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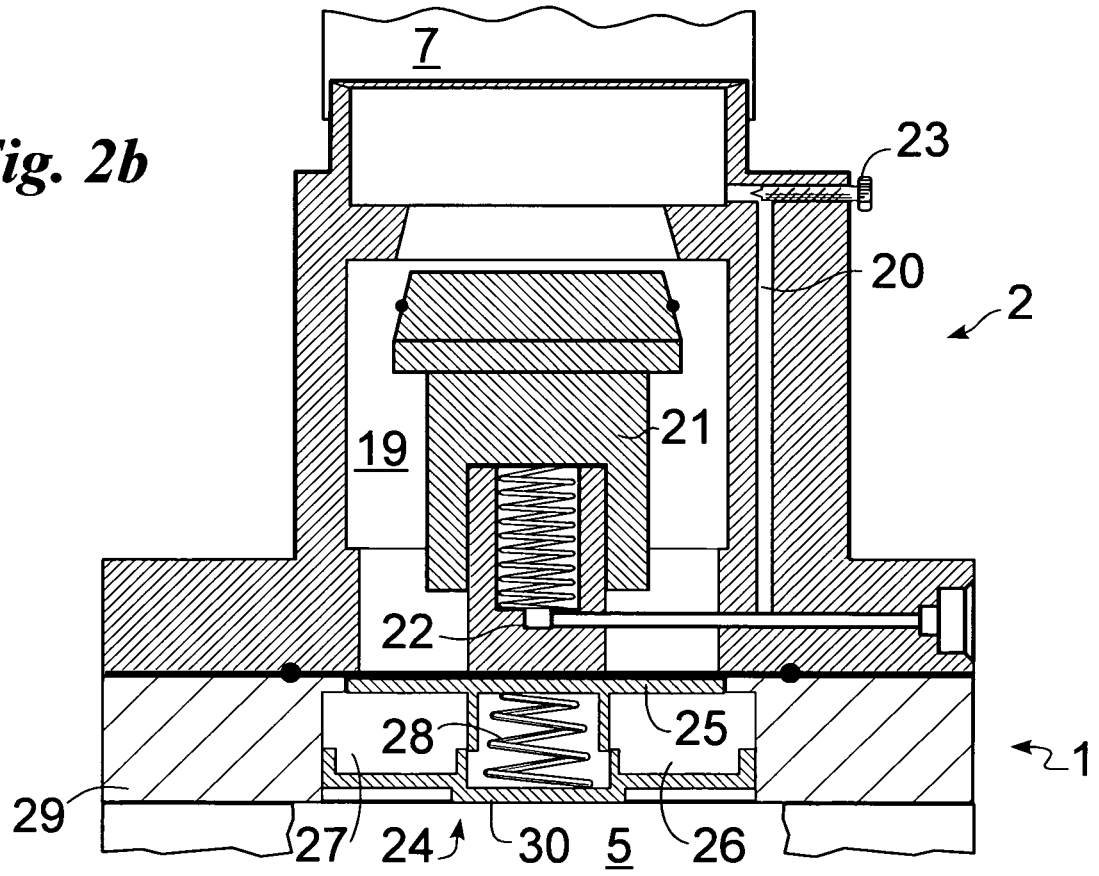
(54) **Safety device for intake valves**

(57) Provided herein is a safety device (1) for an intake valve (2), which can be applied on apparatuses (3) for the compression of fluids comprising a compressor (5) in fluid communication with the intake valve (2), and comprises a retention valve (24) designed to prevent any passage of fluid from the compressor (5) to the intake valve (2) and to enable passage of fluid from the intake valve (2) to the compressor (5).

Fig. 2b



EP 2 063 127 A1

Description

[0001] The subject of the present invention is a safety device for intake valves and an intake valve including said safety device of the type specified in the preamble of the first claim.

[0002] There are currently known intake valves, used in particular in compression apparatuses and the like.

[0003] The above compression apparatuses are designed to bring an air tank up to and keep it at a given pressure, typically comprised between 5 bar and 15 bar, for any purpose, such as for example the inflation of tyres, etc. An apparatus of this sort is described, for example, in the U.S. patent No. US-B-6,811,384.

