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(54) Title: A PISTON ASSEMBLY CAPABLE OF SECONDARY DAMPING

(57) Abstract: The invention relates to at least one piston assembly (10) comprising at least one internal tube (11) and at least one external tube (13) positioned in the invention, at least one external chamber (14) defined between the internal tube (11) and the external tube (13) and the at least one internal chamber (12) defined in the internal tube (11) for placing the hydraulic fluid in it, at least one piston rod (20), which is at least partially movable within the said internal chamber (12), at least one first valve group (V1) positioned on said piston rod (20) to allow limited passage in case of jamming of the hydraulic fluid in the internal chamber (12), at least one second valve group (V2) to allow limited passage in the event of hydraulic fluid entrapment by being positioned between the internal chamber (12) and the internal chamber (14).

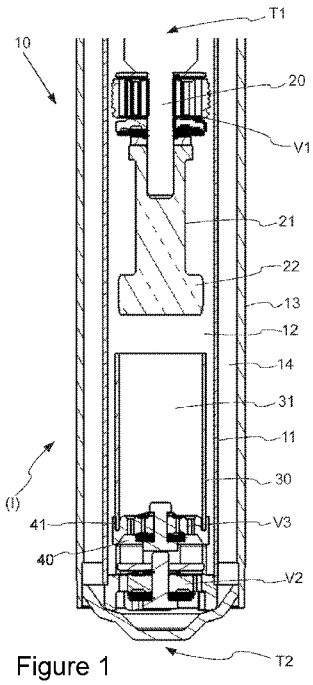

Figure 1

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A PISTON ASSEMBLY CAPABLE OF SECONDARY DAMPING

TECHNICAL FIELD

The present invention relates to at least one piston assembly comprising at least one internal tube and at least one external tube positioned in the invention, at least one external chamber defined between the internal tube and the external tube, and the at least one internal chamber defined in the internal tube for placing the hydraulic fluid in it, at least one piston rod, which is at least partially movable within said internal chamber, at least one first valve group positioned on the said piston rod to allow limited passage in case of jamming of the hydraulic fluid in the internal chamber, at least one second valve group to allow limited passage in the event of hydraulic fluid entrapment by being positioned between the internal chamber and the internal chamber.

BACKGROUND

Pistons, also known as shock absorbers, are elements used to reduce the severity and effect of shocks and vibrations that occur during operation in vehicles. The pistons show a resistance that is inverse to the direction of movement and is proportional to the speed. Thus, they absorb the energy that causes jolt and vibration by converting it into heat. Pistons can be used in all kinds of impact machines (textile machines, presses, construction machines, lifting machines, etc.), especially vehicles. In general, the working principle of the pistons is based on the principle of converting the movement energy into heat and swallowing it by showing resistance to movement by friction. Pistons can be liquid, or liquid-gas based. Liquid types of oil are used. Based on the high viscosity (consistency) property, which is the internal molecular friction of the oils, the energy converted to heat is absorbed by the friction between the molecules compressed by forcing the oil under pressure to pass through narrow channels.

Today, motor vehicles contain elements designed in different ways to meet the expectations of users such as comfort, driving comfort, and safety. Pistons play an important role in these elements. They are effective in the hardness levels of the pistons, the handling of the vehicles, the driving comfort, and the transmission of the defects on the road to the vehicle. The hardness of the pistons increases the vehicle's handling and steering control while

reducing ride comfort. Conversely, the pistons being too soft causes the driver to feel the vibrations on rough roads and reduces their comfort.

