

DESCRIPTION

Shutoff valve for a pressure medium system of a rail vehicle, pressure medium system for a rail vehicle, and rail vehicle

The invention relates to a pressure medium system for a pressure medium system of a rail vehicle, a pressure medium system for a rail vehicle with such a shutoff valve as well as a rail vehicle with a corresponding pressure medium system.

In order to supply pressure medium consumers of a rail vehicle, such as, for example, a braking system or, however, also a suspension system, toilets, door actuating mechanisms and the like, hose couplings can be used to transmit the pressure medium, via which hose couplings the lines of a respective carriage of a rail vehicle can be connected to the next carriage. In the case of a rupture or other damage to the hose coupling, it must be ensured that the pressure medium of the lines connected thereto cannot escape in an uncontrolled manner. It is therefore known from the prior art for compressed air supplies of braking systems of a rail vehicle to use a securing device with two hose couplings for the event of the failure of a hose coupling. The two hose couplings of the redundance-based securing device are connected with a double check valve to the corresponding compressed air line. In the case of a failure of one of the two hose couplings, the vented path is now shut off by the double check valve.

The requirement for two hose couplings and the need for a double check valve with comparatively large cross-sections are disadvantageous in this case. The disadvantage of an overlapping region furthermore arises when using a double check valve, in the case of which overlapping region all of the connections are

connected so that the sensitivity for switching in the case of a leak of a hose coupling is high and the concomitant switching behavior is comparatively slow under certain circumstances.

5

In view of the statements above, the object of the present invention is to provide a shutoff valve for a pressure medium system, a pressure medium system with such a shutoff valve as well as a corresponding rail vehicle, wherein a locking of a line in a compact design is enabled.

The object is achieved by a shutoff valve as claimed in claim 1, a pressure medium system as claimed in claim 12 as well as a rail vehicle as claimed in claim 15. Advantageous further developments of the inventions are contained in the dependent claims.

According to the invention, a shutoff valve for a pressure medium system of a rail vehicle has a first connection portion for the introduction of a pressure medium into and/or the discharge of a pressure medium out of the shutoff valve, a second connection portion connected fluidically to the first connection portion for the discharge of a pressure medium out of and/or the introduction of the pressure medium into the shutoff valve, a control piston which is movable inside the shutoff valve, having a first piston side and an opposite second piston side, and a portion formed as a piston seat or piston receptacle between the first connection portion and the second connection portion. On the piston seat, the first piston side of the control piston, in a closing position, can be placed on in a sealing manner or in the piston receptacle a portion of the control piston having the first piston side in a closing position can be received in a sealing manner, such that the first piston side or the portion having the first piston side disconnects the fluidic connection between the first connection portion and the

second connection portion, and in an opening position is raised up from the piston seat or the piston receptacle and allows the connection.

- 5 As a result of the fluidic connection between the first connection portion and the second connection portion, a pressure medium which is introduced via the first connection portion can thus be discharged from the second connection portion and vice versa. The fluidic
10 connection can be disconnected according to the movement of the control piston into the closing position. The control piston can thus separate the volume which is provided in the shutoff valve between the first connection portion and the second connection
15 portion into a first pressure medium receiving volume adjoining the first connection portion and a second pressure medium receiving volume which adjoins the second connection portion.
- 20 According to one configuration in which the portion between the first connection portion and the second connection portion is formed as a piston seat, a valve plate is formed by the control piston over the first piston side and the second piston side, wherein the
25 first piston side disconnects the fluidic connection when it is placed on the piston seat. This configuration can also be referred to as a seat valve configuration. In the alternative configuration in which the portion is formed between the first
30 connection portion and the second connection portion as a piston receptacle, the control piston acts as a slide piston, wherein the end portion having the first piston side for disconnecting the fluidic connection is received in the piston receptacle. This configuration
35 can also be referred to as a slide piston configuration. The seat valve configuration differs from the slide piston configuration in that the disconnection of the fluidic connection between the first connection portion and the second connection

portion is produced by an axial seal between the first piston side and the piston seat in relation to the longitudinal axis of the control piston which corresponds to a direction of extent of the control piston from the first piston side to the second piston side. In contrast to this, a radial seal is produced in the closing position in the case of the slide piston configuration.

According to the above statements, the first piston side is consequently in each case the side of the control piston facing the portion between the first connection portion and the second connection portion and the second piston side the side facing away from the portion. Insofar as the control piston should furthermore have a control piston pin which is described further below, this is not to be taken into account in the assignment of the first piston side and second piston side in relation to the portion.

In the case of a normal operation of the pressure medium through-line, the same pressure prevails on both connection portions. The shutoff valve is configured such that the control piston is in the opening position. This can be performed in that the pressure provided in normal operation which acts on the first piston side or the pressure force resulting therefrom is greater than a counterforce brought about by the dead weight of the control piston. The forces relate to the force ratios which act in the direction of movement of the control piston for disconnecting or for opening the fluidic connection. The counterforce of the control piston brought about by the dead weight in itself acts in the direction of the closing position. Alternatively or additionally, the control piston can also be retained by other means in the opening position, such as by applying a magnetic force or mechanical holding elements, wherein the retention can be removed to reach the closing position.

