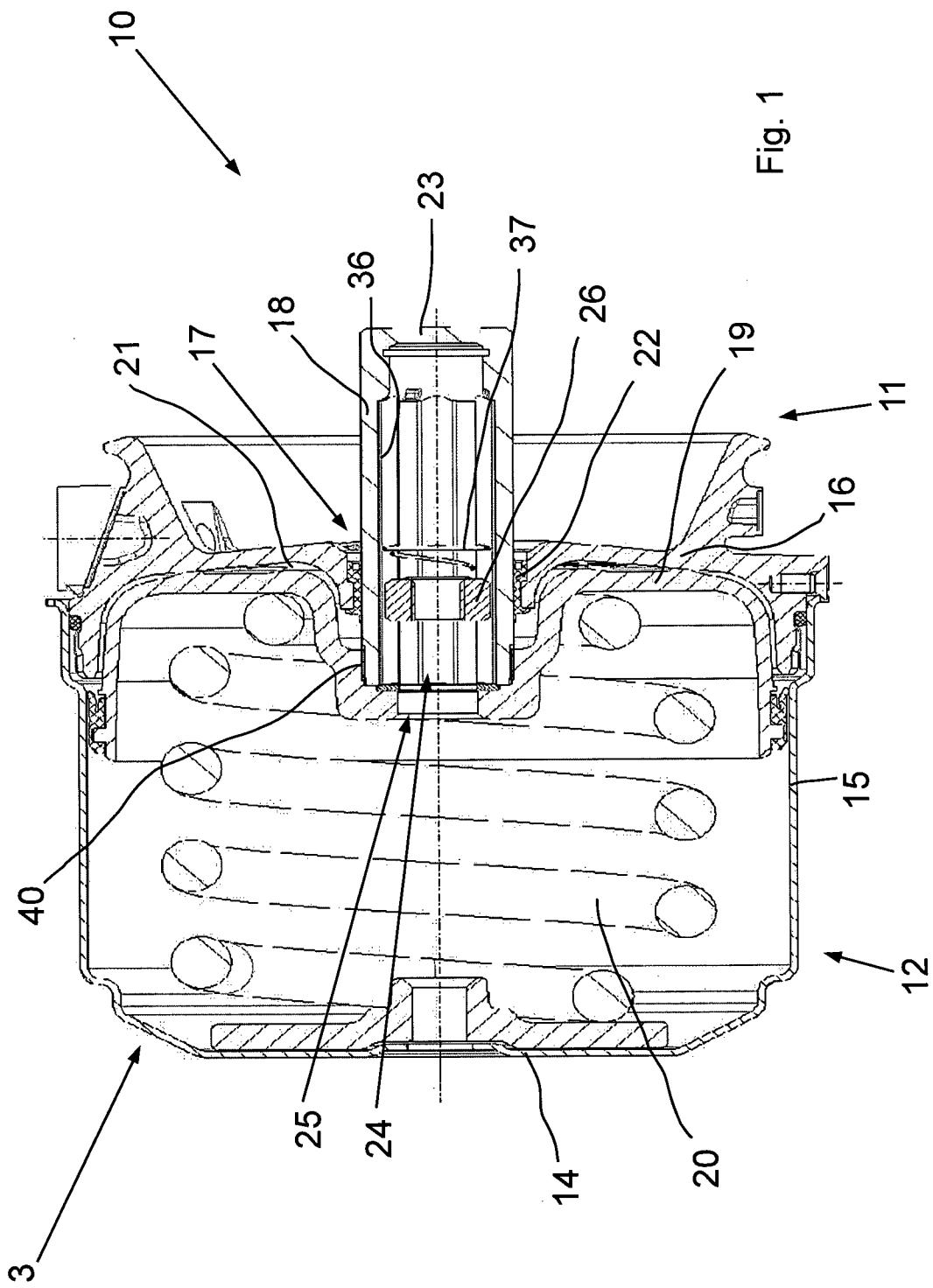

Fig. 1