Application No. US2021404528A1, available in the literature, relates to a hydraulic damper assembly. This hydraulic damping assembly contains a main tube that forms the fluid chamber. An external tube extends around the main tube. Defines a balancing chamber between the main and external tubes. A main piston located in the main tubes divides the fluid chamber into a compression chamber and a recoil chamber. A piston rod is connected to the main piston. A bottom valve located in the compression chamber is connected to the main tube. A hydraulic clamping stopper in the clamping chamber comprises an additional piston, a spacer, and a fixing element. The additional piston is connected to the main piston. The joint in the compression chamber is connected to the base valve. The insert has one main section and one terminal section. The outer diameter of the terminal section is smaller than the outer diameter of the main section. In this embodiment, the liquid chamber has a closed volume and the grooves on the sides allow the passage of fluid. This causes the system damping force not to be adjusted as desired. These grooves in the liquid chamber both bring an additional cost for the manufacture of the liquid chamber and prevent adjustability.

The pistons are designed according to the characteristics of the vehicle on which they will be located and are expected to have a predetermined hardness performance. However, different piston production for each vehicle means additional workload and logistics for the manufacturers.

As a result, all the above-mentioned problems have made it imperative to innovate in the relevant technical field.

BRIEF DESCRIPTION OF THE INVENTION

The present invention relates to a piston assembly for eliminating the above-mentioned disadvantages and bringing new advantages to the relevant technical field.

An object of the invention is to provide a piston assembly having an improved damping feature.

Another object of the invention is to provide a piston assembly that allows secondary damping.

The present invention relates to at least one piston assembly comprising at least one internal tube and at least one external tube positioned in the invention, at least one external chamber defined between the internal tube and the external tube, and the at least one internal chamber defined in the internal tube for placing the hydraulic fluid in it, at least one piston rod, which is at least partially movable within said internal chamber, at least one first valve group positioned on the said piston rod to allow limited passage in case of jamming of the hydraulic fluid in the internal chamber, at least one second valve group to allow limited passage in the event of hydraulic fluid entrapment by being positioned between the internal chamber and the internal chamber in order to realize all the objects that will emerge from the abovementioned and the following detailed description. Accordingly, its novelty comprises at least one secondary damping rod positioned on the side of the piston rod facing the internal chamber and movable with the piston rod to dampen sudden force loads, at least one sleeve with an inner cavity in which said secondary damping rod can be at least partially penetrated by moving, and at least one third valve group to allow limited passage to the internal chamber in the event of hydraulic fluid being compressed in the inner cavity on said sleeve. Thus, it is ensured that the piston assembly can dampen against sudden and unusual force loads.

A possible embodiment of the invention is characterized in that it comprises at least one enlarged form for sealing the secondary damping arm into the inner cavity of the sleeve. In this way, the secondary damping rod is firmly pressed against the sleeve and can be moved in a sealed manner.

Another possible embodiment of the invention is characterized in that the third valve group is positioned on the side facing the second valve group on the sleeve. Thus, the hydraulic fluid stuck in the inner cavity passes through the third valve group and then through the second valve group to the external chamber.

Another possible embodiment of the invention is characterized in that the third valve group is positioned on at least one retaining part. Thus, ease of assembly is obtained in the production stage.

Another possible embodiment of the invention is characterized in that it comprises at least one housing for holding the sleeve on said retaining part. Thus, it is ensured that the sleeve is mounted on the retaining part.

Another possible embodiment of the invention is characterized in that the retaining part is secured to the internal chamber. Thus, ease of assembly is obtained in the production stage.

BRIEF DESCRIPTION OF THE FIGURE

Figure 1 shows a representative cross-sectional view of the piston assembly of the invention in the first position.

Figure 2 shows a representative cross-sectional view of the piston assembly of the invention in the second position.

DETAILED DESCRIPTION OF THE INVENTION

In this detailed description, the subject matter of the invention is explained only by means of examples that will not have any limiting effect for a better understanding of the subject matter.

The invention relates to a piston assembly (10). The piston assembly (10) of the invention is a mechanism that at least partially dampens between the first side (T1) and a second side (T2) between which it is positioned during operation. At least one of the first side (T1) and the second side (T2) to which the piston assembly (10) is connected may be movable. The piston assembly (10) allows the force to be damped between the two sides. The piston assembly (10) is located on vehicles in a possible embodiment of the invention. In vehicles, the first side (T1) is the vehicle body, while the second side (T2) is the wheel of the vehicle. In this way, damping is provided between the vehicle body and the vehicle wheel. However, the piston assembly (10) is not limited to this, it can also be used in different areas such as textile machines, presses, construction machines, and lifting machines.

