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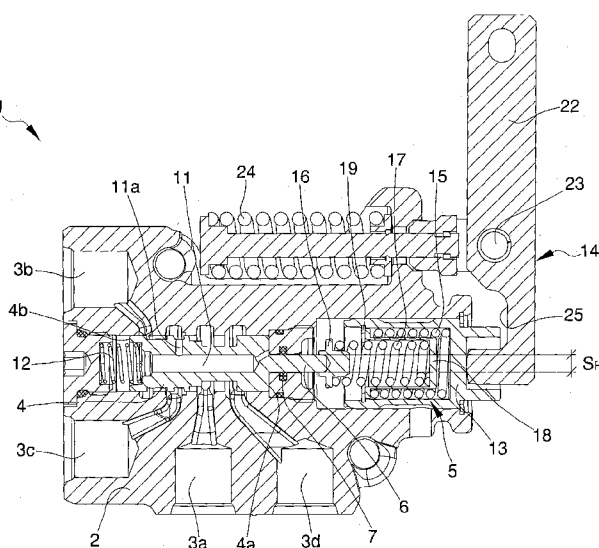
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(54) Title: BRAKING DEVICE OF A TRAILER

Fig. 1



(57) Abstract: A braking device (1) of a trailer comprising a body (2) internally hollow in which are defined at least a delivery gap (3a) of a working fluid, at least a discharge gap (3b) and at least a braking gap (3c), at least a distributor element (4) housed sliding inside the body (2), operating means (5) housed inside the body (2) and suitable for exerting a force on the distributor element (4) to cause the movement thereof, the distributor element (4) having at least a connection element (6) to the operating means (5) and at least a reaction surface (SR) communicating with the braking gap (3c), on which the working fluid acts to exert a further force on the distributor element itself; the braking device (1) further comprising sealing means (7, 8) housed in the body (2) and arranged around the connection element (6) so as to hydraulically separate the distributor element (4) from the operating means (5).

BRAKING DEVICE OF A TRAILER

Technical Field

The present invention relates to a braking device of a trailer.

Background Art

5 It is known that in the case of a trailer towed by a prime mover the braking systems thereof are operatively linked in such a way that the braking of the prime mover by the operator also causes the braking of the towed trailer.

The trailer's braking system is therefore piloted by the braking system of the prime mover for the purpose of synchronizing the braking forces acting on
10 them.

It follows therefore that when the operator operates the brake pedal of the prime mover, this intervenes on the wheels of same and, by means of the brake valve, also on the trailer's braking system.

The braking devices of a trailer of known type generally comprise a hollow
15 body in which a plurality of gaps is defined, including a working fluid supply gap, a working fluid discharge gap and a gap that can be connected to the trailer braking system. Inside such hollow body, a distributor is housed sliding, suitable for selectively putting the braking gap in communication with the supply gap or with the discharge gap.

20 The distributor is operatively connected to operating means which can in turn be piloted in a mechanical or fluid dynamic way. The operating means comprise elastic means which act on the distributor.

Because, as it is easy to appreciate, the body inside which the distributor is housed has to be hydraulically insulated from outside, the known devices
25 contemplate sealing means generally placed between the operating means and the hollow body or between the piloting means and the hollow body (in particular in the case of fluid-dynamic piloting).

These braking devices do have a number of drawbacks.

These, in fact, are complicated to make and are, therefore, very costly. In
30 particular, it is pointed out that the sealing means fitted to these devices are of large size and this, besides making them costly to make also produces strong friction forces. Such friction forces can cause an imprecise movement of the

distributor and, therefore, an imperfect response of the trailer's braking system with respect to that of the towing vehicle.

Another drawback of the braking devices of known type consists in so-called "hysteresis", i.e., the fact that, the position of the braking pedal of the vehicle
5 being equal, a different braking pressure will occur depending on whether the towing vehicle is in braking phase or in release phase, where the greater the rigidity of the elastic means acting on the distributor, the greater such difference will be.

Such drawback can be eliminated by reducing the rigidity of the spring which,
10 on the other hand, requires a longer pedal stroke for braking.

The devices of known type, furthermore, due to the strong forces involved, require the use of large-size springs.

Yet another drawback of the known braking devices consists in the fact that, in the event of the piloting means being of the mechanical type and of a
15 malfunction occurring such as to prevent the movement of the operating means, the piloting means are also consequently blocked and it is not even therefore possible to brake the towing vehicle.

Again, the braking devices of known type generally have an ample reaction surface, meaning by this the surface on which the working fluid acts in contrast
20 to the thrust exerted by the operating means to cause braking, which has the drawback of making the device itself particularly sensitive to the pressure waves that can occur during operation and which act on the distributor.

Description of the Invention

The main aim of the present invention is to provide a braking device of a trailer
25 that is simpler to make than the devices of known type, and in particular which cuts manufacturing costs and reduces the frictions produced during movement of the relative distributor.