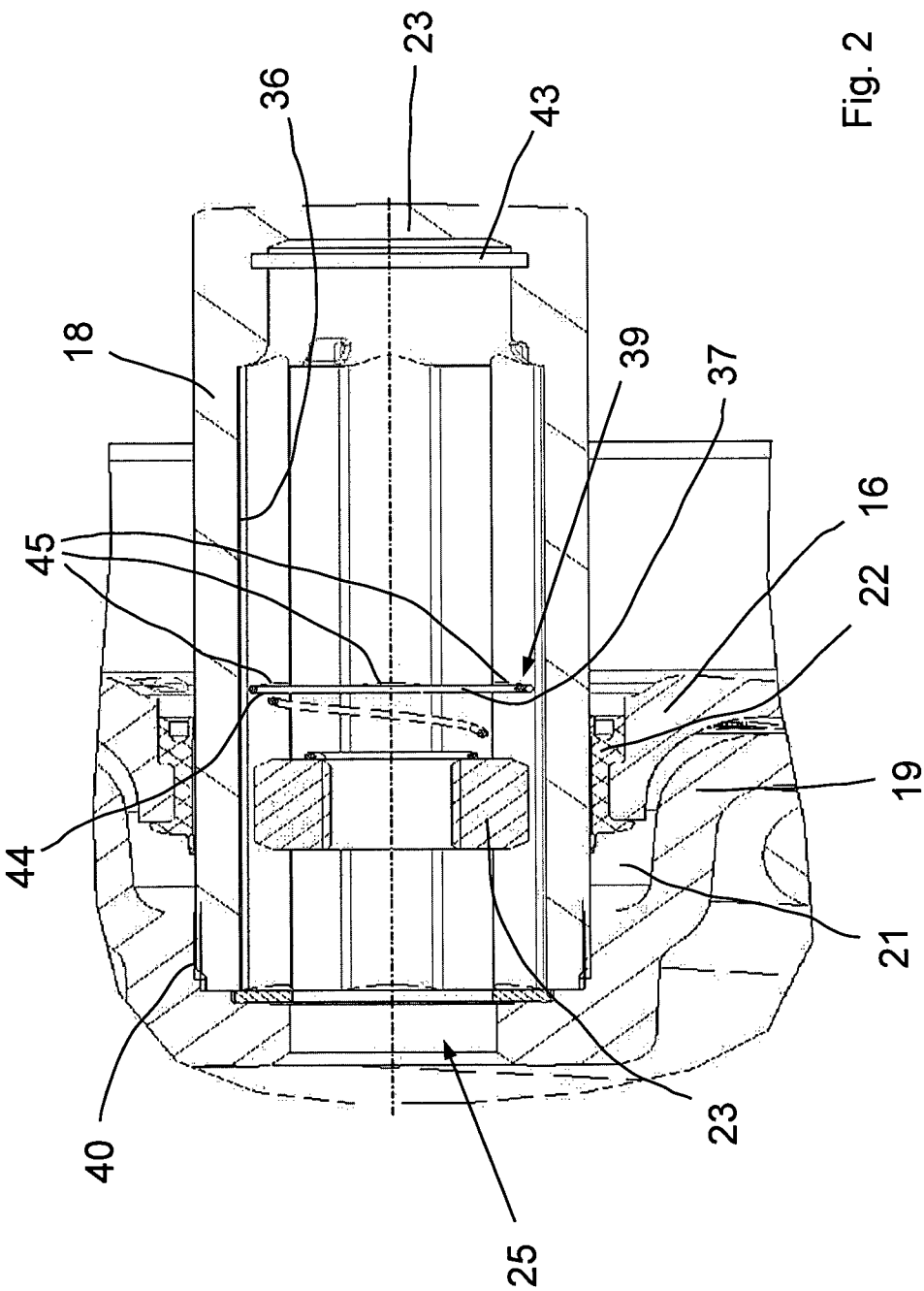

Fig. 2

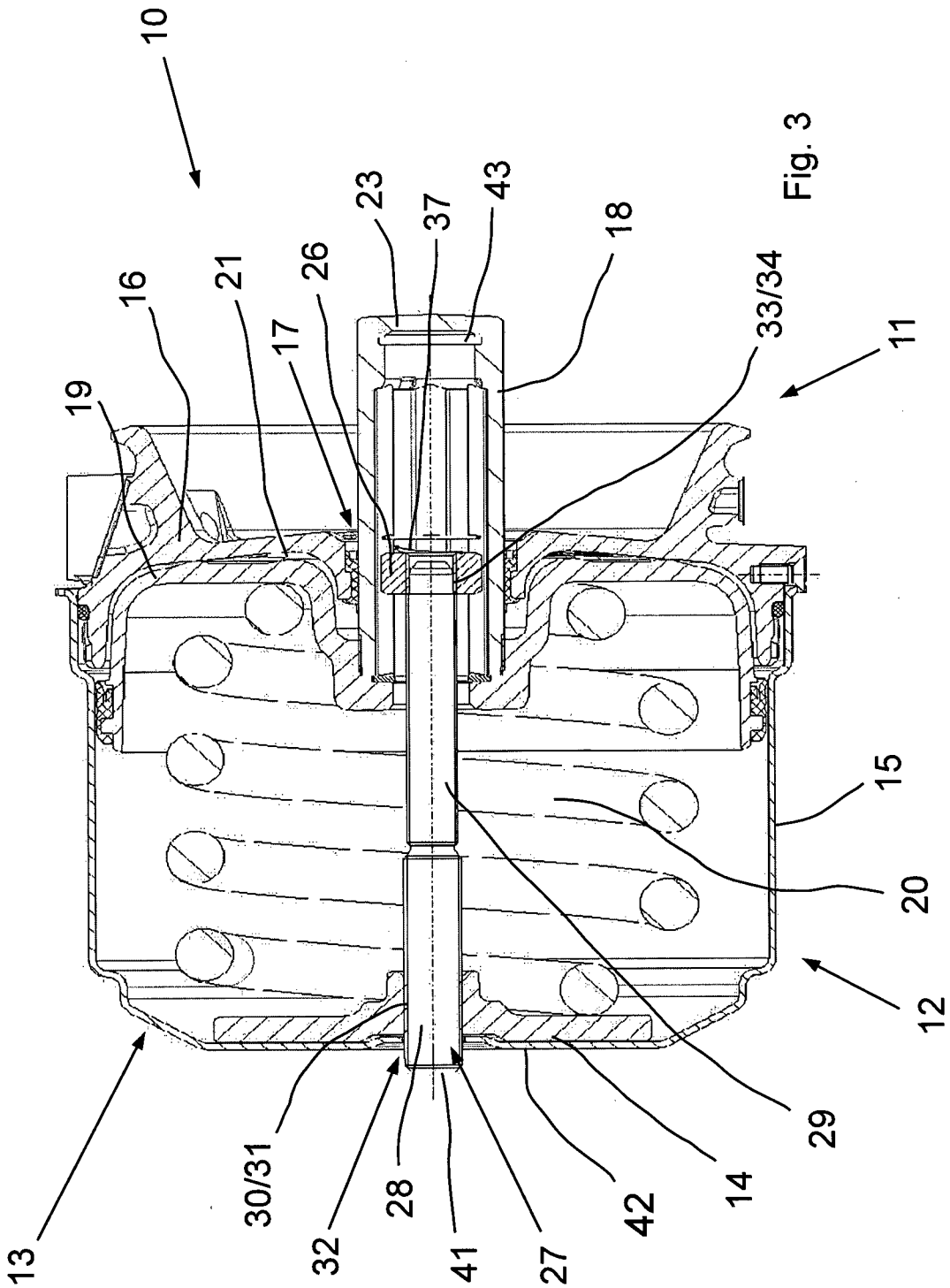
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Fig. 3