[0004] The above apparatuses act by means of a compressor, generally actuated by an electric motor, which takes in air from the external environment, through the intake valve, and introduces it into a purposely provided accumulation tank.

[0005] Said apparatuses then comprise a circuit for the air under pressure, which enables transfer of air to the accumulation tank and, when the latter has reached the desired pressure, exhaust of the residual pressurized air present in the same circuit. Exhaust of the pressurized air takes place generally through the intake valve, which discharges into the external environment, without causing high levels of noise and pressure jumps.

[0006] The above apparatuses then comprise a lubrication circuit, designed to enable continuous lubrication of the compressor by means of recirculation and cooling of a lubricant. The same lubrication circuit generally has some elements in common with the pressurized-air circuit, in particular in a position corresponding to, and in the proximity of, the compressor.

[0007] Consequently, during regular operation of the apparatus, the lubricant is located in the area corresponding to the compressor and the lubrication valve, in environments at a pressure higher than the pressure of the external environment.

[0008] The known art referred to above presents some important drawbacks.

[0009] In fact, when interruptions of operation occur, the lubricant leaks into the external environment through the intake valve on account of the aforementioned pressure difference.

[0010] The present drawback has been partially overcome by means of a piston that enables closing of part of the intake valve when the apparatus is in discharging the residual air.

[0011] However, when sudden interruptions occur on account, for example, of technical failures, interruptions of the supply of electric current, a sudden turning-off of the apparatus, the piston does not close the intake valve and does not prevent leakage of lubricant into the external environment through the intake valve.

[0012] The aforesaid leakage of lubricant entails a long and burdensome cleaning of the intake valve and of the surrounding environment, stoppage of the compression apparatus during cleaning of the intake valve itself, environmental pollution due to the waste of lubricant and various other drawbacks.

[0013] In this situation, the technical task underlying the present invention is to provide a safety device for intake valves capable of substantially overcoming the drawbacks referred to.

[0014] In the framework of said technical task, an important purpose of the invention is to obtain a safety device for intake valves capable of preventing the leakage of lubricant into the intake valve and out of the latter in situations of sudden blocking of the compressor or in other unexpected situations that can occur during the use of the compression apparatuses.

[0015] The technical task and the purposes specified have been achieved by a safety device for intake valves, as claimed in the annexed Claim 1.

[0016] Preferred embodiments are highlighted in the dependent claims.

[0017] Further features and advantages of the invention are better explained in the detailed description of a preferred embodiment of the invention, with reference to the attached drawings, in which:

Figure 1 is a schematic representation of the components of a compression apparatus including an intake valve equipped with safety device according to the invention;

Figure 2a is a sectional view of an intake valve equipped with safety device according to the invention, in a first operating position;

Figure 2a is a sectional view of an intake valve equipped with safety device according to the invention, in a second operating position;

Figure 3a is a view from beneath of part of the safety device according to the invention;

Figure 3b is a view from beneath of a further part of the safety device according to the invention;

Figure 4 is a section taken along IV-IV of Figure 2a; and

Figure 5 is a section taken along V-V of Figure 2a.

[0018] With reference to the above figures, the safety device according to the invention is designated as a whole by the reference number **1.**

[0019] It is designed to be applied in a position corresponding to an intake valve **2,** in particular in a position corresponding to an intake valve 2 which can be applied on an apparatus **3** for compression of fluids.

[0020] The fluid-compression apparatuses 3 are designed to supply compressed air to an accumulation tank **4** that can be used directly by a user for any purpose, such as, for example, for inflating tyres of vehicles, etc.

[0021] The same compression apparatuses 3 act by means of a compressor **5,** designed to draw in fluids, conveniently constituted by air, from the external environment, through the intake valve 2, and to introduce them into the accumulation tank 4 through a circuit for

pressurized fluids **6.**

[0022] In greater detail, the air coming from the external environment is filtered by means of a purposely provided filter **7,** passes through the intake valve 2, reaches the compressor 5, and is then sent, through a first duct **9,** to an intermediate tank **10,** which is at pressures higher than the external pressure. The latter is connected, through a second duct **11** and a third duct **12,** which are equipped with purposely provided valves **13,** respectively to the intake valve 2 and to the accumulation tank 4.