The piston assembly (10) of the invention has an interlocking internal tube (11) and an external tube (13). The inner part of the internal tube (11) is defined as an internal chamber (12) and the part between the internal tube (11) and the external tube (13) is defined as an external chamber (14). The internal chamber (12) and the external chamber (14) are associated with each other and contain hydraulic fluid. The hydraulic fluid enables damping in the piston assembly (10). There is a piston rod (20) extending from one side of the internal tube (11) towards the internal chamber (12). The piston rod (20) is at least partially movable through the internal chamber (12). There is a first valve group (V1) provided around the end of the piston rod (20) inside the internal tube (11). The first valve group (V1) is configured to

dampen during fluid transport within the internal chamber (12). For this, the first valve group (V1) limits the passage of fluid from the internal chamber (12) to the external chamber (14). During the operation of the piston assembly (10), controlled fluid passage is provided between the opposite sides of the internal chamber (12), which is divided by the first valve group (V1). In the event that one of the first side (T1) or the second side (T2) is moved towards the other in the piston assembly (10), the fluid passage within the internal chamber (12) is controlled by the first valve group (V1). There is also at least one second valve group (V2) around the opposite end of the internal tube (11) facing the piston rod (20). The second valve group (V2) regulates fluid passage between the internal chamber (12) and the external chamber (14). Depending on the amount of compression in the piston assembly (10), hydraulic fluid is transported from the internal chamber (12) to the external chamber (14). This fluid transport is controlled by the second valve group (V2) in the piston assembly (10). In the event of reverse movement, the fluid transfer from the external chamber (14) to the internal chamber (12) is carried out in a controlled manner by the second valve group (V2).

The piston assembly (10) of the invention is configured to perform secondary damping. Secondary damping provides damping in case of sudden and unusual force on the piston assembly (10). For this, there is at least one sleeve (30) around the second valve group (V2) in the piston assembly (10). The sleeve (30) is formed to have an inner cavity (31). The sleeve (30) is preferably cylindrical in shape. There is at least one secondary damping rod (21) on the piston rod (20) in response to said sleeve (30). The secondary damping rod (21) is located on the side of the piston rod (20) facing the sleeve (30). The secondary damping rod (21) is sized to enter and exit the sleeve (30). Preferably, the secondary damping rod (21) is sealed against the sleeve (30). For this, the secondary damping rod (21) has an extended form (22). In addition, the chamfered form can be found on the side of the sleeve (30) facing the secondary damping rod (21) so that the secondary damping rod (21) can easily enter and exit the sleeve (30). At least one third of the valve group (V3) is positioned on the other side of the sleeve (30) while it is passed to the secondary damping rod (21). The third valve group (V3) is inserted tightly into the internal chamber. The third valve group (V3) allows the fluid passage between the inner cavity (31) of the sleeve (30) and the internal chamber (12) to be regulated. With the secondary damping rod (21) entering the sleeve (30), the liquid in the inner cavity (31) is compressed and there is a limited fluid passage to the internal chamber (12) through the third valve group (V3). In the opposite case, the liquid is provided to the inner cavity (31) in the sleeve (30) by means of the third valve group (V3). The third valve group (V3) is preferably positioned on at least one retaining part (40). The retaining part (40) is formed to surround the third valve group (V3). In this way, ease of assembly is obtained during the production phase. There is at least one housing (41) on the

retaining part (40). The housing (41) is essentially a recessed form provided on the retaining part (40). The wall of the sleeve (30) is at least partially located in the housing (41). In this way, it is ensured that the sleeve (30) is fixed on the third valve group (V3).