Within this aim, one object of the present invention is to provide a braking device of a trailer which is not very sensitive to pressure waves.

30 Another object of the present invention is to reduce the difference in braking pressure due to a different position of the distributor, the position of the piloting pedal being equal, while maintaining at the same time a limited stroke of the

pedal itself.

Another object of the present invention is to reduce, with respect to devices of known type, the amount of forces involved during the braking phase and, consequently, also the size of the elastic means used.

- 5 Another object of the present invention is to also allow the movement of the piloting pedal, and therefore the braking of the towing vehicle, in emergency conditions, in which the distributor's operation means are blocked.

Another object of the present invention is to provide an upgraded braking device of a trailer which allows to overcome the mentioned drawbacks of the state of the art in the ambit of a simple, rational, easy and effective to use as well as low cost solution.

The above mentioned objects are achieved by the present breaking device of a trailer according to claim 1.

Brief Description of the Drawings

- 15 Other characteristics and advantages of the invention will become more evident from the description of a preferred, but not sole, embodiment of an upgraded braking device of a trailer according to the invention, illustrated purely as an example but not limited to the annexed drawings in which:

Figure 1 is a section view of a device according to the invention in a first embodiment;

Figure 2 is a section view of a device according to the invention in a second embodiment;

Figure 3 is a section view of a device according to the invention in a third embodiment;

- 25 Figure 4 is a section view of a device according to the invention in a fourth embodiment.

Embodiments of the Invention

With reference to such figures, globally indicated by 1 is a braking device of a trailer.

- 30 The device 1 comprises a body 2 internally hollow, in which is defined at least a delivery gap 3a of a working fluid, at least a discharge gap 3b of the working fluid and at least a braking gap 3c connectable to the braking system of a trailer.

In the embodiments shown in the illustrations, the body 2 also comprises a further gap 3d connectable to an external user point.

Inside the body 2 is housed sliding a distributor element 4, which is shaped so as to put in communication at least the braking gap 3c with the delivery and discharge gaps 3a and 3b. More in particular, the distributor element 4 has a plurality of recesses defined on the outer surface thereof which permit, depending on the position of the distributor element inside the body 2, putting into communication the braking gap 3c with the delivery gap 3a or with the discharge gap 3b.

10 The device 1 also comprises operating means 5 housed sliding inside the body 2 and suitable for exerting a force on the distributor element 4 to cause this to move. More in particular, the operating means 5 are alternately mobile between an idle configuration, which corresponds to an end of stroke position of same and in correspondence to which, the braking gap 3c is in communication with the discharge gap 3b, and a maximum braking configuration, which corresponds to another end of stroke position and in correspondence to which the force exerted on the distributor element 4 is maximum. Between the idle configuration and the maximum braking configuration are a plurality of intermediate configurations. In each braking configuration, the distributor element is in a condition of unstable balance in which it alternately puts in communication the braking gap 3c with the delivery gap 3a and with the discharge gap 3c.

The distributor element 4 has at least a connection element 6 for connection to the operating means 5 and at least a reaction surface SR communicating with the braking gap and on which the working fluid acts to exert a further force on the distributor element itself in a direction opposite to that exerted by the operating means 5.

As can be seen in the illustrations, the connection element 6 is integrally defined with the distributor element 4.

30 According to the invention, the device 1 comprises sealing means 7, 8 housed inside the body 2 and arranged around the connection element 6 so as to hydraulically separate the distributor element 4 from the operating means 5.

Advantageously, the operating means 5 are placed in communication with the outside. More in detail, the area of the body 2 inside which the operating means 5 are housed is placed in communication with the outside. The sealing means 7, 8 are therefore suitable for separating an environment under pressure, and inside 5 which is a working fluid, from an atmospheric-pressure environment in which there is air. This makes the operating means 5 substantially insensitive to the fluid hammers that can occur during use and which act on the distributor element 4.

Preferably, the sealing means 7, 8 comprise at least an elastic ring 7 fitted over 10 the connection element 6.

The sealing means 7, 8 partially delimit a first thrust chamber facing onto the distributor element 4 and communicating with a second thrust chamber, also facing onto the distributor element 4 on the opposite side with respect to the first chamber, where the useful surfaces of the distributor element 4 facing onto 15 the first and the second chamber are different from each other.

More in particular, the first and the second thrust chambers face onto a first and a second extremity 4a and 4b of the distributor element 4 respectively, which are opposite one another.

As can be seen in the illustrations, the connection element 6 extends from the 20 first extremity 4a, which means that the useful surface of the first extremity 4a is smaller than that of the second extremity 4b and that the section of the connection element 6 defines the reaction surface SR.

Suitably, the distributor element 4 comprises a connection channel 11 for the connection of the first thrust chamber to the second thrust chamber which has a 25 connection gap 11a facing onto the outer surface of the distributor element itself and which is communicating with the braking gap 3c. In particular, between the second extremity 4b of the distributor element 4 and the bottom wall of the body 2 a spring 12 is located suitable for pressing the distributor element itself towards the operating means 5. The spring 12 is suitable for keeping the braking 30 gap 3c in communication with the discharge gap 3b in the idle configuration described above.