[0023] The compression apparatus 3, and in particular the intermediate tank 10, then supplies the accumulation tank 4 until the latter has reached the desired pressure, on average between 5 and 15 bar, and subsequently exhausts the residual air through the same intake valve 2.

[0024] The latter enables, in fact, a slow and calibrated exhaust of the air, which does not cause any noise or pressure jumps in the external environment.

[0025] Subsequently, when the pressure of the air inserted in the accumulation tank 4 drops below a given value on account of the use of the accumulation tank 4 itself, the apparatus 3, and in particular the compressor 5, starts working again, and again supplies air to the accumulation tank 4.

[0026] There then starts a new cycle of supply of the accumulation tank 4 and of exhaust of the residual air from the pressurized-fluid circuits 6.

[0027] The apparatus 3 moreover comprises a lubrication circuit **14,** designed to supply the compressor 5 with lubricant continuously.

[0028] The lubrication circuit 14 coincides in part with the pressurized-fluid circuit 6 described above. In particular, the first duct 9 and the intermediate tank 10 form part both of the lubrication circuit 14 and of the pressurized-fluid circuit 6.

[0029] The lubrication circuit 14 moreover comprises a return channel **15** and a radiator **16** for cooling the lubricant.

[0030] The lubricant is then constantly transferred, through the first duct 9 and together with the air, from the compressor 5 to the intermediate tank 10 and from here again to the compressor 5 through the return channel 15 and the radiator 16.

[0031] Both the pressurized air and the lubricant, which are separated by gravity or in some other way, are then stored in the intermediate tank 10.

[0032] Finally, the apparatus 3 comprises a motor **17,** preferably an electric motor, and a drive belt **18,** designed to move the compressor 5, usually constituted by a twin-screw compressor.

[0033] The aforesaid intake valve 2 constitutes one of the most delicate and complex portions of the entire apparatus 3. It is illustrated in Figures 2a and 2b.

[0034] In particular, the same valve 2 comprises an intake duct **19,** in fluid communication with the compressor 5 and with the filter 7, and an exhaust duct **20** in fluid communication with the intermediate tank 10, through the second duct 11.

[0035] Within the intake duct 19 there is a purposely provided piston **21,** designed to keep the intake duct 19 open in the case where the compressor 5 is taking in air through the valve 7 and to close it in the case where the apparatus 3 is discharging the pressurized air through the purposely provided exhaust duct 20. To enable closing of the intake duct 19 in the phase of exhaust of the pressurized air, the exhaust duct 20 comprises a closing channel **22** in fluid communication with the inside of the piston 21, designed to cause the pressurized air coming from the second duct 11 to be able to press the same piston 21 and set it in a position for closing the intake duct 19.

[0036] The exhaust duct 20 is then designed to enable a gradual exhaust of the pressurized air, and, for this purpose, conveniently comprises a needle valve **23,** which can be regulated from outside and is designed to enable a partial closing of the same exhaust duct 20.

[0037] The safety device 1, as previously mentioned, is designed to be applied in a position corresponding to an intake valve 2.

[0038] It comprises a retention valve **24** designed to prevent any passage of fluid from the compressor 5 to the intake valve 2 and to enable passage of fluid from the intake valve 2 to the compressor 5.

[0039] In greater detail, the retention valve 24 comprises an open/close element **25** mobile within a seat **26** conveniently set in a duct **27** in fluid communication with the intake valve 2, and more in particular with the intake duct 19, and with the compressor 5, as illustrated in Figures 2a and 2b.

[0040] The open/close element 25 and the seat 26 define a closing position (Figures 2b and 5), in which the open/close element closes the duct 27 completely, and an opening position (Figures 2a and 4), in which the open/close element 25 does not obstruct the duct 27 completely.