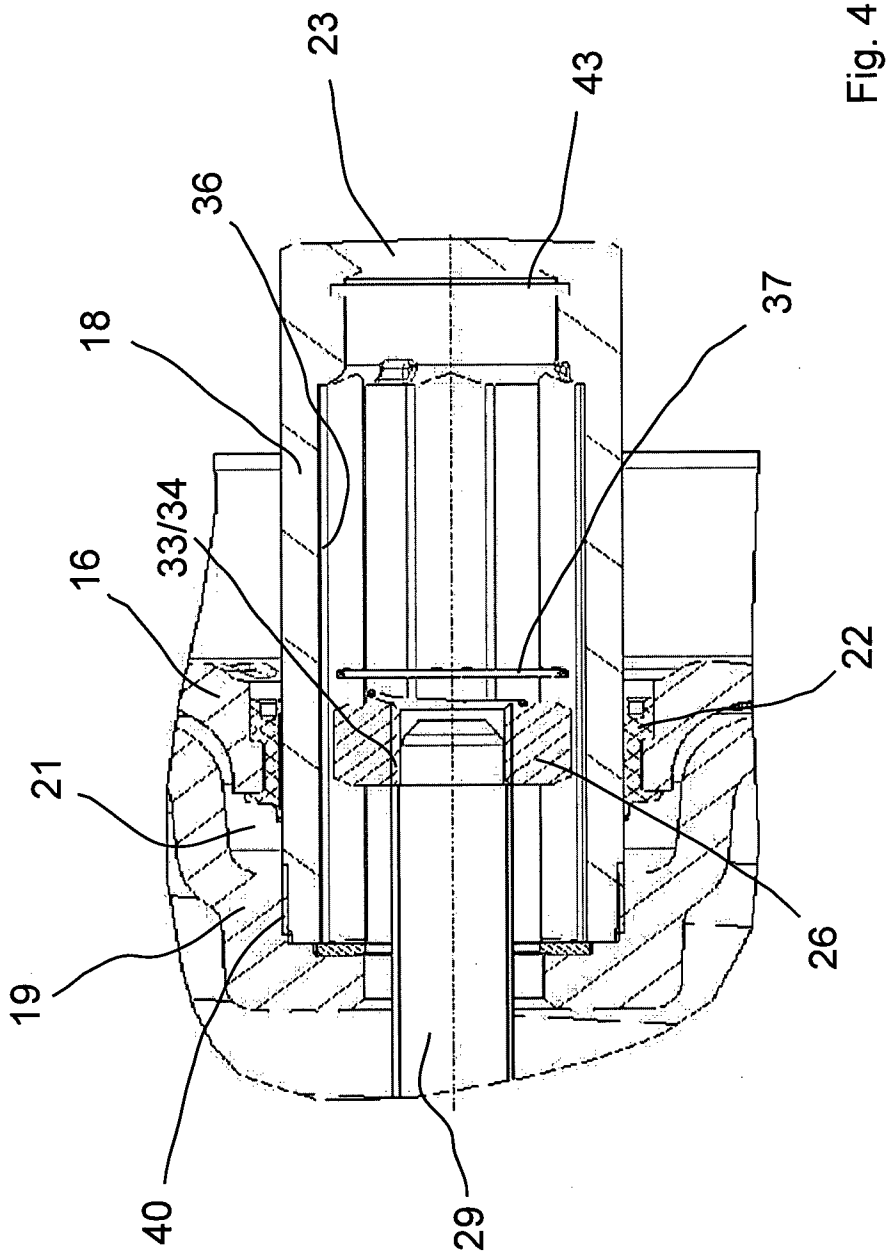


Fig. 4