More in detail, the distributor element 4 and the connection element 6 both have

substantially round sections.

In the embodiments shown in the figures 2 and 4, the sealing means 7, 8 comprise first sealing means 7 and second sealing means 8 arranged in series with each other along the connection element 6.

- 5 Preferably, the second sealing means 8 are also of the ring type, elastic or not, fitted over the connection element 6 and placed between the elastic ring 7 and the operating means 5. In these embodiments, the area between the rings 7 and 8 is placed in communication with the discharge gap 3b, and consequently the discharge pressure does not act on any active area of the distributor element 4.
- 10 In the particular, but not exclusive embodiment shown in the illustrations, the ring 8 has a bigger diameter than the elastic ring 7 and achieves a seal of the mechanical type. In this embodiment therefore, the elastic ring 7 prevents the flow of the working fluid towards the operating means 5, while the ring 8 defines the reaction surface SR. Any leaks passing through the ring 8 therefore
- 15 are then conveyed towards the discharge gap 3b.

The operating means 5 comprise at least a command element 13 operatively connected to piloting means 14, in turn connectable to the braking system of the towing vehicle, and moving close to/away from the connection element 6.

- The operating means 5 also comprise at least first elastic means 17 acting on the connection element 6 and placed between the latter and the command element
- 20 13.

- In the embodiments shown in the illustrations, the first elastic means 17 are made, e.g., of a helical spring having an extremity associated with a plate 16 connected integral to the connection element 6 and the opposite extremity
- 25 turned towards the command element 13.

- In the embodiment shown in the figures 1 and 2, where the piloting means are of the mechanical type and the movement of the command element 13 is correlated to the physical movement of a mechanically operable lever 22, the operating means 5 also comprise second elastic means 15 connected in series to
- 30 the first elastic means 17 so that the resulting rigidity of the elastic means 17 and 15 which acts on the connection element 6 is below the rigidity of the elastic means themselves considered individually.

More in particular, in the embodiment shown in the figures 1 and 2, the command element 13 is shaped like a glass and the second elastic means 15 are placed between the command element itself and the first elastic means 17.

The second elastic means 15 are also of the helical spring type with a larger diameter than the spring 17 and being arranged outside it.

In the embodiment shown in the figures 1 and 2, the spring 15 is fitted around a glass-shaped element 18, inside which the spring 17 is inserted and in turn arranged inside the command element 13. The two springs 15 and 17 therefore act the one on the other by means of the glass-shaped element 18.

More in detail, the spring 15 has an extremity resting against the bottom of the command element 13 and the opposite extremity resting on the base of the glass-shaped element 18.

Inside the command element 13 is arranged a locator element 19 against which the base of the glass-shaped element 18 is intended to rest, while the bottom of the latter is intended to rest against the bottom wall of the command element 13. The bottom wall of the command element 13 and the locator element 19 therefore define the end-of-stroke positions of the glass-shaped element 18.

In this embodiment, the second elastic means 15, pre-compressed, are preferably less rigid than the first elastic means 17, which are free, i.e., not pre-compressed. More in detail, the springs 15 and 17 act in series the one to the other once the force exerted by the spring 17 on the spring 15 reaches the calibration pre-compression of the latter.

It follows therefore that, during a first part of the stroke of the command element 13 towards the connection element 6, the spring 17 is compressed to exert a gradually increasing force on the connection element itself, while the spring 15 remains at a standstill with respect to the command element 13. As the spring 17 is gradually compressed, the force which this exerts on the spring 15 also gradually increases and, once this force is the same as the calibration pre-compression of the spring 15 itself, the latter also starts to compress as a result of the relative movement of the glass-shaped element 18 with respect to the command element 13.

In the embodiment shown in the figures 3 and 4, where the piloting means 14

are of the hydraulic type and the movement of the command element 13 is correlated to the changes in pressure of a piloting fluid, the operating means 5 only comprise the first elastic means 17 which immediately exert a force on the plate 16.

- 5 In this case, the first elastic means 17 are of the type of a pre-compressed helical spring (alternative embodiments cannot however be ruled out wherein the spring 17 is not pre-compressed), placed between the command element 13 and a plate 16 associated integral with the connection element 6. More in detail, the extremities of the spring 17 rest on one side against the plate 16 and on the
10 opposite side against a guide element 20 moving between two ends of stroke defined by the inner walls of the body 2. The guide element 20 is operated in translation near the distributor element 4 by the command element 13, which is glass shaped and is arranged in such a way that its extremities make contact with the guide element itself. The guide element 20 has a through hole through
15 which is fitted a rod 21 associated integral with the plate 16. The guide element 20 is sliding with respect to the rod 21, the extremity of which is arranged inside the command element 13 with the latter in idle configuration. The bottom wall of the command element 13 is suitable for coming into contact with the extremity of the rod 21 in its shift towards the maximum braking configuration.
- 20 As has already been said, the piloting means 14 of the command element 13 can be of the hydraulic type, as in the embodiments shown in the figures 3 and 4, or they can be of the mechanical type, as in the embodiments shown in the figures 1 and 2.