In the event of a drop in pressure at the second connection portion, for example, in the case of failure of a hose coupling connected thereto, the pressure acting on the first piston side reduces suddenly. As a result of this, the control piston is moved into the closing position. This can be performed in relation to the exemplary simple configuration above of the shutoff valve via the counterforce brought about by the dead weight of the control piston. The movement of the control piston into the closing position is thus performed independently in this constellation in the case of a corresponding drop in pressure. Further configuration possibilities of an independent movement of the control piston into the closing positions are furthermore described below in relation to respective configurations and further developments, wherein these are not mutually exclusive and can also be used in combination with one another. This equally applies to an independent movement of the control piston into the opening position, as is also stated on the basis of further configurations. Alternatively or in addition to an independent movement, drive mechanisms can furthermore also be provided to move the control piston, wherein these are then actuated by a detected drop in pressure in order to move the control piston into the closing position and/or opening position.

According to one configuration, the pressure medium is compressed air.

The use of compressed air is frequently employed as a result of easy availability. Alternatively, the pressure medium can, however, also involve a liquid of a hydraulic system.

In a further development, the control piston is mounted by a resilient element, the opening force of which acts in the direction of the opening position.

The movement of the control piston into the opening position can be brought about or supported via a resilient element. Insofar as the spring force is smaller than the oppositely acting counterforce brought about by the dead weight of the control piston, the movement of the control piston into the opening position requires yet another pressurization of the first piston side. In contrast, a greater spring force in comparison with the counterforce brought about by the dead weight of the control piston requires an additional pressurization of the second piston side, as is also stated, and/or an additional movement mechanism in order to overcome the spring force for movement of the control piston into the closing position. Via the resilient element, the control piston can therefore be moved independently or at least in combination with a minimum pressure on the second connection portion into the opening position or held there in order to create or maintain a fluidic connection.

The resilient element can, for example, be arranged between the first piston side and the second connection portion. The resilient element is accordingly supported on the second connection portion and can move the control piston in the direction of extent of the resilient element or in the direction of action of the spring force, which point in each case in the direction of the longitudinal axis of the control piston, relative to the second connection portion. For example, a pressure spring can be used as the resilient element in an arrangement on the first piston side. Alternatively or additionally, a tension spring can also be used, wherein this should then be arranged on the second piston side.

Alternatively, the resilient element can also act in the direction of the closing position. As a result of this, for example, a secure sealing off can be ensured

or at least supported to ensure the disconnection of the fluidic connection between the first connection portion and the second connection portion. In the case of an arrangement of the resilient element between the first piston side and the second connection portion, as described above, the resilient element should then be embodied, for example, as a tension spring. A comparable effect can also be achieved by using a pressure spring, wherein this should then also be arranged on the second piston side.

According to one configuration, the shutoff valve is equipped with a radial guide so that the control piston is guided at least in portions radially in the shutoff valve in the case of a movement between the opening and closing position at least in portions in relation to its longitudinal axis which corresponds to a direction of extent of the control piston from the first piston side to the second piston side.

The guidance in the case of the axial movement of the control piston in relation to the longitudinal axis of the control piston between the opening and closing position is accordingly performed by radial surface portions.

In particular, the at least in portions radial guidance of the control piston is performed via a radial surface portion of the control piston in relation to the longitudinal axis between the first piston side and the second piston side in interaction with a housing portion of the shutoff valve.

The guidance of the control piston is thus possible without further guide elements.

Alternatively or additionally, the control piston has on a side facing the second connection portion a control piston pin which extends into the piston seat

or the piston receptacle and is guided via a guide element in interaction with at least one portion of an inner surface, facing the control piston pin, of the piston seat or the piston receptacle in the event of a
5 movement of the control piston in the direction of the longitudinal axis between the opening and closing position at least in portions.

The control piston pin thus extends from the first
10 piston side. In particular in combination with a radial guidance via a radial surface portion between the first piston side and the second piston side in interaction with a housing portion of the shutoff valve, a tipping or tilting of the control piston can be prevented and a
15 corresponding risk can be minimized. A tipping or tilting can hinder the movement of the control piston and/or also lead to leaks in the event of the disconnection of the fluidic connection.

20 According to a further development, a space is provided in the shutoff valve on the second piston side, which space is fluidically connected to the first connection portion in order to transmit a corresponding pressure to the second piston side of the control piston.

25 As a result of the fluidic connection between the first connection portion and the space on the second piston side, the pressure medium flowing through the first connection portion or located therein can be supplied
30 to the space. A discharge of the pressure medium is equally possible. The space forms a third pressure medium receiving volume. The fluidic connection can be configured in such a manner that the pressure prevailing in the space on the second piston side
35 corresponds directly to the pressure of the first pressure medium receiving volume. Alternatively, the pressure of the first pressure medium receiving volume can be transmitted via the fluidic connection by pressure reducers or comparable pressure control

elements only proportionally into the space or the third pressure medium receiving volume. In an analogous manner to the direct or proportional transmission of pressure between the first pressure medium receiving volume and the third pressure medium receiving volume, the space on the second piston side can likewise transmit the pressure which prevails there directly or proportionally to the second piston side of the control piston. The respective proportional transmission of pressure thus corresponds to an indirect transmission of pressure. The indirect transmission of pressure is, however, not restricted to a proportional transmission of pressure, but rather can equally also transmit a pressure identical to the pressure in the first pressure medium receiving volume, wherein the term indirect transmission then relates to the components involved in the transmission of pressure.