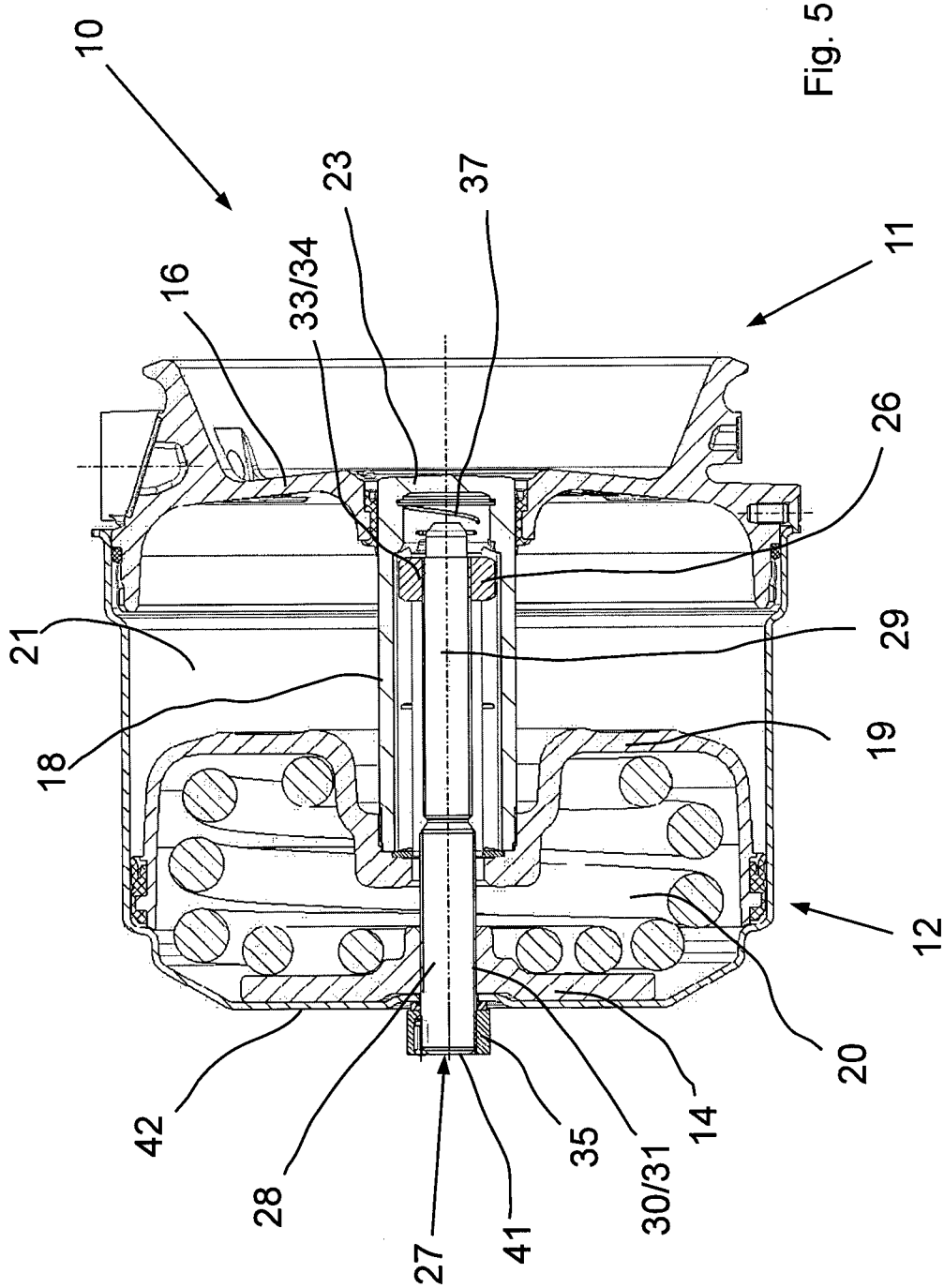


Fig. 5

Fig. 6