[0041] The open/close element 25 is then mobile between the opening position and the closing position. It is conveniently set in an opening position (Figure 2a) when subjected to a pressure by a flow of fluid coming from the intake valve 2 and directed to the compressor 5, or equivalently by a pressure difference that will create the same flow, and is set in the closing position (Figure 2b) when subjected to a pressure by a flow coming from the compressor 5 and directed to the intake valve 2, or by an equivalent pressure difference.

[0042] The open/close element **25** is preferably constituted by a disk-shaped element made of metal material as illustrated in Figures 2a, 2b and 3.

[0043] The seat 26, illustrated in the sections of Figures 4 and 5, comprises a first section (Figure 5), which defines the closing position (Figure 2b), substantially counter-shaped to the open/close element 25, and a second section (Figure 4), which defines the opening position (Figure 2a) and comprises guide elements **26a,** designed to keep the open/close element 25 in the correct position, and elements of passage **26b,** designed to en-

able passage of fluid through the duct 27 at the margins of the open/close element 25.

[0044] The retention valve 24 then comprises an elastic element **28** designed to keep, in the absence of flow, the open/close element in a closing position (Figure 2b).

[0045] The device 1 is structurally constituted by a metal plate **29,** which can be connected, through screws or the like, to the intake valve 2 and to the compressor 5, within which the duct 27 is made.

[0046] Alternatively, the device 1 can be pre-arranged so that it is joined to an intake valve 2; in this case, the duct 27 is constituted by a portion of the intake duct 19.

[0047] Finally, the aforesaid plate 29 supports the open/close element 25 by means of a supporting element **30** (illustrated in Figures 3a and 3b), which can be constrained to the plate by means of a purposely provided thread or the like and does not interrupt the duct 27 thanks to the presence of a plurality of holes for passage **30b.**

[0048] Finally, the supporting element 30 comprises a cylindrical guide **30a** available in a position corresponding to a second cylindrical guide **25a** present on the open/close element 25 and designed to include the elastic element 28 and constrain the same open/close element 25 in a purposely provided direction.

[0049] Operation of a safety device 1, applied to an intake valve 2 and to a compression apparatus 3, illustrated above in a structural sense, is described hereinafter.

[0050] The compression apparatus 3 performs its normal functions irrespective of the presence of the safety device itself.

[0051] In particular, when the compression apparatus 3 itself is supplying the accumulation tank 4, the retention valve 24 is in the opening position (Figure 2a) and enables passage of fluid from the intake valve 2 to the compressor. When, instead, the compression apparatus 3 is in the exhaust phase, the retention valve 4 is located preferably in the closing position, on account of the presence of the elastic element 28, and prevents passage of fluid between the valve 2 and the compressor 5.

[0052] In the case where operation of the apparatus 3, and in particular of the compressor 5, is suddenly interrupted on account of a lack of electric current or for some other reason, the retention valve 24 closes, given that the pressure in the compressor 5 is higher than the external pressure, and prevents the passage of lubricant from the compressor 5 to the valve 2 and to the filter 7 or to the external environment.

[0053] The invention achieves important advantages.

[0054] In fact, the safety device 1 is able to prevent systematically and safely the leakage of lubricant from the intake valve 2 and/or from the filter 7 even in emergency conditions.

[0055] The safety device 1 is moreover very simple, sturdy, inexpensive and does not require particular maintenance.

[0056] Furthermore, an intake valve 2 including the safety device 1 achieves the same advantages of the latter.

[0057] All the details can be replaced by equivalent elements and the materials, the shapes and dimensions can be any.

Claims

1. A safety device (1) for an intake valve (2), which can be applied on apparatuses (3) for compression of fluids, said apparatuses (3) comprising a compressor (5) in fluid communication with said intake valve (2), said device being **characterized in that** it comprises a retention valve (24) designed to prevent any passage of fluid from said compressor (5) to said intake valve (2) and to enable passage of fluid from said intake valve (2) to said compressor (5).

2. The device according to Claim 1, comprising a duct (27) in fluid communication with said compressor (5) and said intake valve (2).