Alternatively to the formation of the space on the second piston side by a third pressure medium receiving volume, the space on the second piston side can, however, also be formed via the first pressure medium receiving volume or be encompassed by it.

Since the second piston side is the side of the control piston which faces away from the portion formed as a piston seat or piston receptacle, the control piston can be moved into the closing position and/or be held in the closing position via the pressure in the space on the second piston side. For example, the pressure transmitted through the space onto the second piston side can, in the event of a drop in pressure on the first piston side, move the control piston in the direction of the piston seat or the piston receptacle into the closing position. If the fluidic connection between the first connection portion and the second portion is disconnected by reaching the closing pressure, the pressure of the space on the second piston side can furthermore act on the control piston

and hold it in the closing position. The retaining force brought about by the pressure in the space on the second piston side for holding the control piston in the closing position, as a result of which, for example, leaks can be avoided as a result of shocks, can be reduced or increased again as required by reducing pressure in the space on the second piston side, such as, for example, via a venting process, as is taken up again below. The use of the term "venting" is not restricted to compressed air as the pressure medium, but also encompasses the discharge of such a liquid to reduce pressure when using a liquid as a pressure medium.

In particular, the fluidic connection between the first connection portion and the space on the second piston side is configured in such a manner that it brings about a delayed pressure equalization between the first connection portion and the space. In one preferred embodiment, the fluidic connection is formed as a nozzle.

Via the fluidic connection between the first connection portion and the second connection portion, a drop in pressure at the second connection portion can bring about, under certain circumstances, a drop in pressure in the first pressure medium receiving volume. As a result of the delayed pressure equalization between the first connection portion and the space on the second piston side or the first pressure medium receiving volume and the third pressure medium receiving volume, a sufficiently high pressure can furthermore be applied via the space on the second piston side in order to move the control piston into the closing position. Even if the pressure is subsequently balanced out between the first connection portion and the space on the second piston side, the control piston can be held in the closing position since the pressure on the second

piston side is further reduced by the drop in pressure in relation to the second connection portion.

On the basis of the above-mentioned differentiation
5 between the first and third pressure medium receiving
volume, the respective assignability becomes clear
through the fluidic connection through a nozzle or
other configurations for delayed pressure equalization.
In other words, in the case of the exemplary use of the
10 nozzle, the first pressure medium receiving volume is
the volume which faces the first connection portion in
relation to the nozzle and the third receiving volume
is the volume which faces away from the first
connection portion in the shutoff valve. The statement
15 above relates to the volume or the volumes which is/are
separated from the second pressure medium receiving
volume in the event of movement of the control piston
into the closing position.

20 The nozzle diameter of the nozzle for the delayed
pressure equalization between the first connection
portion and the space on the second piston side is, for
example, 0.5mm. The diameter is in particular selected
so that this is not so small that the nozzle is not
25 prone to blocking by dirt or other particles. An upper
limit of the nozzle diameter is adapted to a sufficient
time delay. The adjustment arises, for example,
according to the gradients on the second connection
portion for the case of insensitivity or a normal air
30 consumption of $< 0.5 \text{ bar/s}$ and a sensitivity of $> 0.65 \text{ bar/s}$. At the sensitivity threshold, the response time
is, for example, $< 2 \text{ s}$. In the case of a rupture in the
hose, a significantly greater gradient should be
assumed since the venting cross-section of a separated
35 hose coupling is significantly larger. The response
time can be correspondingly reduced, wherein the time
delay as a result of the adjusted nozzle diameter is
sufficient to move the control piston into the closing
position. It should additionally be noted here that the

volume of the space on the second piston side can also have an influence on the delayed pressure equalization. The volume should preferably be kept as small as possible in terms of as compact as possible a design.

5

In one configuration, the shutoff valve has a housing portion for receiving the control piston and a housing portion for at least partial receiving of the space on the second piston side.

10

As a result of the separation of the shutoff valve into at least two housing portions, the shutoff valve can have a modular structure. It is thus, for example, possible in a simple manner to provide different spaces on the second piston side in order to be able to adapt pressure conditions as necessary. Alternatively or additionally, different control pistons can also be combined with a space on the second piston side.

15

When using the resilient element described above and a correspondingly provided space, as stated above, in one configuration at least the force brought about by the dead weight of the control piston in the direction of the second connection portion up to a maximum change in position which is suitable to the application and thus change in angle of the shutoff valve with respect to a starting position is smaller than the force of the resilient element in the opposite direction.