A representative cross-sectional view of the piston assembly (10) of the invention at the first position (I) is given in Figure 1. Accordingly, in the first position (I), the piston assembly (10) is not subjected to a sudden load. While in this position, the secondary damping rod (21) is positioned outside the sleeve (30). The piston assembly (10) can operate in the first position (I) continuously in cases where a high force load is not applied to the piston assembly (10). For this, the fluid is transferred directly to the second valve group (V2) without being compressed in the sleeve (30). A representative cross-sectional view of the piston assembly (10) of the invention at the second position (II) is given in Figure 2. In said second position (II), the piston assembly (10) is loaded with a sudden and unusual force. When the first side (T1) and the second side (T2) are brought closer to each other in the piston assembly (10), the first position (I) is moved to the second position (II). The reason for this approach may be undesirable vibrations where the piston assembly (10) is used. In the case of load on the piston assembly (10), the hydraulic fluid in the internal chamber (12) first tries to stop the piston rod (20) by compressing. However, if the load on the piston rod (20) is high, the secondary damping rod (21) enters the sleeve (30). In this case, the hydraulic fluid in the inner cavity (31) of the sleeve (30) is compressed. In this case, the third valve group (V3) provides limited hydraulic fluid passage to the internal chamber (12). During these movements, the second valve group (V2) also provides a limited hydraulic fluid selection from the internal chamber (12) to the external chamber (14). In case the load on the piston assembly (10) is lifted, the valve groups are allowed to return to the first position (I) by allowing back fluid movement.

In addition to the standard force loads in the piston assembly (10), sudden and high-energy forces are damped with this whole embodiment. During this process, it is also ensured that the compression density can be adjusted by the user by using a sleeve (30) with the third valve group (V3). In addition, since the fluid passage of the first valve group (V1) and the second valve group (V2) is adjustable, it is ensured that the desired damping adjustment can be made in the piston assembly (10).

The protection scope of the invention is specified in the appended claims and cannot be strictly limited to those explained in this detailed description for illustrative purposes. It is evident that a person skilled in the art may exhibit similar embodiments in light of the foregoing without departing from the main theme of the invention.

REFERENCE NUMBERS GIVEN IN THE FIGURE

10 Piston Assembly
11 Internal Tube
12 Internal Chamber
13 External Tube
14 External Chamber

20 Piston Rod
21 Secondary Damping Rod
22 Extended Form

30 Sleeve
31 Inner Cavity

40 Retaining Part
41 Housing

V1 First Valve Group
V2 Second Valve Group
V3 Third Valve Group

T1 First Side
T2 Second Side

(I) First Position
(II) Second Position

CLAIMS

1. The invention is at least one piston assembly (10) comprising at least one internal tube (11) and at least one external tube (13) positioned in the invention,
At least one external chamber (14) defined between the internal tube (11) and the external tube (13) and the at least one internal chamber (12) defined in the internal tube (11) for placing hydraulic fluid in it,
At least one piston rod (20), which is at least partially movable within said internal chamber (12),
At least one first valve group (V1) positioned on said piston rod (20) to allow limited passage in case of jamming of the hydraulic fluid in the internal chamber (12),
At least one second valve group (V2) to allow limited passage in the event of hydraulic fluid entrapment by being positioned between the internal chamber (12) and the internal chamber (14), ***characterized in that*** it comprises the following:
At least one secondary damping rod (21) positioned on the side of the piston rod (20) facing the internal chamber (12) and movable together with the piston rod (20) to dampen the sudden force loads,
At least one sleeve (30) with an inner cavity (31) into which the secondary damping rod (21) can at least partially enter by being moved,
At least one third valve group (V3) to allow limited passage to the internal chamber (12) in case of compression of hydraulic fluid in the inner cavity (31) on the sleeve (30).

2. A piston assembly (10) according to Claim 1, ***characterized in that*** the secondary damping rod (21) comprises at least one extended form (22) for sealing the inner cavity (31) of the sleeve (30).

3. A piston assembly (10) according to Claim 1, ***characterized in that*** said third valve group (V3) is located on the side facing the second valve group (V2) on the sleeve (30).