3. The device according to Claim 2, in which said retention valve (24) comprises an open/close element (25) and a seat (26) for said open/close element (25) defining a closing position, in which said open/close element (25) closes said duct (27) completely, and an opening position, in which said open/close element (25) does not obstruct said duct (27) completely, said open/close element (25) being mobile between said positions of opening and closing.

4. The device according to Claim 3, in which said open/close element (25) is set in said opening position when subjected to a pressure by a flow coming from said intake valve (2) and directed to said compressor (5) and is set in said closing position when subjected to a pressure by a flow coming from said compressor (5) and directed to said intake valve (2).

5. The device according to Claim 3 or Claim 4, in which said open/close element (25) consists of a disk-shaped element.

6. The device according to one or more of Claims 3 to 5, in which said intake valve (2) comprises an elastic element (28) designed to keep, in the absence of flow, said open/close element (25) in said closing position.

7. The device according to one or more of Claims 2 to 6, comprising a plate (29), which can be connected to said intake valve (2) and to said compressor (5) and including said duct (27) and said retention valve (24).

8. The device according to Claim 6 or Claim 7, in which said open/close element (25) is supported by said

plate (29) by means of a supporting element (30), which can be constrained to said plate (29) and does not interrupt said duct (27).

9. An intake valve (2), which can be applied on apparatuses (3) for compression of fluids and includes a safety device (1) according to one or more of the preceding claims.