25

Insofar as the longitudinal axis of the control piston deviates from a parallel orientation to the gravitational force as a result of the installation and/or as a result of the rail vehicle traveling on an upward slope or downward slope, the above ratio of the spring force to the force which is caused by the dead weight of the control piston relates to the maximum angle range which can be expected in the direction of movement of the piston from the closing position into the opening position and vice versa and is thus

35

predetermined or the corresponding change in position and thus angle of the shutoff valve with respect to a starting position. The starting position relates in turn to the position of the shutoff valve in the case of an even route, i.e. a route without an upward or downward slope. In other words, the shutoff valve is configured in terms of the spring force of the resilient element in relation to the counterforce brought about by the dead weight of the control piston in particular in such a manner that both in the case of predetermined installation angle of the control piston and in the case of changes in angle over a predetermined range the control piston can move independently into the opening position. In the case of a corresponding design, where applicable, further forces which counteract the spring force of the resilient element, such as, for example, frictional forces as a result of a radial guidance of the control piston, should be taken into account. In relation to a straight route profile, the shutoff valve or the control piston is preferably installed in such a manner that the longitudinal axis of the control piston is oriented parallel to the gravitational force and the second connection portion is arranged below the first piston side.

Via the above configuration, the control piston can be moved independently into the opening position after a venting of the space on the second piston side or at least after a reduction in pressure predetermined for this purpose in the space. A corresponding venting or the reduction in pressure can be performed irrespective of the connection with the above features via the first connection portion or another actuable pressure outlet.

For example, the control piston is moved initially in the case of a drop in pressure at the second connection portion by the pressure prevailing in the space on the second piston side counter to the spring force of the

resilient element in interaction with the weight force brought about by the dead weight of the control piston into the closing position. If the space on the second piston side is now vented, the force which acts counter to the spring force of the elastic element is reduced to such an extent that as a result of this the control piston is moved by the spring force into the opening position.

According to a further development, a housing portion of the shutoff valve forms a stop for the control piston which restricts the movement of the control piston in a direction facing away from the second connection portion.

The movement of the control piston in the direction of the opening position is thus restricted. Via this, the stroke of the control piston required to reach the closing position and thus also the time required to disconnect the fluidic connection between the first connection portion and the second connection portion are adjusted. The cross-section of the fluidic connection can furthermore be adjusted in an analogous manner to this in order, for example, in the case of a drop in pressure at the second connection portion, to reduce the influence of the pressure medium which subsequently flows via the second connection portion. As a result of the restriction of the stroke of the control piston, it can furthermore be prevented with the provision of the space on the second piston side that the control piston disconnects or at least restricts the fluidic connection between the space and the first connection portion.

A further aspect of the invention relates to a pressure medium system for a rail vehicle, having a shutoff valve, as described above, a hose coupling which is connected directly or indirectly to the second connection portion of the shutoff valve, and a pressure

medium line which is connected directly or indirectly to the first connection portion, wherein the shutoff valve is configured in such a manner that the control piston can be moved independently into the closing position by the pressure gradient brought about by a failure of the hose coupling between the first connection portion and the second connection portion.

By way of example, the mode of operation of the above-mentioned pressure medium system using a shutoff valve is described, in the case of which the space is provided on the second piston side of the control piston and brings about the fluidic connection between the space and the first connection portion of a delayed pressure equalization. In normal operation, i.e. in the case of normal air consumption and flow through the shutoff valve, the pressures at the first connection portion or of the first pressure medium receiving volume, in the space fluidically connected thereto or the third pressure medium receiving volume on the second piston side and at the second connection portion or of the second pressure medium receiving volume are identical. In the event of a rupture of the hose coupling, a rapid drop in pressure arises at the second connection portion. The pressure on the first piston side of the control piston thus drops suddenly. Since the pressure in the space on the second piston side can only follow with a time delay, the control piston is moved into the closing position via this pressure and optionally in combination with the dead weight of the control piston. While the control piston is still located in the closing position, the pressure at the second connection portion reduces further to zero as a result of the ruptured hose coupling. Parallel to the further reduction in pressure at the second connection portion, the pressure equalization is performed between the space on the second piston side and the first connection portion. The pressure in the space on the second piston side acts on the second piston side and

not on the first piston side relieved of pressure and holds the control piston in the closing position.

According to a further development, the pressure medium
5 line has a pressure medium discharge device which can be switched in order to optionally be able to reduce a medium pressure in the first connection portion, and wherein the control piston of the shutoff valve can be moved independently into the opening position in
10 particular by an associated drop in pressure in the first connection portion.

The switching of the pressure medium discharge device can be actuated electronically and/or manually
15 actuatable. In one simple configuration, a cock can be provided on the pressure medium line. If this is opened, the first connection portion can be vented.

The independent movement of the control piston into the opening position can be performed, for example, via the
20 renewed application of a pressure on the first piston side via the second connection portion and/or the use of the resilient element described above in relation to the shutoff valve. For example, in the case of the
25 above-mentioned exemplary configuration of the pressure medium system, a resilient element can be used which is formed as a pressure spring and engages on the first piston side of the control piston. If the first connection portion or the first pressure medium
30 receiving volume is now vented, a venting of the space on the second piston is likewise performed. No pressure thus acts any more counter to the resilient element from the second piston side. Provided that the force counteracting the spring force, where applicable,
35 taking into account further counterforces, such as frictional forces, is smaller than the spring force by the dead weight of the control piston, the control piston can now be moved via the resilient element from the closing position into the opening position.

In one configuration, the pressure medium system has a sensor which is configured in such a manner that a triggering of the shutoff valve for the movement of the control piston into the closing position can be monitored by the sensor, in particular via a pressure switch in the second connection portion and/or a sensing of the stroke of the control piston.