4. A piston assembly (10) according to Claim 1, ***characterized in that*** the third valve group (V3) is located on at least one retaining part (40).

5. A piston assembly (10) according to Claim 4, ***characterized in that*** it comprises at least one housing (41) to hold the sleeve (30) on said retaining part (40).

6. A piston assembly (10) according to Claim 4, ***characterized in that*** the retaining part (40) is secured to the internal chamber (11).

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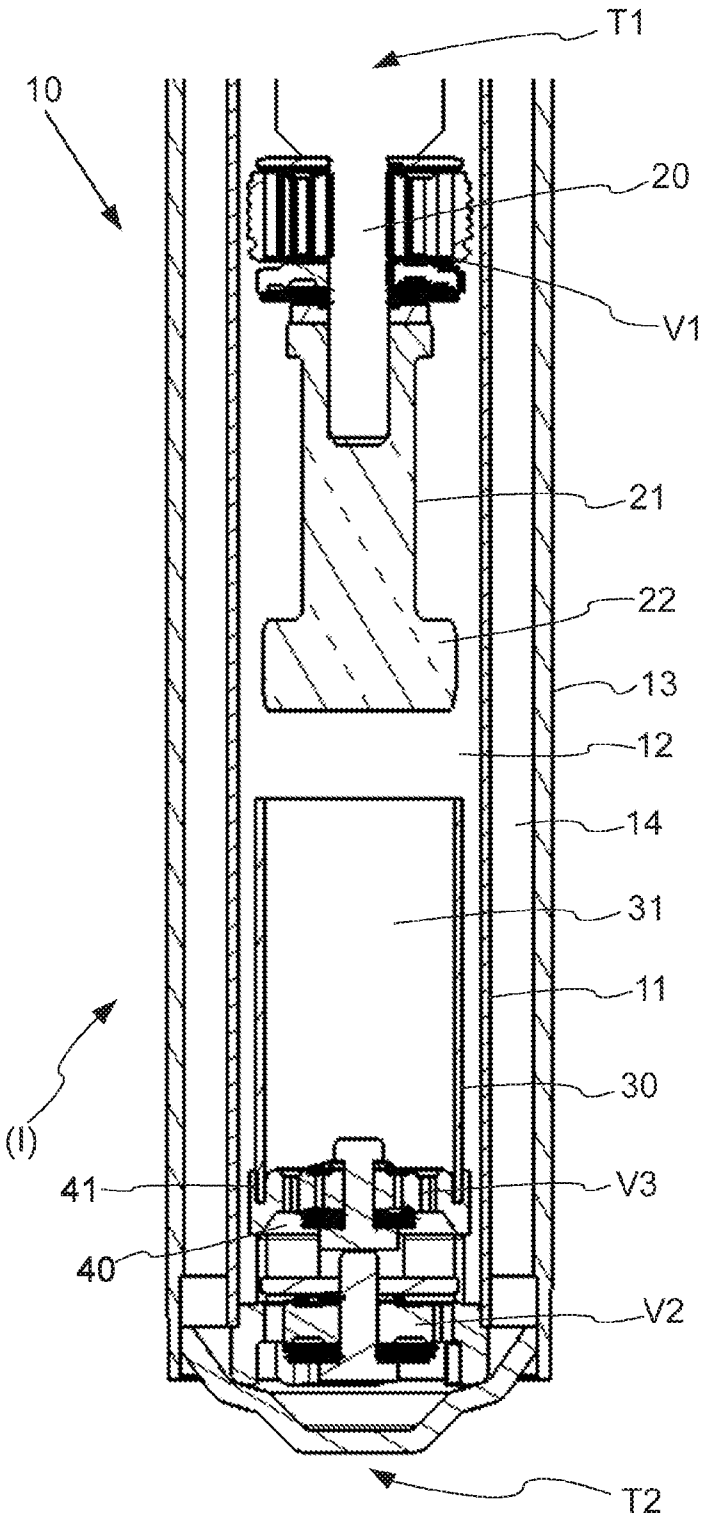