More in particular, in the embodiments shown in figure 1 and in figure 2, the
25 piloting means 14 comprise at least a lever 22 mechanically operable by an operator and suitable for cooperating with the command element 13. The lever 22 is mobile in rotation around a fulcrum 23 outside the body 2.

Advantageously, the fulcrum 23 is moving with respect to the body 2 and the
30 piloting means 14 also comprise third elastic means 24 associated with the lever 22, where the latter is suitable for compressing the third elastic means 24 following the movement of the fulcrum 23. The movement of the fulcrum 23 thus occurs in emergency conditions, e.g., if the command element 13 is

blocked, and the need in any case exists to brake the towing means.

The third elastic means 24 can also be made, e.g., of a helical type spring.

Preferably, the third elastic means 24 have a pre-compression load which is greater than that of the elastic means 17, 15, so as to avoid the undesired
5 movement of the fulcrum 23 in normal operating conditions. In particular, the third elastic means 24 have a pre-compression load greater than the reaction force exerted on the fulcrum by the elastic means 17 and 15 in condition of maximum compression.

In the preferred embodiments shown in the figures 1 and 2, the lever 22 also has
10 a weakened area 25 suitable for deforming itself following a force of pre-defined entity. The weakened area 25 is suitably arranged between the fulcrum 23 and the area of contact of the lever itself with the command element 13. The weakened area 25 therefore provides a further safety element which allows operating the lever 22 to also brake the prime mover in emergency conditions
15 wherein the lever itself is blocked and unable to move around the fulcrum 23.

It has in fact been ascertained how the described invention achieves the proposed objects and in particular, the fact is underlined that the braking device forming the object of the present invention is considerably simpler from a construction viewpoint than the devices of known type.

20 In particular, the positioning of the sealing means around the element connecting the distributor element to the operating means permits considerably reducing the dimensions of the sealing means themselves, with respect to known devices, and consequently cutting both manufacturing costs and the frictions produced by the movement of the distributor element.

25 The device according to the invention also permits reducing the entity of the forces involved and, therefore, the dimension of the elastic means used.

Again, compared to known devices, the device according to the invention allows considerably reducing the difference in braking pressure due to a different position of the distributor, the piloting pedal position being equal,
30 while maintaining at the same time a limited stroke of the pedal itself. This is obtained thanks to the use of two springs connected in series, which permit reducing the overall rigidity and, at the same time, reducing the stroke of the

relative pedal.

Last but not least, the braking device according to the invention also permits moving the braking pedal of the prime mover in emergency conditions wherein the command element acting on the distributor is blocked.

CLAIMS

1) Braking device (1) of a trailer comprising:

- a body (2) internally hollow in which are defined at least a delivery gap (3a) of a working fluid, at least a discharge gap (3b) of the working fluid and at least a braking gap (3c) connectable to the braking system of a trailer;
- at least a distributor element (4) housed sliding inside said body (2) and shaped so as to put in communication at least said braking gap (3c) with said delivery gap (3a) or with said discharge gap (3b);
- operating means (5) housed inside said body (2) and suitable for exerting a force on said distributor element (4) to cause the movement thereof, said distributor element (4) having at least a connection element (6) to said operating means (5) and at least a reaction surface (SR) communicating with said braking gap (3c), on which the working fluid acts to exert a further force on the distributor element itself;

15 characterized by the fact that it comprises sealing means (7, 8) housed in said body (2) and arranged around said connection element (6) so as to hydraulically separate said distributor element (4) from said operating means (5).

2) Device (1) according to claim 1, characterized by the fact that said sealing means (7, 8) partially delimit a first thrust chamber facing onto a first portion of said distributor element (4) and communicating with a second thrust chamber facing onto a second portion of said distributor element (4) opposite said first portion, the useful surfaces of said distributor facing onto said first and second thrust chamber being different from each other.

3) Device (1) according to claim 2, characterized by the fact that said first thrust chamber faces onto a first extremity (4a) of said distributor element and that said second thrust chamber faces onto a second extremity (4b) of said distributor element (4) opposite said first extremity (4a) and characterized by the fact that said connection element (6) extends from said first extremity (4a), the useful surface of said first extremity (4a) being smaller than the useful surface of said second extremity (4b) and the section of said connection element (6) defining said reaction surface (SR).

4) Device (1) according to one or more of the preceding claims, characterized

by the fact that said distributor element (4) comprises a connection channel (11) of said first chamber to said second chamber and having a connection gap (11a) which faces onto the outer surface of the distributor element itself and which communicates with the braking gap (3c).

5 5) Device (1) according to one or more of the preceding claims, characterized by the fact that said operating means (5) communicate with the outside.