It can, for example, be ascertained on the basis of the monitoring whether the control piston has been moved into the closing position in the case of a drop in pressure at the second connection portion. Alternatively or additionally, the monitoring can also be used to ascertain whether the control piston has moved into the closing position although no drop in pressure occurs at the second connection portion. For this purpose, an evaluation logic of an evaluation unit connected to the sensors can be configured in such a manner that both the pressure in the second connection portion and a position of the control piston are compared with one another in accordance with the sensing of the stroke. The sensing of the stroke of the control piston can be implemented, for example, via a sensitive switch or contactless Hall effect sensor.

In a further aspect, the invention relates to a rail vehicle with a pressure medium system described above, wherein the rail vehicle has at least two carriages which have in each case at least one pressure medium line, and wherein the respective pressure medium lines for fluidic connection of one end of the pressure medium line of one carriage to a corresponding end of the pressure medium line of the other carriage via a respective shutoff valve, which is arranged in particular sufficiently close to the hose coupling, are connected to a hose coupling.

The arrangement of the respective shutoff valve sufficiently close to the hose coupling relates to a maximum distance to the hose coupling which makes it possible that the drop in pressure caused by a failure of the hose coupling at the second connection portion arises sufficiently rapidly and/or to a sufficient degree in the sense of the magnitude of the drop in pressure. In other words, the respective shutoff valves are arranged at a distance to the hose coupling over which a predetermined throttling of the pressure drop gradient between the hose coupling and the second connection portion of the respective shutoff valves is not exceeded or does not occur in the first place due to the path length or the connection dimensions.

In particular, the respective shutoff valve is arranged between the hose coupling and respective consumers of the corresponding carriage. Sufficient proximity to the hose coupling is also advantageous here in order to improve accessibility to a pressure medium discharge device which is provided, for example, for the consumer and the shutoff valve. The pressure medium discharge device is in this case therefore located between the consumer and the respective shutoff valve.

The invention is explained in greater detail below with reference to the enclosed figures. In detail:

Figure 1 shows a schematic representation of a rail vehicle with a pressure medium system with shutoff valves according to an exemplary embodiment of the invention;

Figure 2 shows a schematic cross-sectional view of a shutoff valve according to an exemplary embodiment which can be used for the pressure medium system of the rail vehicle according to figure 1.

Figure 1 shows a schematic representation of a rail vehicle 1 with a pressure medium system 10 with shutoff valves 100 according to an exemplary embodiment of the invention. Only one carriage 2 is shown in its entirety and one carriage 2 is shown partially in the representation, wherein in each case further carriages can adjoin. The pressure medium system 10 of the rail vehicle 1 has in each of the carriages 2 a pressure medium line 400. The pressure medium lines 400 of the respective carriages 2 are connected to one another via a hose coupling 200 between the carriages 2. The pressure medium used in the described embodiment is compressed air. According to alternative embodiments, another gaseous medium or also a liquid can, however, also be used. The functional principles described here in relation to a pneumatic system can be applied to a hydraulic system.

In order to shut off the respective pressure medium line 400 with respect to the respectively connected hose coupling 200, the pressure medium line 400 has in each case a shutoff valve 100 for each hose coupling connection. In an alternative embodiment, only one shutoff valve can also be provided for each carriage 2 or according to a further alternative on the grounds of redundancy more than one shutoff valve 100 for each hose coupling connection. The shutoff valves 100 according to the exemplary embodiment shown in **figure 1** are arranged in each case in the vicinity of the hose coupling 200 connected thereto. A first connection portion I of the respective shutoff valve 100 is connected to the respective pressure medium line 400 and a second connection portion II of the respective shutoff valve 100 is connected to the respective hose coupling. In the embodiment shown, the shutoff valves 100 are not connected directly to the respective hose coupling itself, but rather indirectly via a further pressure medium line portion which can, however, be assigned to the respective hose coupling 200.

Alternatively, a shutoff valve 100 can also be connected directly to the hose coupling 200 in order to reduce as much as possible the distance between the respective shutoff valve 100 and the respective hose coupling 200.

The respective pressure medium line 400 for each shutoff valve 100 furthermore has a vent cock 300 as a pressure medium discharge device. A pressure medium located in the respective shutoff valve 100 can be discharged via the respective vent cock 300 and thus the pressure present at or in the first connection portion I of the shutoff valve can be reduced. Even if here a vent cock 300 is assigned to each shutoff valve 100, alternatively only one vent cock 300 can be provided for each carriage 2. On the grounds of redundancy and/or for venting via several actuating principles, in a further alternative, several vent cocks 300 or other pressure medium discharge devices can also be provided for a shutoff valve 100. In terms of the stated actuating principles, the vent cock 300 can, in the embodiment shown, be opened and closed manually and in an electrically actuated manner. According to one alternative embodiment, the vent cock is actuated only manually or electrically. The actuating principles can relate not only to a manual or electric controlled actuation, but rather can also relate to various mechanisms for opening and closing such a pressure medium discharge device, such as mechanical, pneumatic, hydraulic, electric or magnetic opening and closing mechanisms or combinations thereof.