10. An apparatus (3) for compression of fluids including an intake valve (2) according to Claim 9.

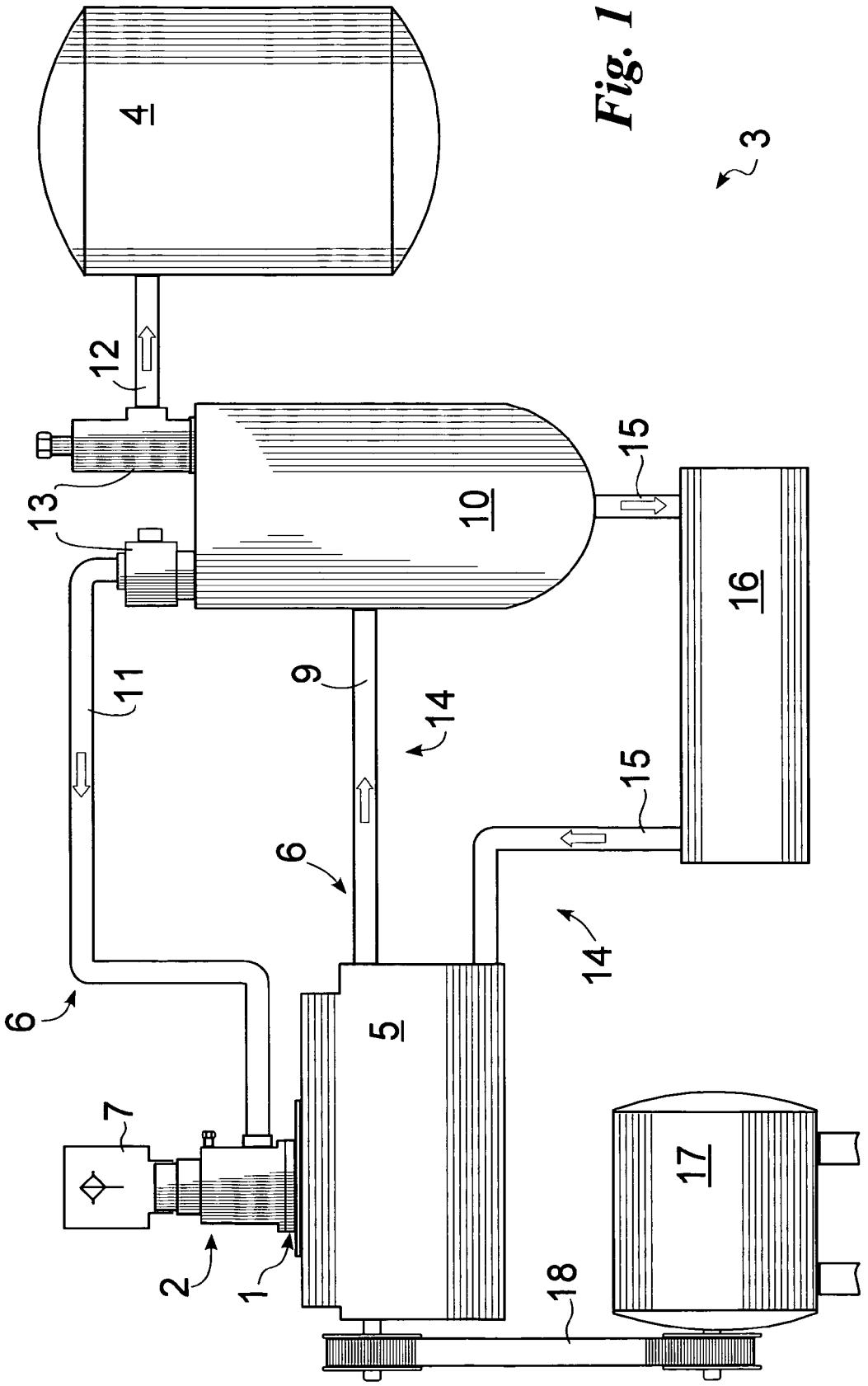


Fig. 1

Fig. 2a

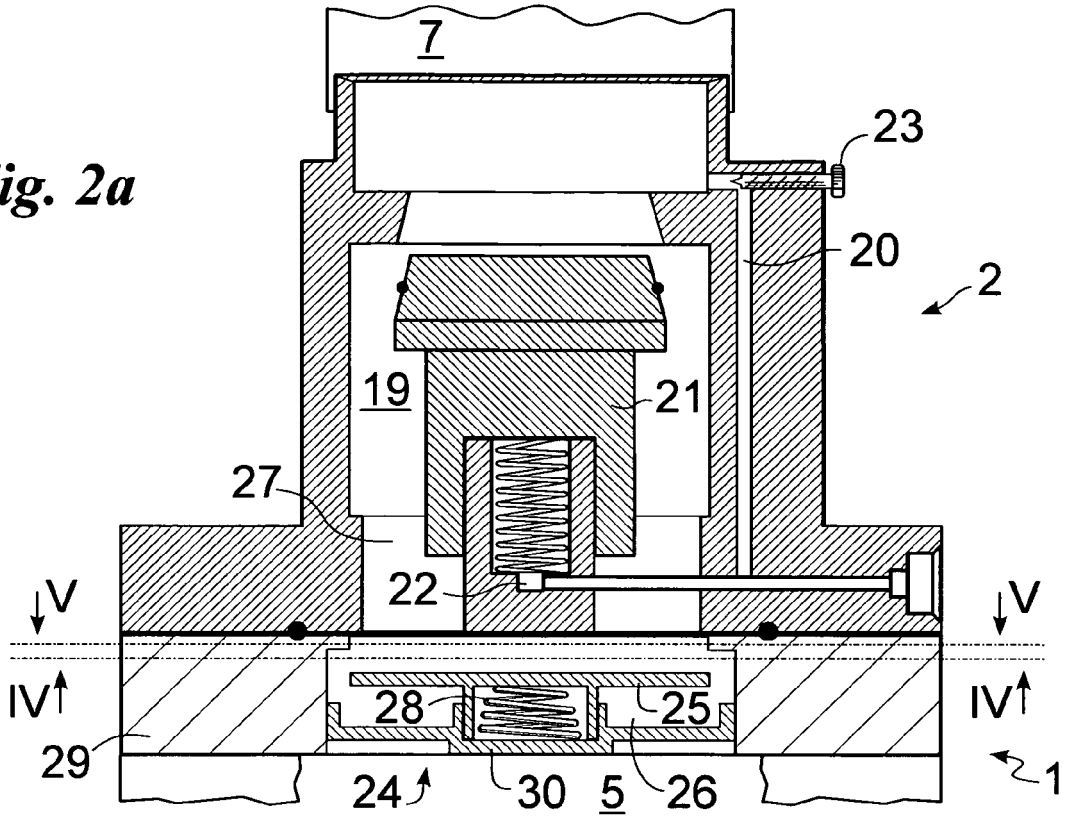