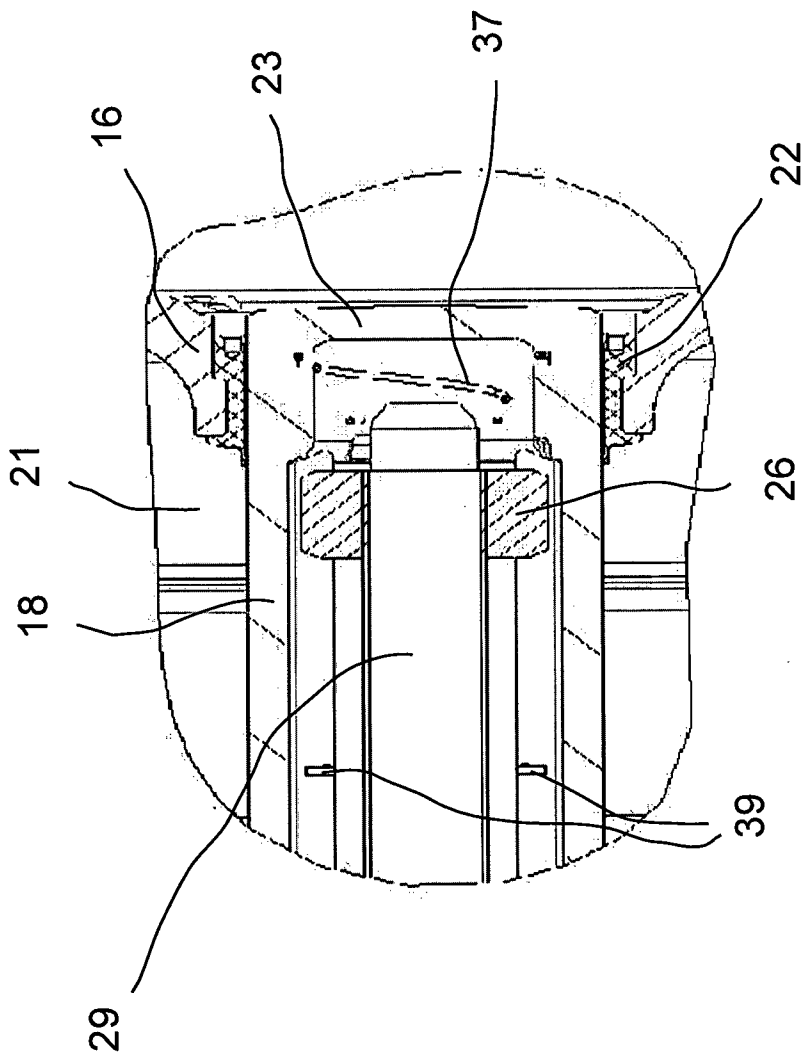
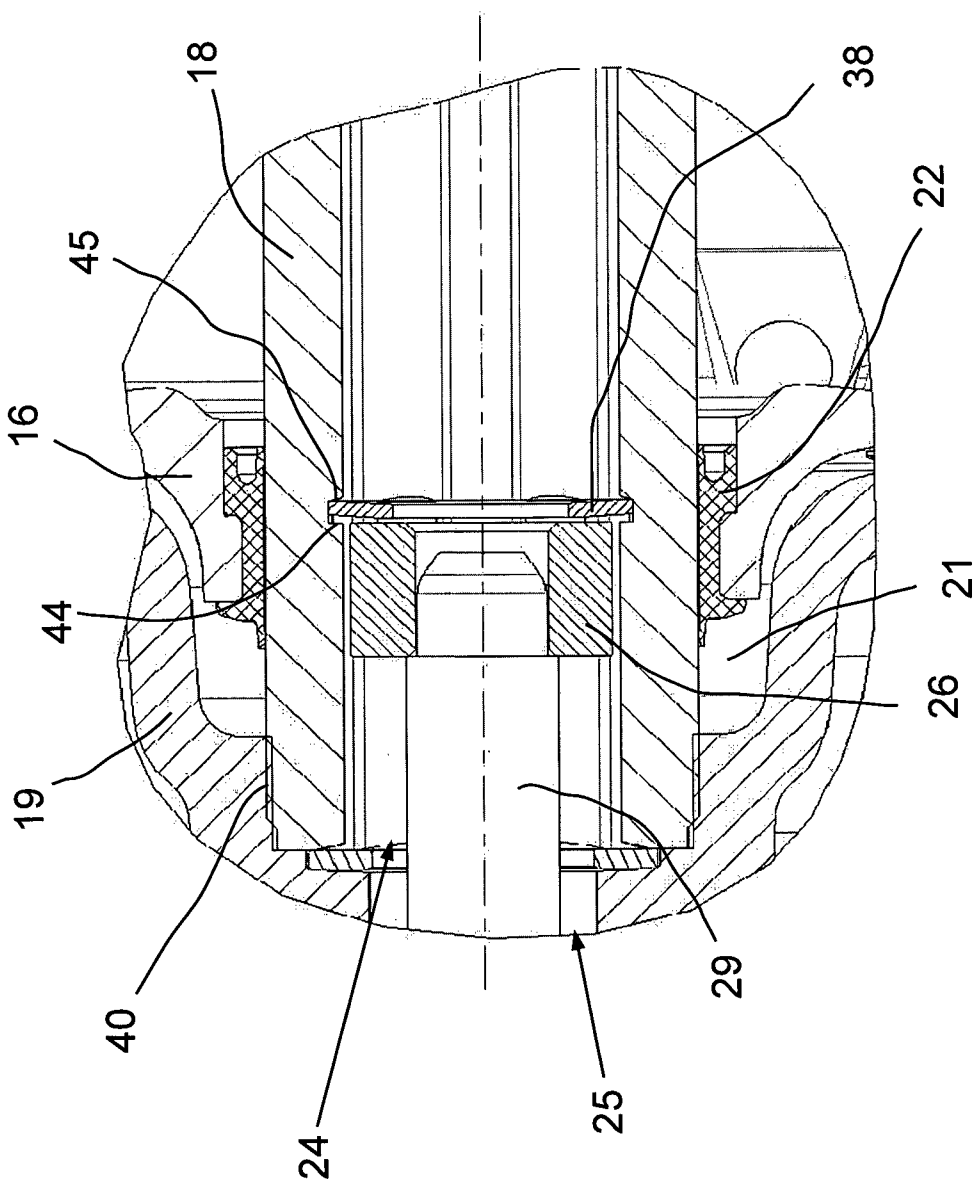