A detailed description of the mode of operation of the pressure medium system 10 of the rail vehicle 1 according to **figure 1** is performed below with reference to a shutoff valve 100 represented in **figure 2**. In this regard, **figure 2** shows a schematic cross-sectional view of the shutoff valve 100 according to an exemplary embodiment which can be used for the pressure medium

system 10 of the rail vehicle 1 according to **figure 1**. The use of the shutoff valve 100 is, however, not restricted to this.

5 The shutoff valve 100 has a first connection portion I and a second connection portion II. The first connection portion I is fluidically connected to the second connection portion II. The fluidic connection in
10 a closing position of the control piston 130 can be disconnected via a control piston 130. In the embodiment shown, the control piston 130 separates a first pressure medium receiving volume 110 which adjoins the first connection portion I from a second
15 pressure medium receiving volume 120 which adjoins the second connection portion II. The second pressure medium receiving volume 120 is formed here via a piston seat 151 which extends here as a cylindrical portion, which is opened in each case on a side facing toward
20 the second connection portion III into the shutoff valve 100.

The control piston 130 has a first piston side 130a facing the piston seat 151 and an opposite second
25 piston side 130b facing away from the piston seat 151. A longitudinal axis L of the control piston 130 extends perpendicular to the piston sides 130a, 130b in its distance direction. The control piston 130 is formed in
30 interaction with the piston seat 151 as a valve plate, wherein the first piston side 130a lies in a sealing manner on the piston seat 151 in the event of movement of the control piston 130 in the direction of the longitudinal axis L into the closing position. The seal
35 is supported by axial sealing elements 131 in relation to the longitudinal axis L. In an alternative embodiment, the control piston 130 can also be formed as a sliding piston, wherein then a piston portion having the first piston side is received in the piston seat 151 which then acts as a piston receptacle. The

sealing is performed in such a case not axially, but rather radially in interaction with the radially circumferential inner surface of the piston seat 151. In this alternative, the piston seat 151 is, to be
5 strict, not a piston seat, but rather a piston receptacle. As a result of the comparable configuration possibility, for example, via a cylinder portion, only the alternative sealing possibility is described here on the basis of the piston seat 151.

10

In order to guide the control piston 130 in the case of a movement in the direction of the longitudinal axis L, a radially circumferential surface in relation to the longitudinal axis L between the first piston side 130a
15 and the second piston side 130b is guided in the axial direction radially in a housing portion 150. So that no pressure medium can thus escape from a space 110* described below on the second piston side 130b, the radial guide surface portion between the first piston
20 side 130a and the second piston side 130b has radial sealing elements 132. In order to prevent a tipping or tilting of the control piston in the guide described above, the control piston 130 furthermore has a control piston pin 130c which extends from the first piston
25 side 130a in the direction of the longitudinal axis L to the second connection portion II into the piston seat 151 or into the opening formed by the piston seat 151. A guide element 133 is arranged on the control piston pin 130c, which guide element 133 extends
30 radially outwardly in relation to the longitudinal axis L and guides the control piston along an inner wall of the piston seat 151 in the case of a movement in the axial direction.

35 The control piston 130 is mounted here furthermore by a pressure spring 140 as a resilient element. The pressure spring 140 is, for this purpose, arranged around the piston seat 151 between the first piston side 130a and an end of the piston seat 151 facing the

second connection portion II. The spring force of the pressure spring 140 acts in the direction of the longitudinal axis L. In an alternative embodiment, a resilient element can also be provided in the portion
5 which forms the piston seat 151. In a further alternative, several resilient elements can also be used instead of a resilient element.

The shutoff valve 100 furthermore has the space 110*
10 already briefly discussed on the second piston side 130b. The space 110* forms a third pressure medium receiving volume. The space 110* or the third pressure medium receiving volume is fluidically connected via a nozzle 161 to the first connection portion I or the
15 first pressure medium receiving volume 110. A pressure equalization between the space 110* and the first connection portion I is thus performed with a time delay via the nozzle 161.

20 The space 110* on the second piston side 130b is formed by a clearance in a second housing portion 160 of the shutoff valve 100. Via the radial side walls of the space 110* in relation to the longitudinal axis L or their ends facing the second piston side 130b, the
25 second housing portion 160 furthermore forms a stop 162 for the control piston 130b which correspondingly restricts the movement of the control piston 130 in the direction of the space 110*. The space 110* is open on a side facing the second piston side 130b so that a
30 pressure in the space 110* can be transmitted via the second piston side 130b to the control piston 130. The second housing portion 160 furthermore has the nozzle 161. As a result of the separation into a first housing portion 150 and a second housing portion 160, the space
35 110* and/or the nozzle 161 can in each case be adapted flexibly by exchanging the second housing portion.

