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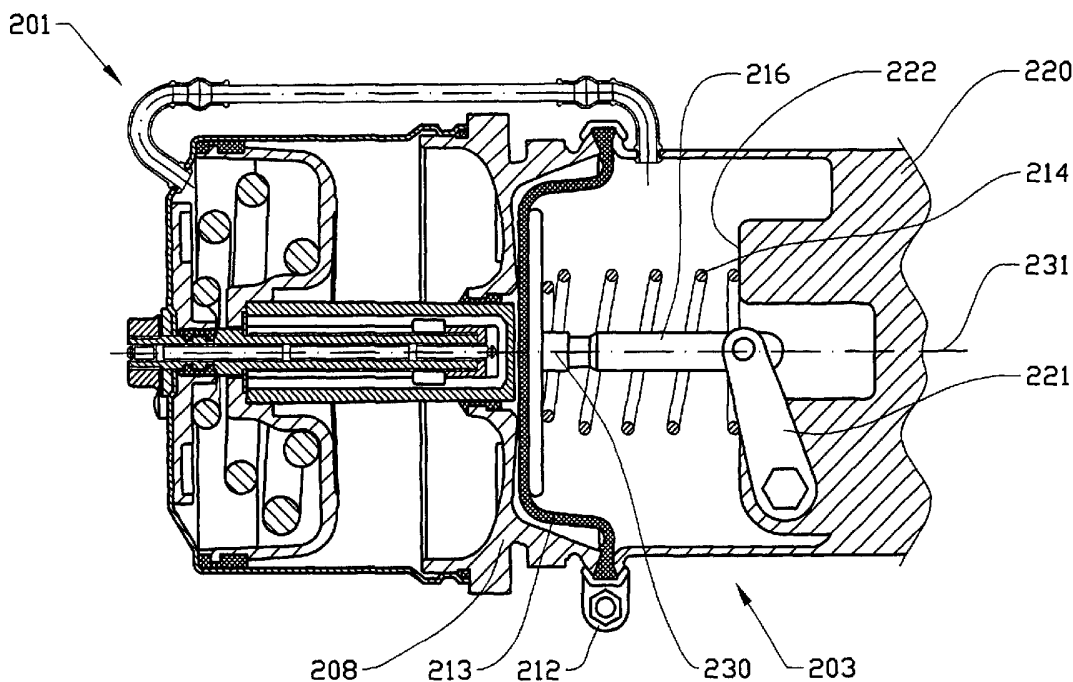
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(54) Title: BRAKE DEVICE FOR A COMPRESSED AIR OPERATED BRAKE



(57) Abstract: The invention relates to a brake device for a vehicle, comprising at least one air-operated brake section and a disc brake caliper, in which the service brake section of the brake device is integrated with the disc brake to form one unit.



WO 03/064232 A1



For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

TITLE: Brake device for a compressed air operated brake.

5 **TECHNICAL SPHERE:**

The present invention relates to a compressed air-operated brake device for a vehicle.

BACKGROUND OF THE INVENTION:

10 A brake arrangement for heavy vehicles currently comprises a brake cylinder, which is fitted to a brake caliper. Brake arrangements for heavy vehicles are air-operated, either directly by air or by means of electrical valves controlling the air to the brake
15 arrangement. The brake cylinder comprises a parking brake section and a service brake section. The parking brake section is used when the vehicle is to be parked, the air in the parking brake section being discharged and a strong spring applying the brake by way of a push rod.
20 The service brake is applied in that air in proportion to the movement of the brake pedal is admitted into a pressure chamber in the service brake section causing a push rod to actuate the brake by way of a lever arm. In the brake caliper is an arrangement which is acted upon
25 by the lever arm so that a brake lining is pressed against a brake disc or brake drum. In most disc brakes the brake caliper has a floating suspension, which means that whilst the brake lining is being pressed against the brake disc on one side, a part of the brake caliper is
30 moving so that a brake lining is simultaneously pressed against the opposite side of the brake disc. The brake cylinder and the brake caliper comprise separate units, which are assembled to form a brake arrangement.

35 Examples of conventional brake cylinders forming part of a brake arrangement for heavy vehicles are to be found, for example, in EP 0 219 613 B2 and DE 2 218 070.