Figure 1

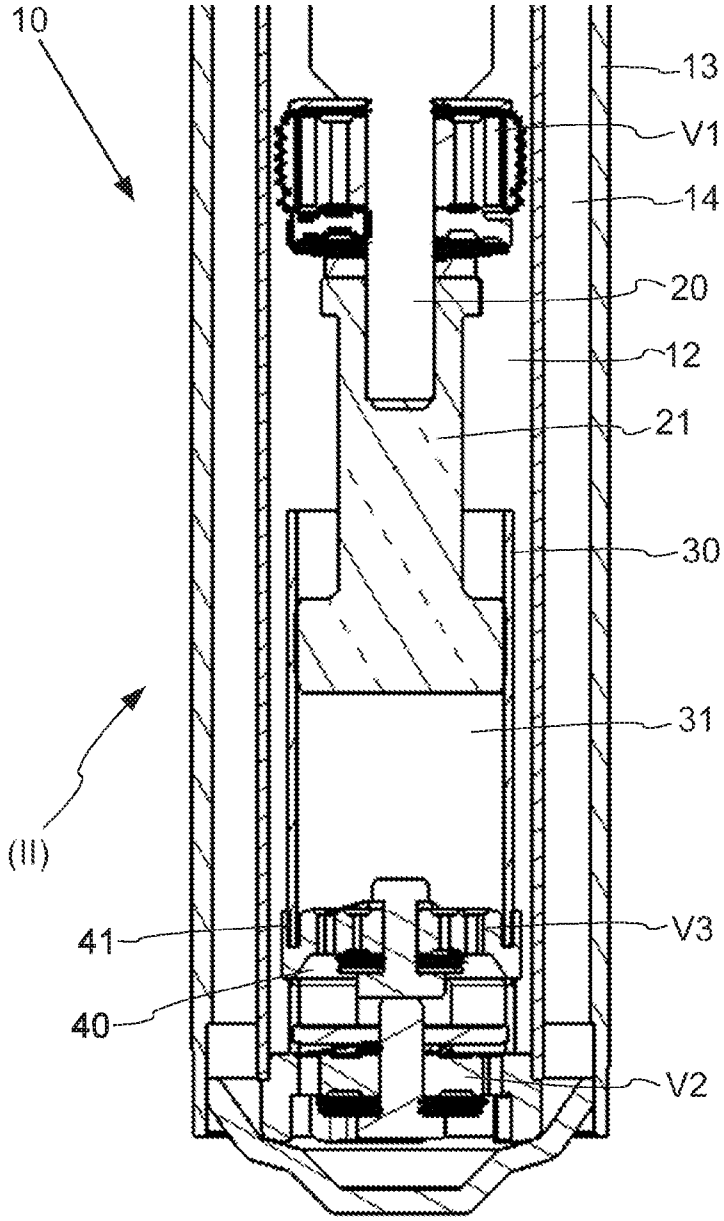

Figure 2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/TR2023/050309

A. CLASSIFICATION OF SUBJECT MATTER

F16F 9/49 (2006.01)i; F16F 9/32 (2006.01)i; F16F 9/18 (2006.01)i; F16F 9/512 (2006.01)i

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)

F16F

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

Turkpatent Database

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

EPO Abstract & Full text databases

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2984321 A (GEN MOTORS CORP) 16 May 1961 (1961-05-16) Abstract & Drawings	1-6
X	US 2021088096 A1 (DRIV AUTOMOTIVE INC [US]) 25 March 2021 (2021-03-25) Abstract, drawings, paragraphs 40-48 of the description and claims	1-6
A	US 2015330475 A1 (SLUSARCZYK PAWEL [PL]) 19 November 2015 (2015-11-19) Whole document	1-6

☐ 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
"D" document cited by the applicant in the international application
"E" earlier application or patent but published on or after the international filing date
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"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
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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/TR2023/050309

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
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