Figure 2 shows the shutoff valve 100 in normal operation of the pressure medium system 10 represented

in **figure 1**. In normal operation, the pressure medium line 400 is fluidically connected via the shutoff valve 100 to the hose coupling 200. The pressure medium is guided via the connection portion I and the connection portion II. The pressures in the first pressure medium receiving volume 110, in the second pressure medium receiving volume 120 and in the third pressure medium receiving volume or the space 110* are identical in this state. The control piston 130 is in the opening position and is held there via the spring force of the pressure spring 140. If a rupture of the hose coupling 200 occurs, the pressure acting on the first piston side 130a, in the drawing representation the pressure below the control piston 130, drops suddenly. As a result of the nozzle 161, the pressure in the space 110* initially however remains substantially constant and only reduces to the extent that the pressure gradient between that on the second piston side 130b and on the first piston side 130a is sufficient to move the control piston 130 in the direction of the piston seat 151 into the closing position in which the first piston side 130a lies in a sealing manner on the piston seat 151. The fluidic connection between the first connection portion I and the second connection portion II and thus in relation to the pressure medium system 10 between the pressure medium line 400 and the hose coupling 200 is thus disconnected by the control piston 130. As a result of the rupture of the hose coupling 200, the pressure in the second pressure medium receiving volume is reduced to zero and the pressures in the first pressure medium receiving volume 110 and in the third pressure medium receiving volume or in the space 110* align. The pressure which prevails after the alignment in the space 110* holds the control piston 130 in the closing position. The pressure spring 140 is correspondingly configured such that the spring force of the pressure spring 140 is smaller than the sum of the pressure force acting through pressure in the aligned state on the second piston side 130b and the

force acting in the closing direction by the dead weight of the control piston 130. At the same time, the spring force here is greater than the force acting in the closing direction by the dead weight of the control piston 130 in order to enable the independent movement described below of the control piston into the opening position.

In order to move the control piston 130 independently out of the closing position into the opening position, the vent cock 300 provided for the respective shutoff valve 100 is opened. As a result of this, the first pressure medium receiving volume 110 and the space 110* are vented via the first connection portion I. The pressure acting on the second piston side 130b is correspondingly removed. Since here, as stated above, the spring force of the spring pressure 140 is greater than the force acting in the direction of the closing position by the dead weight of the control piston 130, the control piston 130 is moved back into the opening position via the pressure spring.

In the embodiment shown, the shutoff valve 100 furthermore has a sensor 170 on the second connection portion II. The sensor 170 is formed here as a pressure switch and switches in the case of a predetermined drop in pressure. The sensor 170 senses the venting of the pressure at the second connection portion II and thus implicitly that the connection vents in the direction of the pressure medium line 400 and is possibly shut off. This can be caused by the shutoff valve 100 itself or the position of the vent cock 300. It can furthermore be implicitly sensed via the pressure switch that the pressure level of the entire pressure medium line 400 is too low. A closed shutoff valve can thus be concluded by ruling out the two other above causes. A rupture of the hose coupling 200 and the orderly triggering of the shutoff valve 100 can accordingly be monitored. In an alternative embodiment,

the monitoring can alternatively or additionally be implemented via a sensing of the stroke of the control piston 130. It can, for example, be detected via the sensing of the stroke that the control piston 130 is
5 located in the opening or closing position. An actual triggering of the shutoff valve in the sense of a position of the control piston 130 is thus directly possible via the sensing of the stroke. In comparison with the signal of the pressure switch, an orderly
10 triggering in the sense of a closing in the case of a drop in pressure or a failure of the shutoff valve 100 can be determined. A failure would then be present, for example, if the sensing of the stroke detects that the control piston, despite a drop in pressure, is in the
15 opening position or in reverse has moved into a closing position despite the fact that no drop in pressure is present.

The invention is not restricted to the described
20 embodiments. In particular, features described in relation to the embodiments, configurations and further developments can be combined with one another insofar as they are not within reason mutually exclusive.

LIST OF REFERENCE SIGNS

	1	Rail vehicle
	2	Carriage
5	10	Compressed air system (pressure medium system)
	100	Shutoff valve
	110	First compressed air receiving volume (first pressure medium receiving volume in relation to connection portion I)
10	110*	Third compressed air receiving volume (third pressure medium receiving volume in relation to first compressed air receiving volume 110)
	120	Second compressed air receiving volume (second pressure medium receiving volume in relation to connection portion II)
15	130	Control piston
	130a	First piston side
	130b	Second piston side
	130c	Control piston pin
20	131	Axial sealing element
	132	Radial sealing element
	133	Guide element
	140	(Pressure) spring (resilient element)
	150	First housing portion (control piston)
25	151	Piston seat
	160	Second housing portion (third compressed air receiving volume 110*)
	161	Nozzle
	162	Control piston stop
30	170	Sensor
	200	Hose coupling
	300	Vent cock (pressure medium discharge device)
	400	Compressed air line (pressure medium line)
	I	First connection portion
35	II	Second connection portion
	L	Longitudinal axis (control piston)