These known brake arrangements have a number of disadvantages. Firstly both the brake cylinder and the brake caliper must be completely protected against dirt and water penetration since they are separate units.

5 Depending on the environment and the stresses to which the brake arrangement is exposed this is both difficult and expensive. In particular the interface between the brake cylinder and the brake caliper, that is to say the push rod and the lever arm, are difficult to seal

10 satisfactorily.

Secondly the brake cylinder is fitted in the brake caliper by just two bolts, since there is no space available for more bolts. This means that the bolted

15 connection is subject to great forces. In particular, forces acting perpendicular to the plane in which the bolts are fitted may be very high, since the brake cylinder is heavy and is exposed to very strong vibrations of up to 30 G, whilst the torque arm is very

20 short in this direction. This means that the connection is uneven loaded. This uneven loading also makes it easier for dirt and water to get inside the brake arrangement. Vibrations furthermore cause the brake cylinder and the brake caliper to move in relation to

25 one another, which also contributes to increased leakage since the seals cannot cope with these movements.

Thirdly the space around the brake arrangement is

30 restricted by, among other things, axles, struts, steering arms etc. This means that it is very difficult to accommodate precisely that brake arrangement which was required, the brake arrangement for which space is found often being a compromise between size and

35 function.

Fourthly the bolted connection is difficult to fit, which places limitations on how the brake cylinder can be angled in relation to the brake caliper. There is an

angular interval in the range from approximately 3° to approximately 70° in which the brake cylinder cannot be fitted to the brake caliper. This restriction means that many different variants of brake arrangements are
5 required in order to suit all vehicle variants.

Fifthly this solution requires a separate return spring for the push rod in the brake cylinder and a separate return spring for the brake caliper lever arm.
10

Sixthly the cost is unnecessarily high since this solution requires more parts than necessary, for example, bolts, springs, seals and additional fitting time.
15

Seventhly the weight is unnecessarily high since this solution requires more parts and more material than necessary.
20

20 SUMMARY OF THE INVENTION:

The object of the invention is therefore to provide a compressed air-operated disc brake device for a heavy vehicle which is cheap, compact and reliable and which contains as few parts as possible.
25

With a brake device for a vehicle, comprising at least one air-operated brake section and a disc brake caliper, the object of the invention is achieved in that the service brake section of the brake device is integrated
30 with the disc brake caliper to form one unit. This first embodiment of the brake device according to the invention thus provides a brake device that is constructed as one unit. The advantage to this is that high reliability is combined with a compact construction.
35

In a first development of the brake device according to the invention the service brake section of the brake device is fitted at an angle to the disc brake caliper.

The advantage to this is that the brake device can be adapted to the position in which it is to be fitted.

In a second development of the brake device according to
5 the invention the brake device comprises an intermediate
section which is fitted between the service brake section
and the disc brake caliper. The advantage to this is that
the intermediate section can be used in order to adapt
10 the brake device to the position in which the brake
device is to be fitted. This means that all brake devices
can use the same service brake sections and disc brake
calipers and that the adaptation is made with the
intermediate section.

15 BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be described in more detail below with
reference to exemplary embodiments shown in the drawings
attached, in which

20 FIG 1 shows a cross section through a known brake
device,
FIG 2 shows a cross section through a first
advantageous embodiment of a brake device
according to the invention,
25 FIG 3 shows a cross section through a second
advantageous embodiment of a brake device
according to the invention, and
FIG 4 shows a cross section through a development of
the brake device according to Fig. 3.

30

DESCRIPTION OF EXEMPLARY EMBODIMENTS

The exemplary embodiments of the invention and
developments described below must be regarded only as
examples and in no way limit the scope of the patent
35 claims. In the exemplary embodiments here described the
same reference numbers in the various figures relate to
the same type of part. For this reason not every part is
described in detail in all exemplary embodiments.