Fig. 7



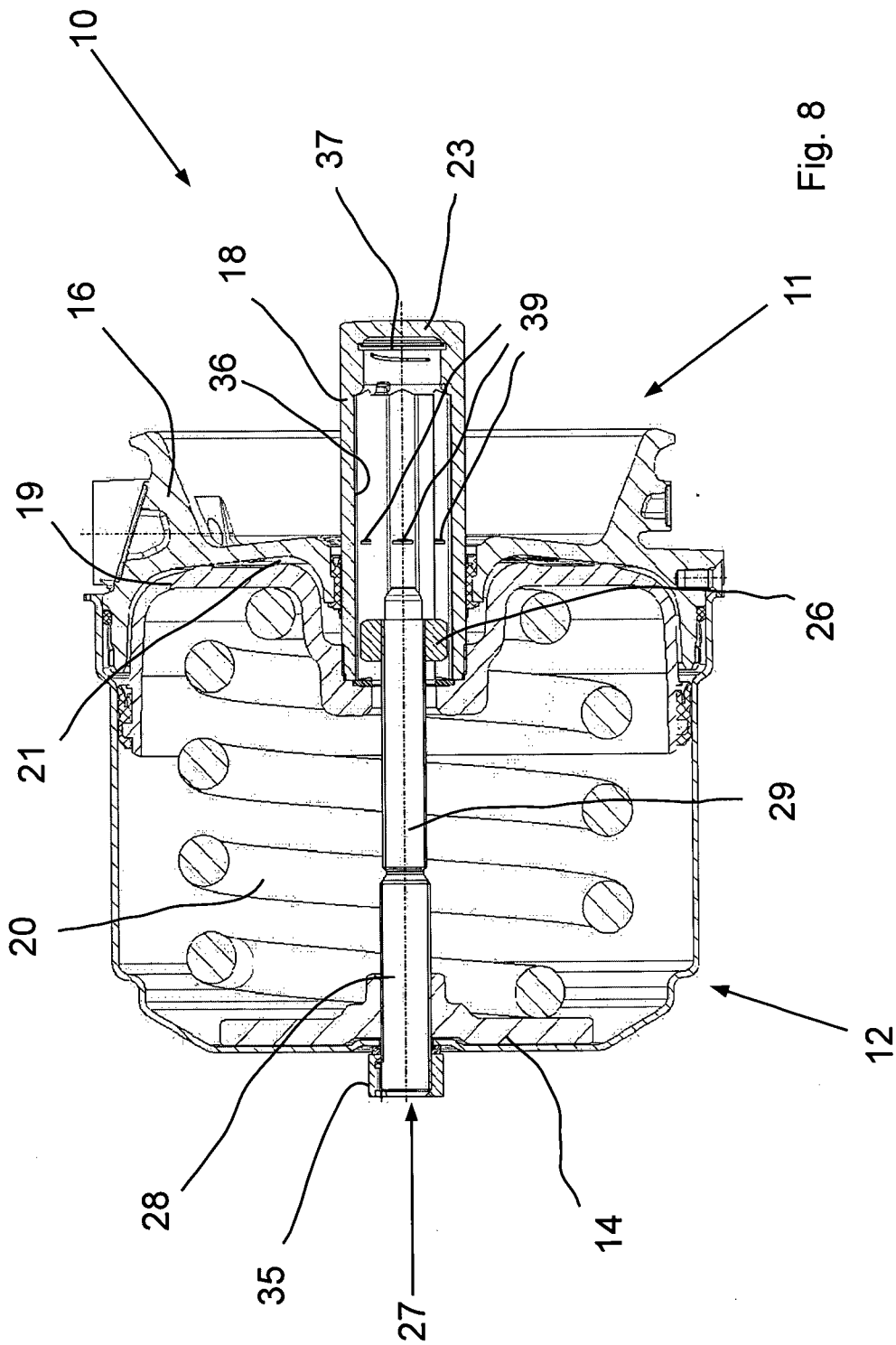


Fig. 8

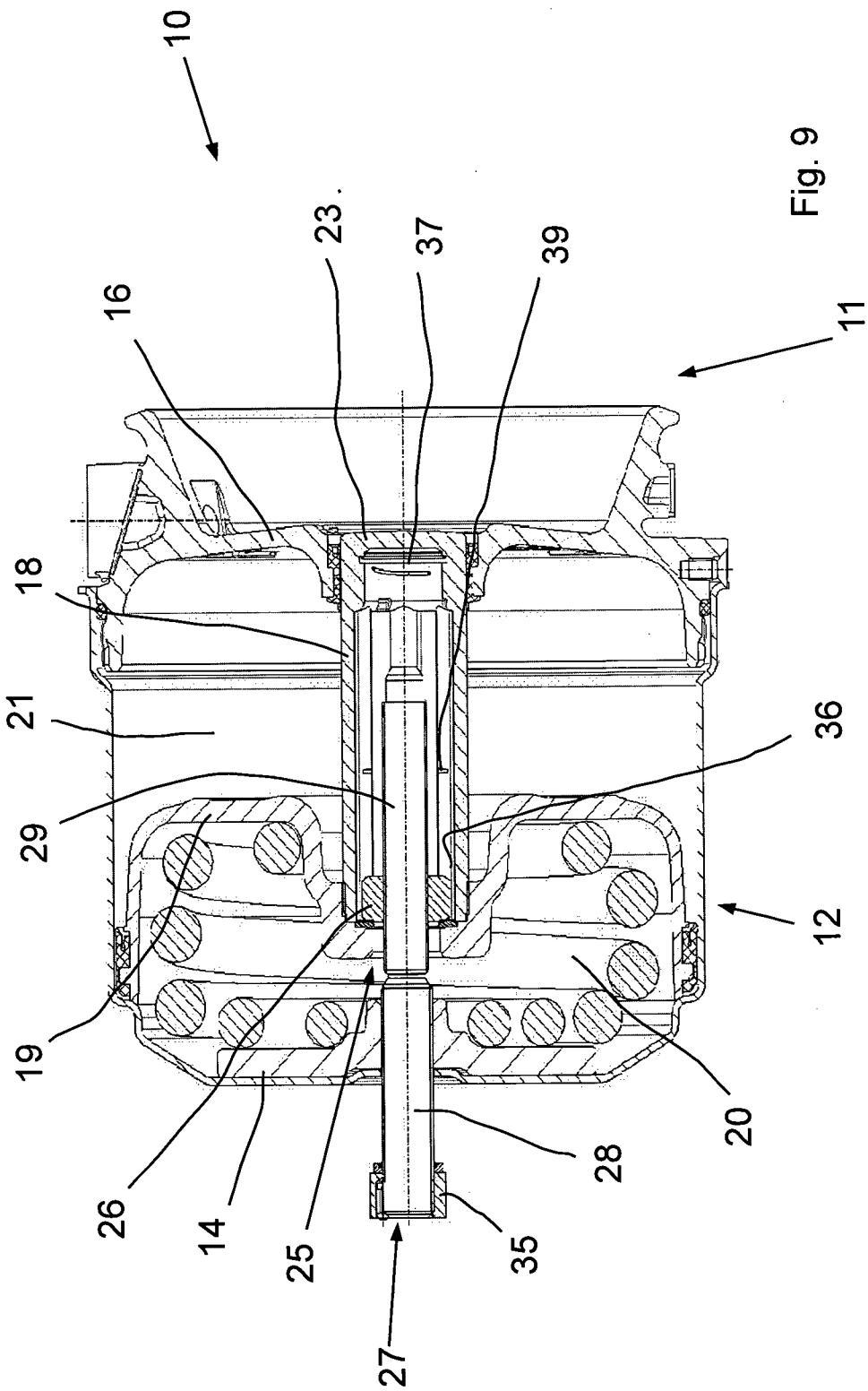


Fig. 9

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2013/003875

A. CLASSIFICATION OF SUBJECT MATTER
INV. B60T17/08
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B60T

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 921 331 A2 (MANNESMANN AG [DE] KNORR BREMSE MRP SYSTEME FUER [DE]) 9 June 1999 (1999-06-09) column 1 - column 6; figure 1 -----	1,9
A	CN 103 318 157 A (NANJING PUZHEN HAITAI BRAKE EQUIPMENT CO LTD) 25 September 2013 (2013-09-25) the whole document -----	1,9

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
19 December 2014	30/01/2015

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Kyriakides, D

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2013/003875

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0921331 A2	09-06-1999	DE 19755896 A1	17-06-1999
		EP 0921331 A2	09-06-1999
		US 6119826 A	19-09-2000
CN 103318157 A	25-09-2013	NONE	