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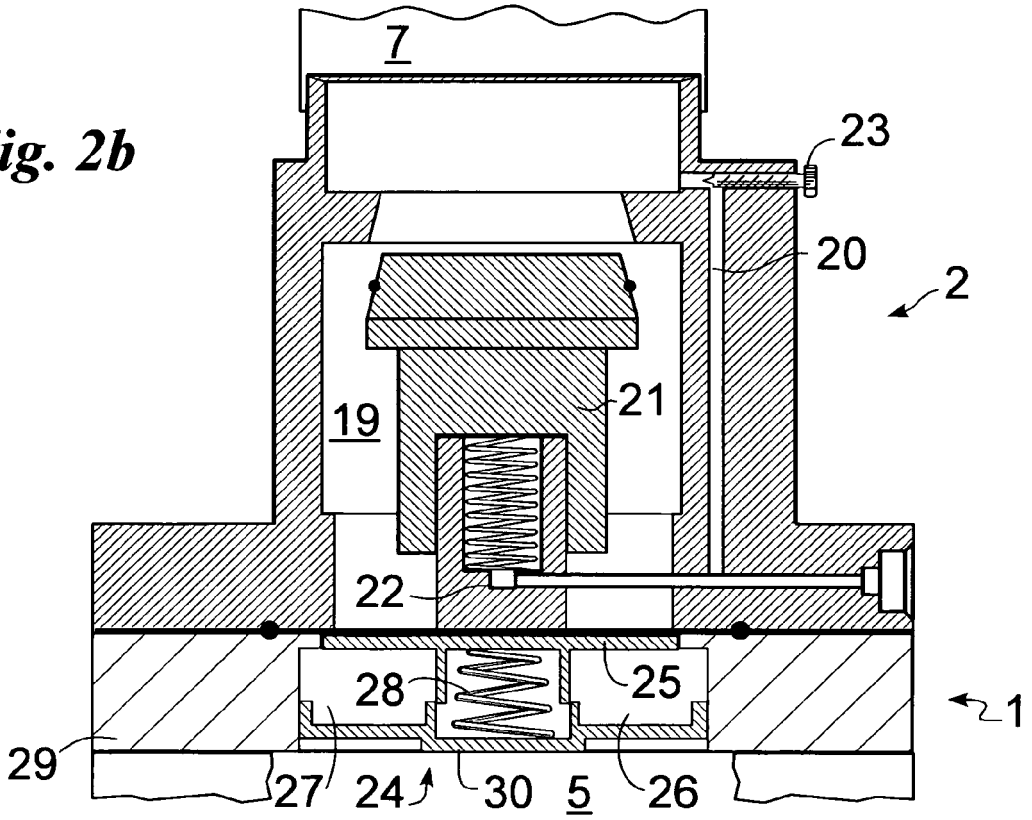
Fig. 2b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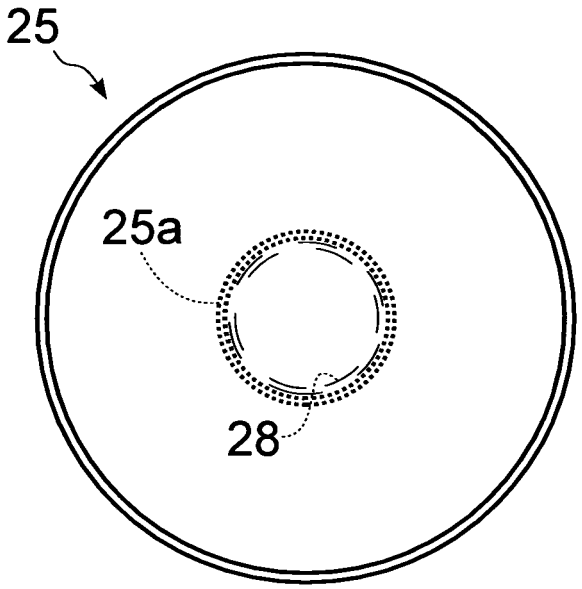