Fig. 1 shows a conventional brake cylinder 101, which is known to the person skilled in the art. The brake cylinder 101 is compressed air-operated. It comprises a parking brake section 102 and a service brake section 5 103. The parking brake section 102 comprises a strong compression spring 104 and a brake spring piston 105. The brake spring piston 105 acts on a push rod 106. When the parking brake is applied, the air is expelled from the pressure chamber 107 with the result that the spring 104 10 acts on the piston 105 and hence on the push rod 106. The push rod 106 is forced out of the parking brake section so that the brake can be applied in a known manner.

The service brake section 103 comprises a rear 15 cylindrical housing 108 and a front cylindrical housing 109. The rear cylindrical housing 108 also extends up to and in certain cases may also include the parking brake section. The front cylindrical housing 109 comprises two fitting bolts 110 and a push rod seal 111. The front 20 cylindrical housing 109 and the rear cylindrical housing 108 are fitted together by a clamp connection 112. The service brake diaphragm 113 is also fastened between the front cylindrical housing 109 and the rear cylindrical housing 108. The service brake section furthermore 25 comprises a return spring 114, a push rod bellows 115 and a push rod 116 fixed to a pressure plate 117. The front cylindrical housing 109 is fixed to a brake caliper (not shown), intended for a disc brake or a drum brake, by means of the two fitting bolts 110. The service brake 30 section also contains a pressure chamber 119, which is filled with air when the service brake is applied. The parking brake section 102 and service brake section 103 are connected by a pressure equalizing duct 118.

35 A first exemplary embodiment of the brake device according to the invention 201 is shown in Fig. 2. The brake device comprises a brake caliper, which is intended for use on disc brakes, in which the brake pistons are operated mechanically by way of a push rod and a lever

arm. In this exemplary embodiment the brake cylinder 201 is integrated with the brake caliper 220, that is to say the front cylindrical housing 109 is replaced by an elongate brake caliper. The brake caliper 220 is fixed to the rear cylindrical housing 208 by a clip connection 212 in the same way as has been shown above. The brake caliper 220 and the rear cylindrical housing 208 can be fitted so that the central axis 230 of the brake caliper and the central axis 231 of the rear cylindrical housing form an angle. This angle is between 0 and 90 degrees. The diaphragm 213 is also the same as is shown above. The push rod 216 in this exemplary embodiment acts directly on a brake lever arm 221, which is situated in the brake caliper 220 and which in turn applies the brake pads against the brake disc (not shown) in a known manner. The push rod 216 may either be suitably fixed to the brake lever arm 221, for example by means of a cotter pin as shown in Fig. 2, or may bear against the brake lever arm. The return spring 214 (here shown in schematic form) bears against a wall 222 in the brake caliper 220 rather than the inside wall in the front cylindrical housing 108. Alternatively a return spring may act against the brake lever arm, which in turn acts on the push rod. In this case the brake lever arm and the push rod need not be firmly connected. The push rod bellows 115 and the push rod seal 111 are omitted, since their function is to provide a seal to prevent dirt and moisture getting in.

The main advantage to this solution is that a highly stressed connection is removed. This also means that there is no risk of leakage in this highly stressed connection. This solution furthermore saves space, since it permits a brake device which is significantly shorter than current solutions. A shortening of between 40 and 80 mm is possible. This may mean that a range of vehicles only needs to use axial brakes, for brake devices on both front and rear axles.

A second exemplary embodiment of the brake device according to the invention 301 is shown in Fig. 3. In this exemplary embodiment the brake caliper 320 is fitted to an intermediate section 323, which can be compared to a modified front cylindrical housing 109. The brake caliper 320 can be fitted to the intermediate section 323 in a number of different ways. The intermediate section 323 may be designed so that the angle between the rear cylindrical housing 308 and the brake caliper 320 can be varied depending on which embodiment of the intermediate section 323 is being used. This is advantageous, for example, where different types of vehicle require different embodiments of the brake device. With different intermediate sections 323 it is possible to use the same rear cylindrical housing 308 and brake caliper 320 for all the various brake device embodiments. Even different diameters of the rear cylindrical housing 308 and the brake caliper 320 can be fitted together by means of a suitable intermediate section 323.