CLAIMS

1. A shutoff valve (100) for a pressure medium system (10) of a rail vehicle (1), having:
 - 5 a first connection portion (I) for the introduction of a pressure medium into and/or discharge of a pressure medium out of the shutoff valve (100),
 - a second connection portion (II) connected fluidically to the first connection portion (I) for the
 - 10 discharge of the pressure medium out of and/or introduction of the pressure medium into the shutoff valve (100),
 - a control piston (130) which is movable inside the shutoff valve (100), having a first piston side (130a)
 - 15 and an opposite second piston side (130b), and
 - a portion (151) formed as a piston seat or piston receptacle between the first connection portion (I) and the second connection portion (II), on which the first
 - 20 piston side (130a) of the control piston (130), in a closing position, can be placed in a sealing manner or into which a portion of the control piston (130) having the first piston side (130a), in a closing position, can be received in a sealing manner, such that the
 - 25 first piston side or the portion having the first piston side (130a) disconnects the fluidic connection between the first connection portion (I) and the second connection portion (II), and in an opening position is raised up from the piston seat or the piston receptacle and allows the connection.
 - 30
2. The shutoff valve (100) as claimed in claim 1, wherein the pressure medium is compressed air.
3. The shutoff valve (100) as claimed in claim 1 or
- 35 2, wherein the control piston (130) is mounted by a resilient element (140), the spring force of which acts in the direction of the opening position.

4. The shutoff valve (100) as claimed in any one of the preceding claims, wherein the shutoff valve is equipped with a radial guide so that the control piston (130) is guided at least in portions radially in the shutoff valve (100) in the case of a movement between the opening and closing position at least in portions in relation to its longitudinal axis (L) which corresponds to a direction of extent of the control piston from the first piston side (130a) to the second piston side (130b).

5. The shutoff valve (100) as claimed in claim 4, wherein the at least in portions radial guidance of the control piston (130) is performed via a radial surface portion of the control piston (130) in relation to the longitudinal axis (L) between the first piston side (130a) and the second piston side (130b) in interaction with a housing portion (150, 160) of the shutoff valve (100).

6. The shutoff valve (100) as claimed in claim 4 or 5, wherein the control piston (130) has, on a side facing the second connection portion (II), a control piston pin (130c) which extends into the piston seat (151) or the piston receptacle and is guided via a guide element (133) in interaction with at least one portion of an inner surface, facing the control piston pin (130c), of the piston seat (151) or the piston receptacle in the event of a movement of the control piston (130) in the direction of the longitudinal axis (L) between the opening and closing position at least in portions.

7. The shutoff valve (100) as claimed in any one of the preceding claims, wherein a space (110*) is provided in the shutoff valve (100) on the second piston side (130b), which space (110*) is fluidically connected to the first connection portion (I) in order

to transmit a corresponding pressure to the second piston side (130b) of the control piston (130).

8. The shutoff valve (100) as claimed in claim 7,
5 wherein the fluidic connection between the first connection portion (I) and the space (110*) is configured in such a manner that it brings about a delayed pressure equalization between the first connection portion (I) and the space (110*) and is
10 formed in particular as a nozzle.

9. The shutoff valve (100) as claimed in claim 7 or 8, wherein the shutoff valve (100) has a first housing portion (150) for receiving the control piston (130)
15 and a second housing portion (160) for at least partial receiving of the space (110*) on the second piston side (130b).

10. The shutoff valve (100) as claimed in claim 3 and
20 at least one of claims 7 to 9, wherein at least the force brought about by the dead weight of the control piston (130) in the direction of the second connection portion (II) up to a maximum change in position which is suitable to the application and thus change in angle
25 of the shutoff valve (100) with respect to a starting position is smaller than the force of the resilient element (140) in the opposite direction.

11. The shutoff valve (100) as claimed in any one of
30 the preceding claims, wherein a housing portion (150, 160) of the shutoff valve (100) forms a stop (162) for the control piston (130) which restricts the movement of the control piston (130) in a direction facing away from the second connection portion (II).

35

12. A pressure medium system (10) for a rail vehicle (1), having
a shutoff valve (100) as claimed in any one of the preceding claims,

a hose coupling (200) which is connected directly or indirectly to the second connection portion (II) of the shutoff valve (100), and

5 a pressure medium line (400) which is connected directly or indirectly to the first connection portion (I),

wherein the shutoff valve (100) is configured in such a manner that the control piston (130) can be moved independently into the closing position by the
10 pressure gradient brought about by a failure of the hose coupling (200) between the first connection portion (I) and the second connection portion (II).

13. The pressure medium system (10) as claimed in
15 claim 12, wherein the pressure medium line (400) has a pressure medium discharge device (300) which can be switched in order to optionally be able to reduce a medium pressure in the first connection portion (I), and wherein the control piston (130) of the shutoff
20 valve (100) can be moved independently into the opening position in particular by an associated drop in pressure in the first connection portion (I).

14. The pressure medium system (10) as claimed in
25 claim 12 or 13, wherein the pressure medium system (10) has a sensor (170) which is configured in such a manner that a triggering of the shutoff valve (100) for the movement of the control piston (130) into the closing position can be monitored by the sensor (170), in
30 particular via a pressure switch in the second connection portion (II) and/or a sensing of the stroke of the control piston (130).

15. A rail vehicle (1) with a pressure medium system
35 (10) as claimed in any one of claims 12 to 14, wherein the rail vehicle (1) has at least two carriages (2) which have in each case at least one pressure medium line (400), and wherein the respective pressure medium lines (400) for fluidic connection of one end of the

pressure medium line (400) of one carriage to the corresponding end of the pressure medium line (400) of the other carriage via a respective shutoff valve (100), which is arranged in particular sufficiently
5 close to the hose coupling (200), are connected to a hose coupling (200).