6) Device (1) according to one or more of the preceding claims, characterized by the fact that said sealing means (7, 8) comprise first sealing means (7) and second sealing means (8) arranged in series with each other along said
10 connection element, wherein said second sealing means (8) are placed between said first sealing means (7) and said operating means (5), the area between said first and second sealing means (7, 8) communicating with said discharge gap (3b).

7) Device (1) according to one or more of the preceding claims, characterized
15 by the fact that said operating means (5) comprise at least a command element (13), connected to piloting means (14) and moving in translation close to/away from said connection element (6) and comprise at least first elastic means (17) acting on said connection element (6) and placed between the latter and said command element (13).

20 8) Device (1) according to claim 7, characterized by the fact that said operating means (5) comprise second elastic means (15) connected in series to said first elastic means (17).

9) Device (1) according to claim 8, characterized by the fact that said second elastic means (15) are of the pre-compressed type.

25 10) Device (1) according to claim 9, characterized by the fact that during a first part of the stroke of said command element (13) towards said connection element (6) said first elastic means (17) compress and said second elastic means (15) remain at a standstill with respect to the command element itself and by the fact that during a second part of the stroke of said command element (13) said
30 second elastic means (15) compress due to achieving the calibration pre-compression thereof by the force exerted by the first elastic means themselves, said first and second elastic means (17, 15) acting together in series on said

connection element (6) during said second part of the stroke of said command element (13).

11) Device (1) according to one or more of the preceding claims, characterized by the fact that said second elastic means (15) are less rigid than said first elastic means (17).

12) Device (1) according to one or more of the preceding claims, characterized by the fact that it comprises piloting means (14) of the movement of said command element (13), connectable to the braking system of the towing vehicle of said trailer, wherein said piloting means (14) are of the mechanical type and comprise at least a lever (22) which can be operated mechanically by an operator and suitable for cooperating with said command element (13), said lever (22) being mobile in rotation around a fulcrum (23) outside said body (2).

13) Device (1) according to claim 12, characterized by the fact that said lever (22) is operatively connected to a braking pedal of the trailer.

14) Device (1) according to one or more of the preceding claims, characterized by the fact that said fulcrum (23) is moving with respect to said body (2) and that said piloting means (14) comprise at least third elastic means (24) associated with said lever (22), the latter being suitable for compressing said third elastic means (24) following the movement of said fulcrum (23).

15) Device (1) according to one or more of the preceding claims, characterized by the fact that said third elastic means (24) have a pre-compression load greater than the reaction force exerted on said fulcrum (23) by said elastic means (17, 15) in the condition of maximum compression.

16) Device (1) according to one or more of the preceding claims, characterized by the fact that said lever (22) has a weakened area (25) suitable for deforming when subjected to a predefined force, said weakened area (25) being arranged between said fulcrum (23) and the portion of the lever itself suitable for cooperating with said command element (13).