In a first development the brake caliper 320 and the intermediate section 323 each comprise a threaded or bayonet-shaped section, shown schematically by 324, so that the brake caliper 320 and the intermediate section 323 can be screwed or twisted together. A seal 325, in the form of an O-ring, for example, which prevents dirt and water getting in, also advantageously forms part of the connection. A threaded section advantageously comprises a locking arrangement which fixes the brake caliper 320 and the intermediate section 323 to one another. A bayonet fitting is advantageously designed so that it locks when it is assembled, so that it cannot be released when it is exposed to vibrations, for example. This can be done, for example, by some form of spring tongue, which engages in a recess.

There may also be production reasons for fitting the brake caliper 320 to an intermediate section 323, which is in turn fitted to a rear cylindrical housing 308. For

example, a brake caliper 320 may be manufactured from a cast material and the intermediate section 323 from a pressed sheet metal material. From the servicing standpoint, too, it may be advantageous to be able to
5 remove the brake caliper 320 from the intermediate section 323.

In a second development of the brake device 401 according to the invention, shown in Fig. 4, the brake caliper 420
10 and the intermediate section 423 each comprise a flanged section 426, 427 each with its bearing surface. The bearing surfaces are advantageously provided with some form of positioning groove. In this exemplary embodiment the intermediate section 423 and the brake caliper 420
15 are assembled by means of a clamp connection 412, similar to the clamp connection 112. This connection also advantageously comprises a seal 428, for example an O-ring, located in a groove in either of the bearing surfaces. In order to facilitate assembly it may be
20 advantageous to include an additional sealing bead 429 in the diaphragm 413. The sealing bead 429 forms a seal against the inside of the brake caliper 420 with an integral spring.

25 The invention must not be regarded as being limited to the exemplary embodiments described above, a number of further variants and modifications instead being feasible without departing from the scope of the following patent claims. For example, a brake device
30 with no parking brake section is also conceivable.

CLAIMS

1. A brake device for a vehicle, comprising at least one air-operated brake section (203, 303, 403) and a disc brake caliper (220, 320, 420),
- 5 **characterized in that**
the service brake section (203, 303, 403) of the brake device is integrated with the disc brake caliper (220, 320, 420) to form one unit.
- 10 2. The brake device as claimed in claim 1,
characterized in that
the rear cylindrical housing (208, 308, 408) of the brake device is fixed to the disc brake caliper (220) or to an intermediate section (323, 423).
- 15 3. The brake device as claimed in claim 1 or 2,
characterized in that
the rear cylindrical housing (208, 308, 408) of the brake device and the disc brake caliper (220, 320, 420) are
- 20 fitted so that the central axis (230, 330, 430) of the rear cylindrical housing and the central axis (231, 331, 431) of the disc brake caliper form and angle.
4. The brake device as claimed in any of claims 1 to 3,
25 **characterized in that**
the disc brake caliper (220, 320, 420) comprises a lever arm (221, 321, 421) which applies the disc brake mechanically.
- 30 5. The brake device as claimed in claim 4,
characterized in that
the lever arm (216, 316, 416) is moveably connected to a push rod (216, 316, 416).
- 35 6. The brake device as claimed in any of claims 1 to 5,
characterized in that
the brake device also comprises an intermediate section (323, 423) which is fitted between the service brake section (303, 403) and the disc brake caliper (320, 420).

7. The brake device as claimed in claim 6,
characterized in that
the intermediate section (323, 423) and the disc brake
5 caliper (320, 420) comprise a sealing element (325, 428).

8. The brake device as claimed in claim 6 or 7,
characterized in that
the intermediate section (323) and the disc brake caliper
10 (320) each comprise a threaded or bayonet-shaped section
(324) by means of which the intermediate section (323)
and the disc brake caliper (320) are fitted together.

9. The brake device as claimed in claim 6 or 7,
15 **characterized in that**
the intermediate section (423) and the disc brake caliper
(420) each comprise a flanged section (426, 427), in
which the intermediate section (423) and the disc brake
caliper (420) are fitted together by means of a clamp
20 connection (412).

10. The brake device as claimed in claim 9,
characterized in that
the diaphragm (413) comprises a sealing bead (429) which
25 forms a seal against the inside of the brake caliper
(420).

1/4

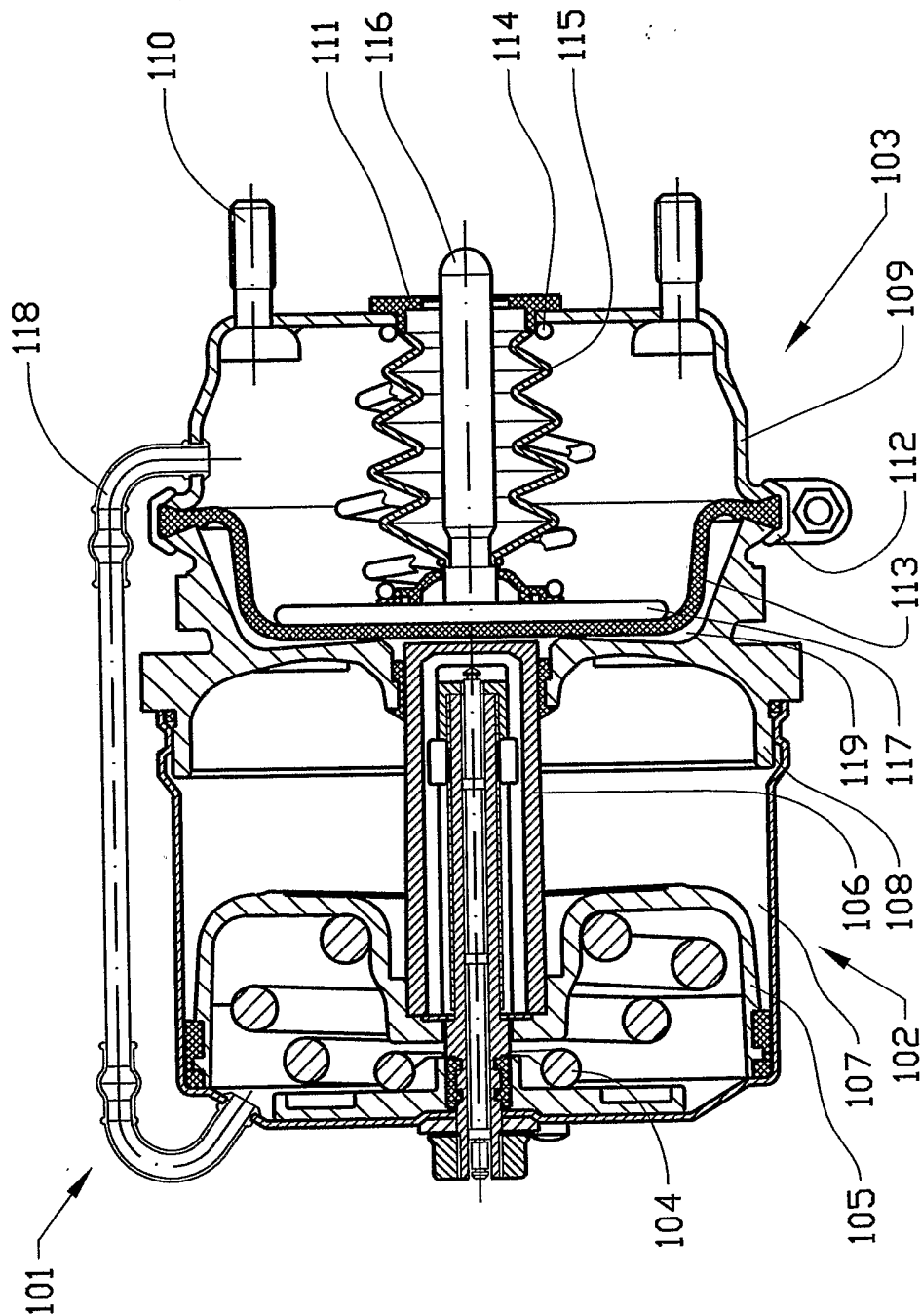


Fig. 1

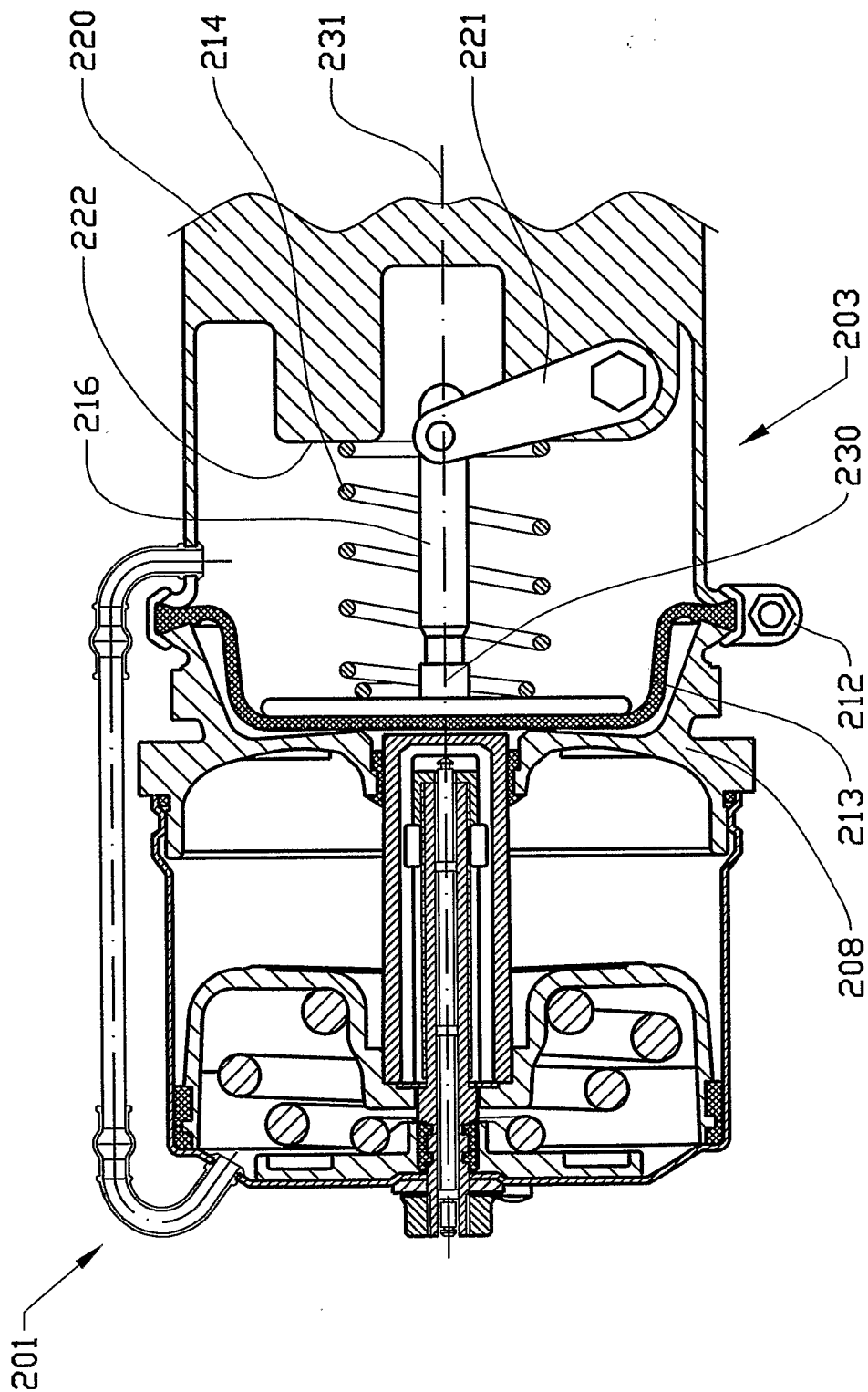


Fig. 2

3/4

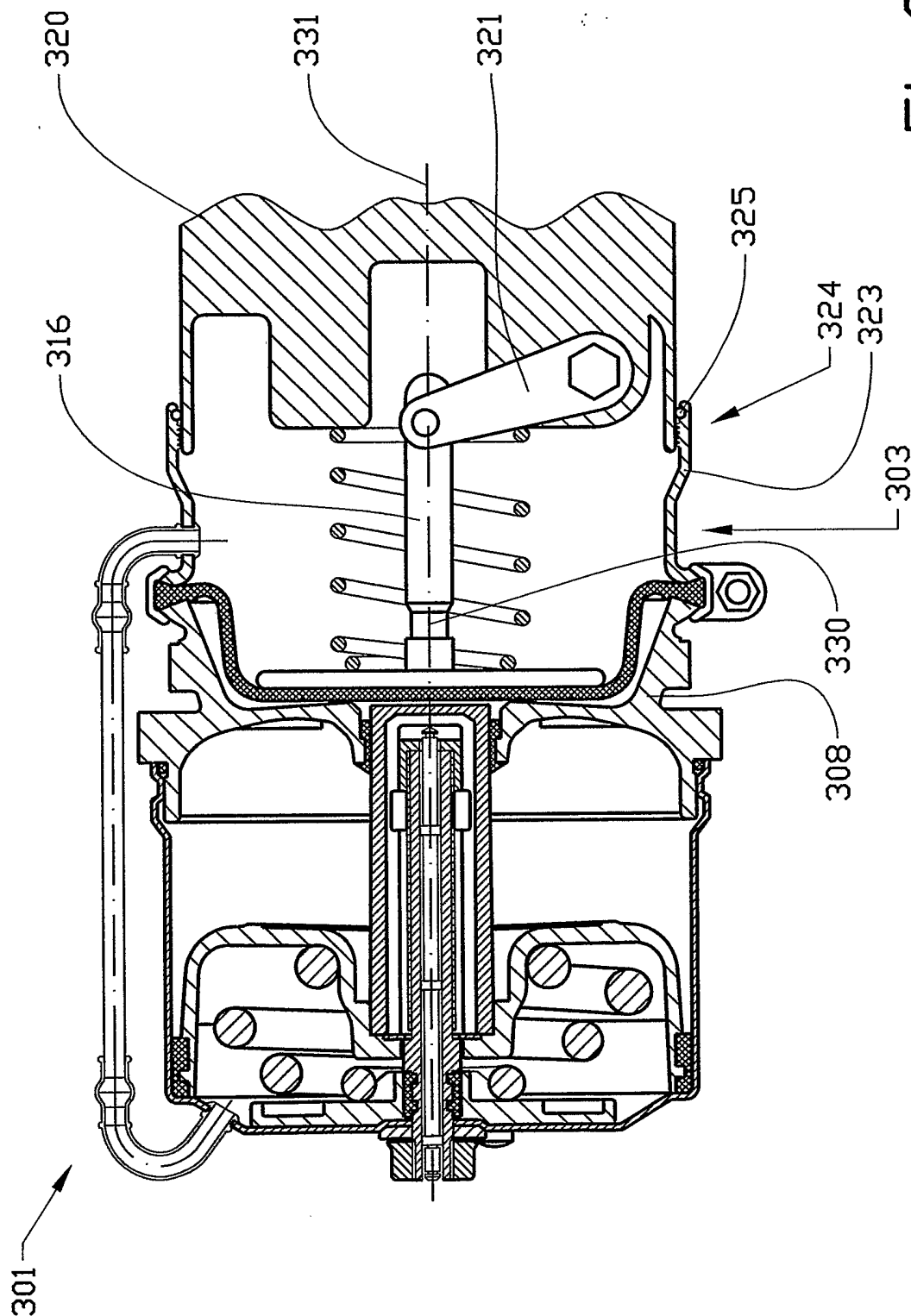


Fig. 3

4/4

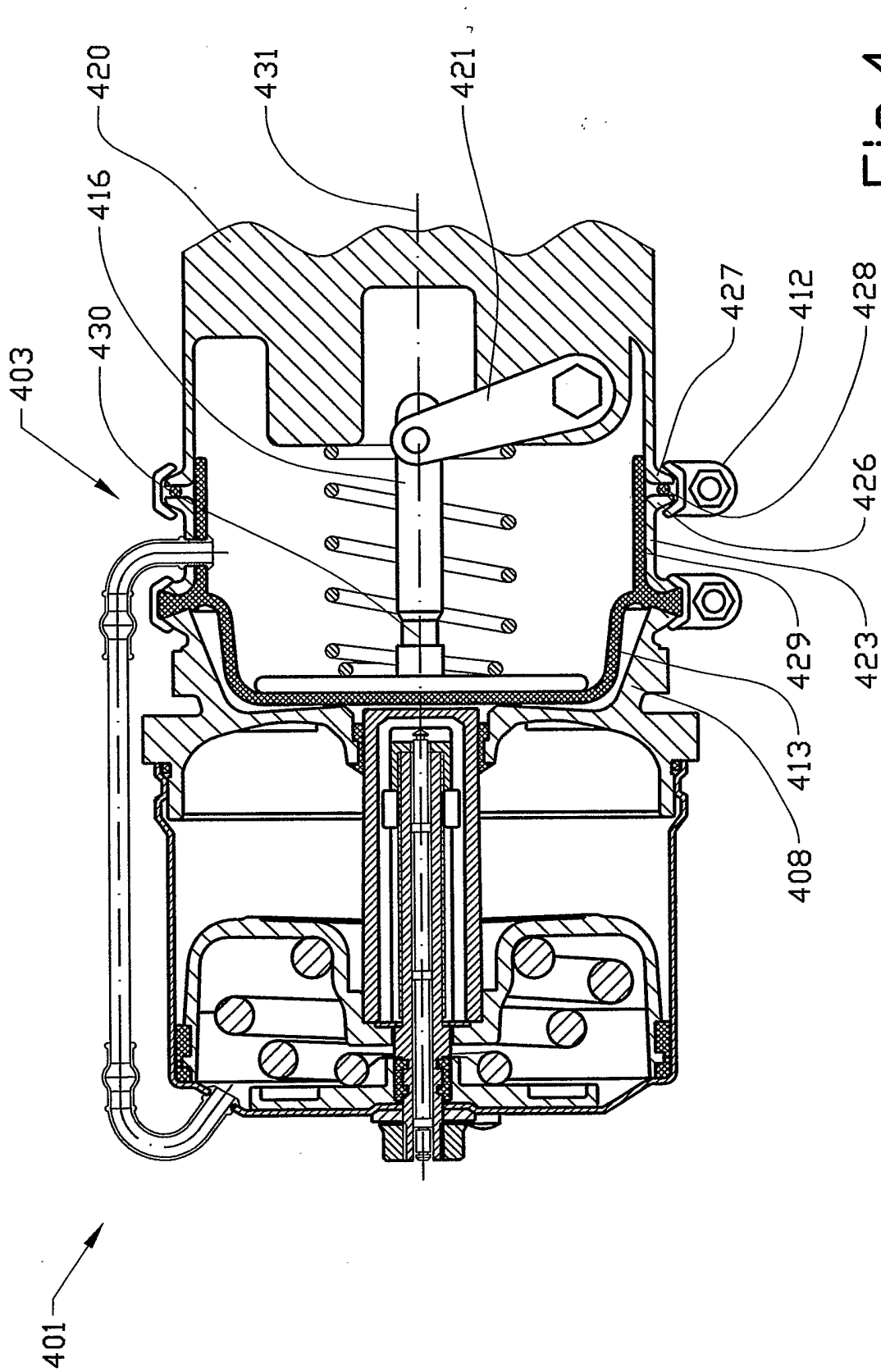


Fig. 4

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 03/00168

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B60T 17/08

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)

IPC7: B60T, F16D

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

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 19935628 A1 (WABCO GMBH & CO. OHG), 1 February 2001 (01.02.01), figure 1, claims 1,5, abstract	1-6
Y	--	7-10
Y	DE 19830154 A1 (KNORR-BREMSE SYSTEME FÜR NUTZFAHRZEUGE GMBH), 28 January 1999 (28.01.99), figure 3, abstract	7,9,10
Y	DE 4135943 A1 (ROBERT BOSCH GMBH), 6 May 1993 (06.05.93), figure 2, abstract	8

 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

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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

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 03/00168

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	FR 2559225 A1 (ROBERT BOSCH GMBH), 9 August 1985 (09.08.85), figure 1, abstract --	6-10
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INTERNATIONAL SEARCH REPORT
Information on patent family members

29/03/03

International application No.
PCT/SE 03/00168

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