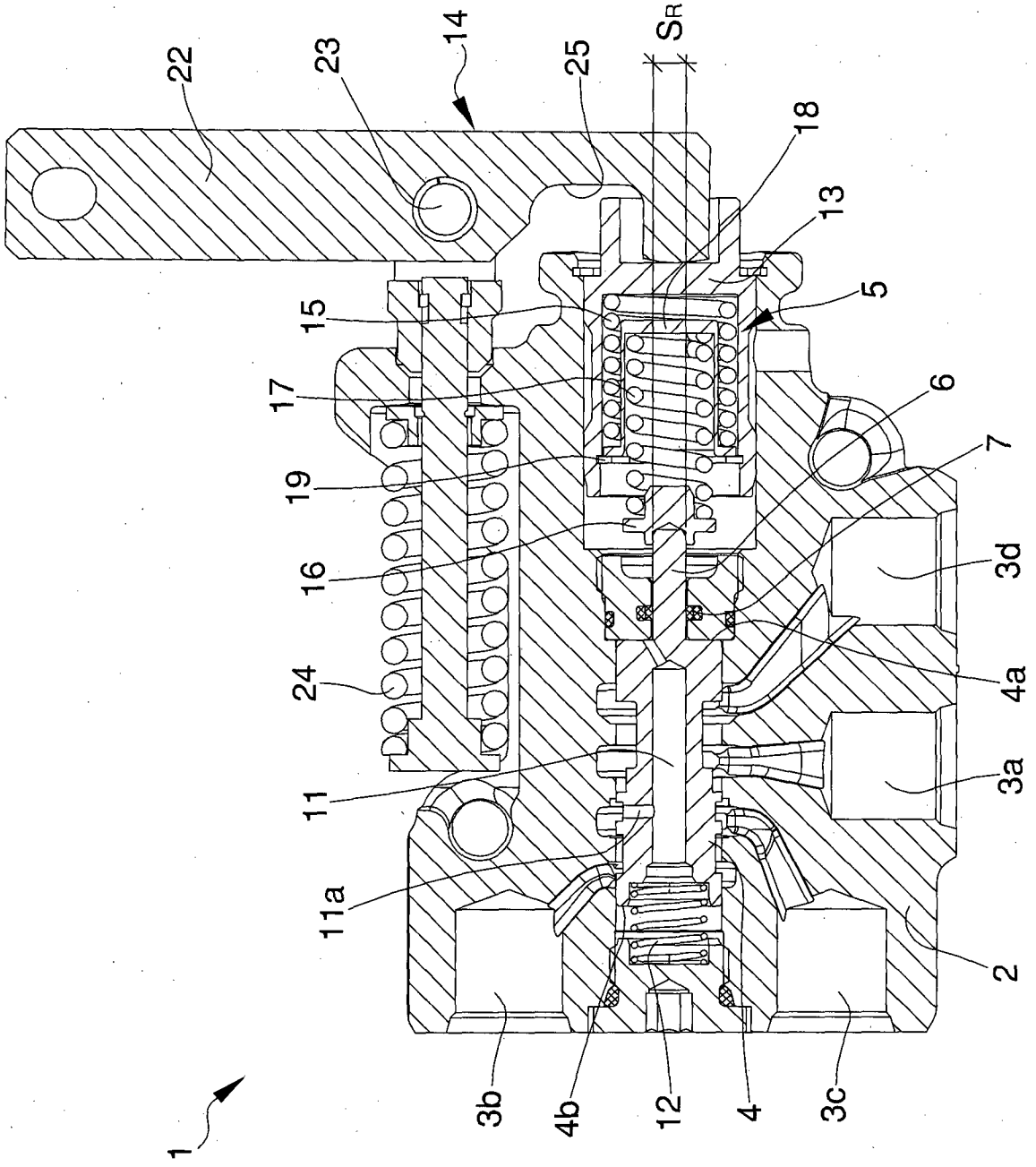


Fig. 1

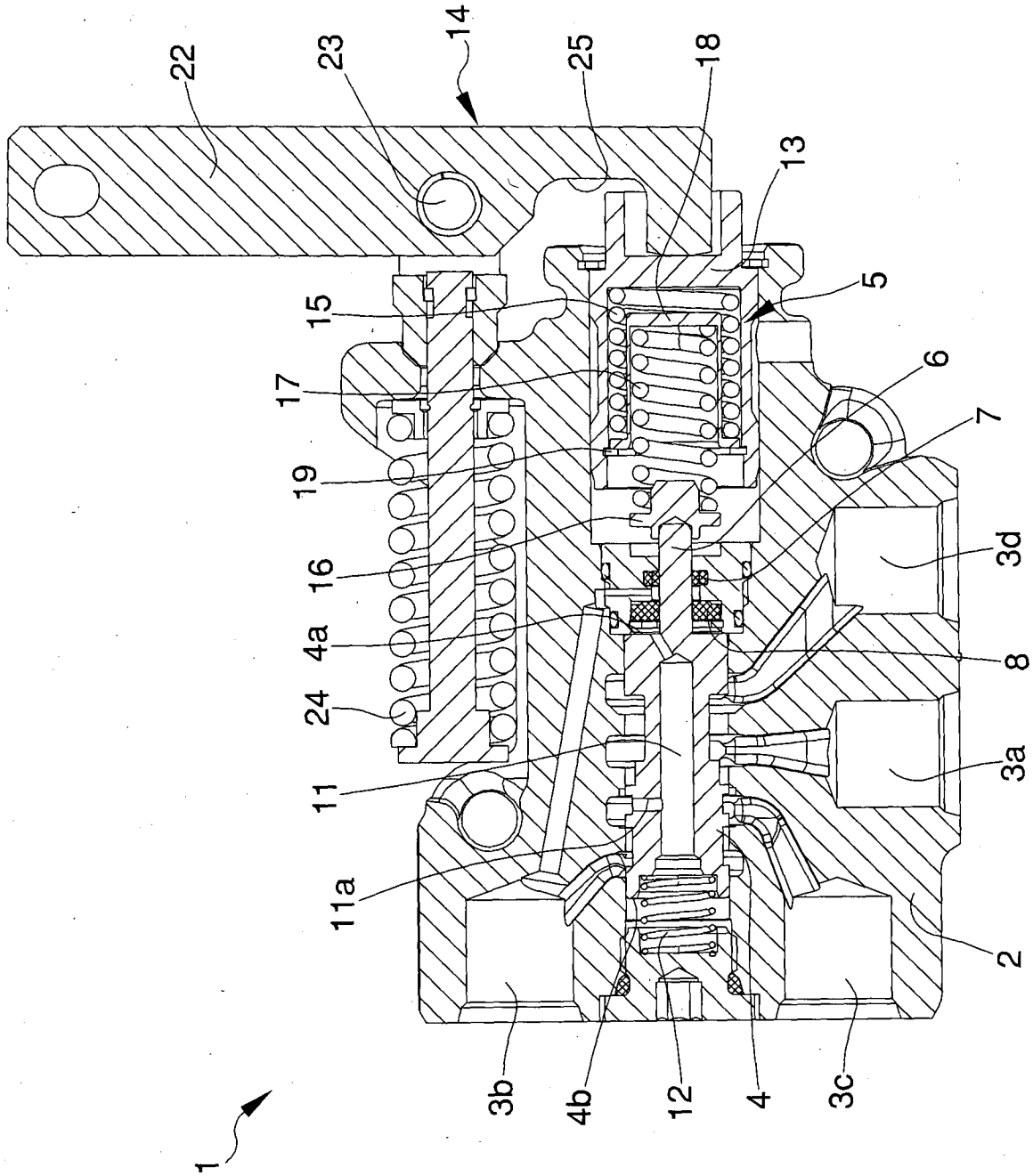


Fig. 2

3 / 4

Fig. 3

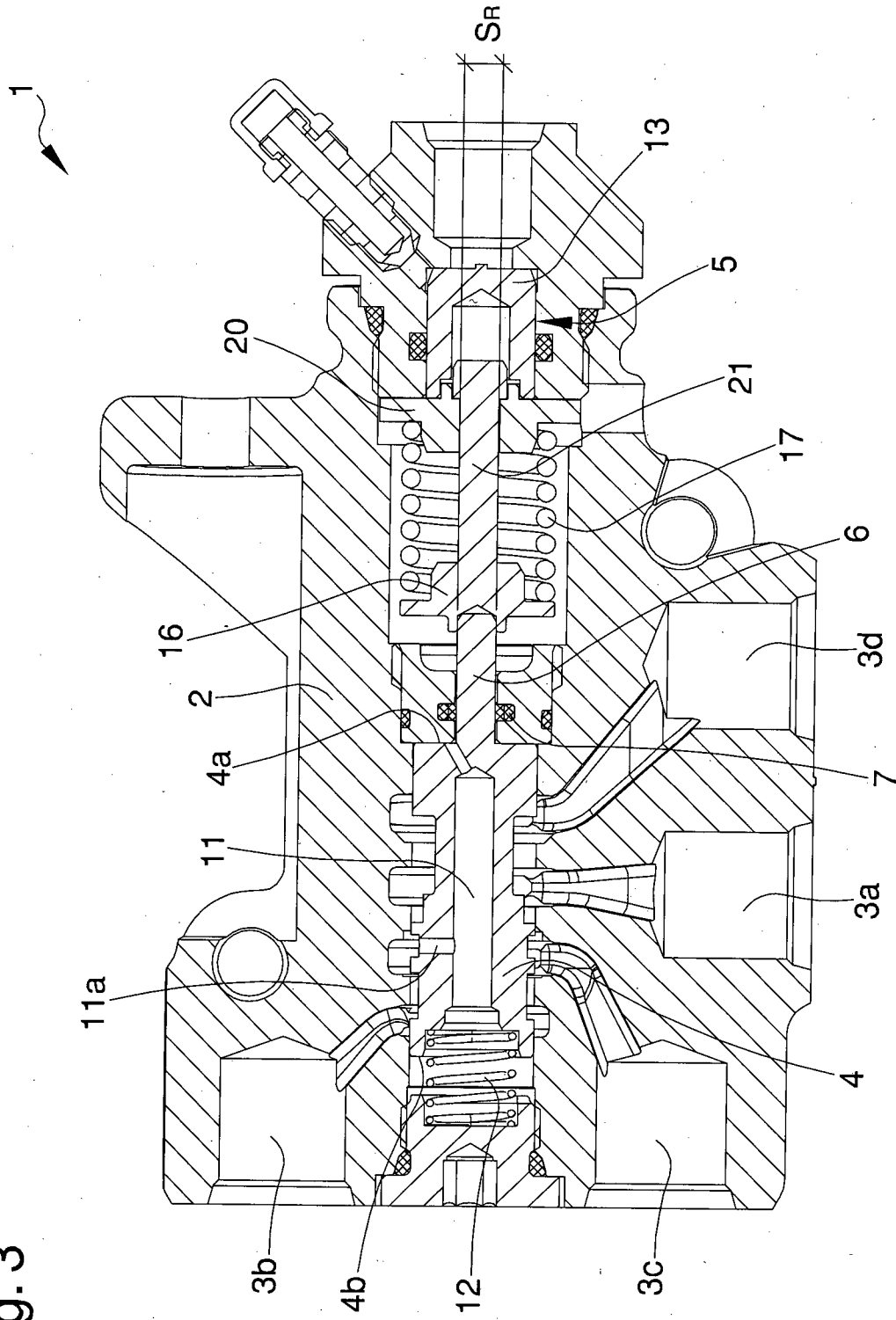
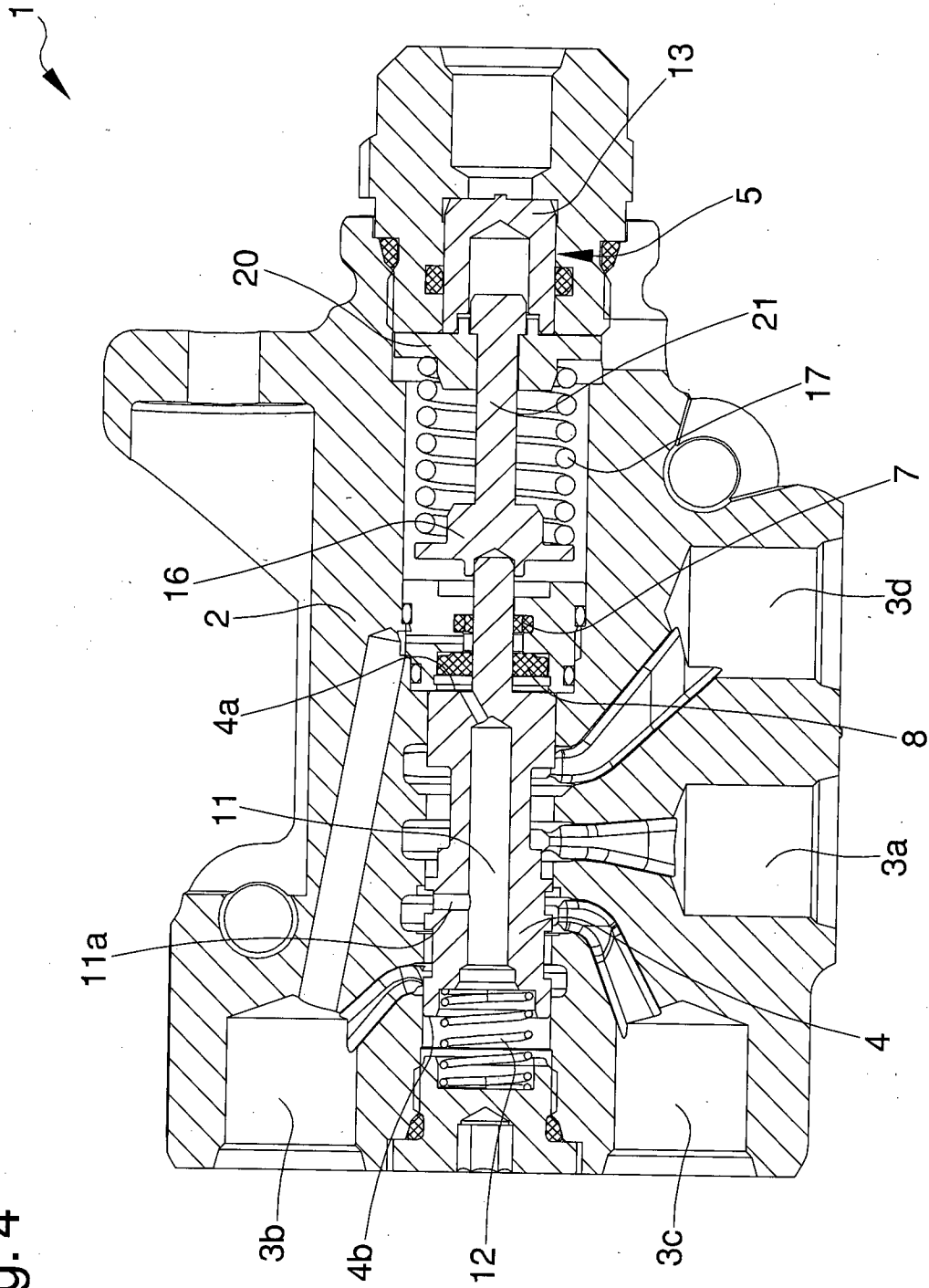


Fig. 4



INTERNATIONAL SEARCH REPORT

International application No PCT/IB2013/001349

A. CLASSIFICATION OF SUBJECT MATTER

INV. B60T7/04	B60T8/18	B60T8/32	B60T8/36	B60T11/10
B60T15/02	B60T15/18	B60T15/20	B60T15/46	B60T17/04
B60T17/18	B60T17/22	B60T15/26		

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.
X	DE 198 57 355 A1 (MANNESMANN REXROTH AG [DE]) 15 June 2000 (2000-06-15)	1,3-5,7, 11-16
Y	the whole document	2,6,8-10
X	DE 41 13 671 A1 (WABCO WESTINGHOUSE FAHRZEUG [DE] WABCO GMBH & CO OHG [DE]) 29 October 1992 (1992-10-29)	1
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Y	the whole document	2,6,8-10
X	DE 195 14 733 A1 (REXROTH MANNESMANN GMBH [DE] BOSCH REXROTH AG [DE]) 24 October 1996 (1996-10-24)	1
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Further documents are listed in the continuation of Box C.

See patent family annex.

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12 November 2013

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INTERNATIONAL SEARCH REPORT

International application No

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