Fig. 3a

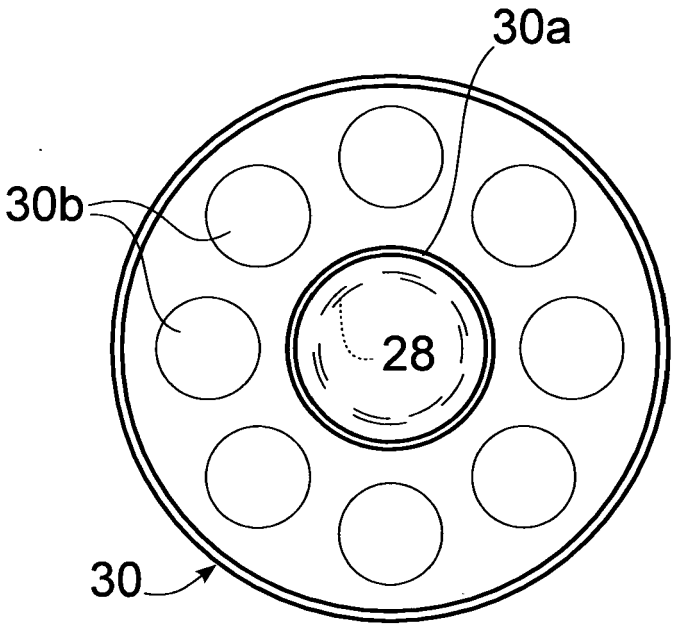


Fig. 3b

Fig. 4

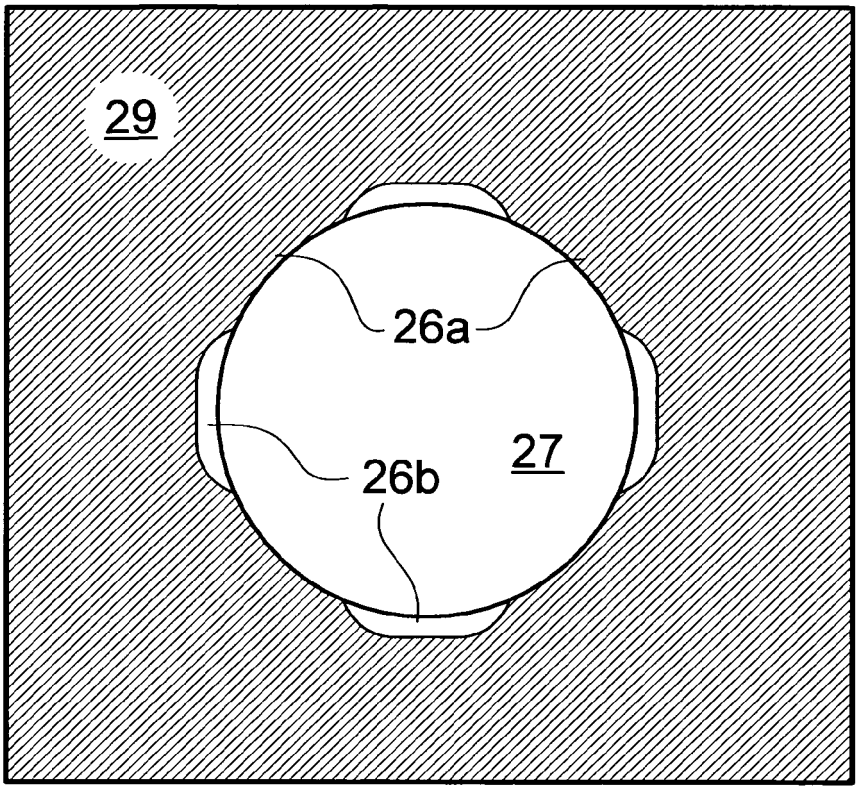
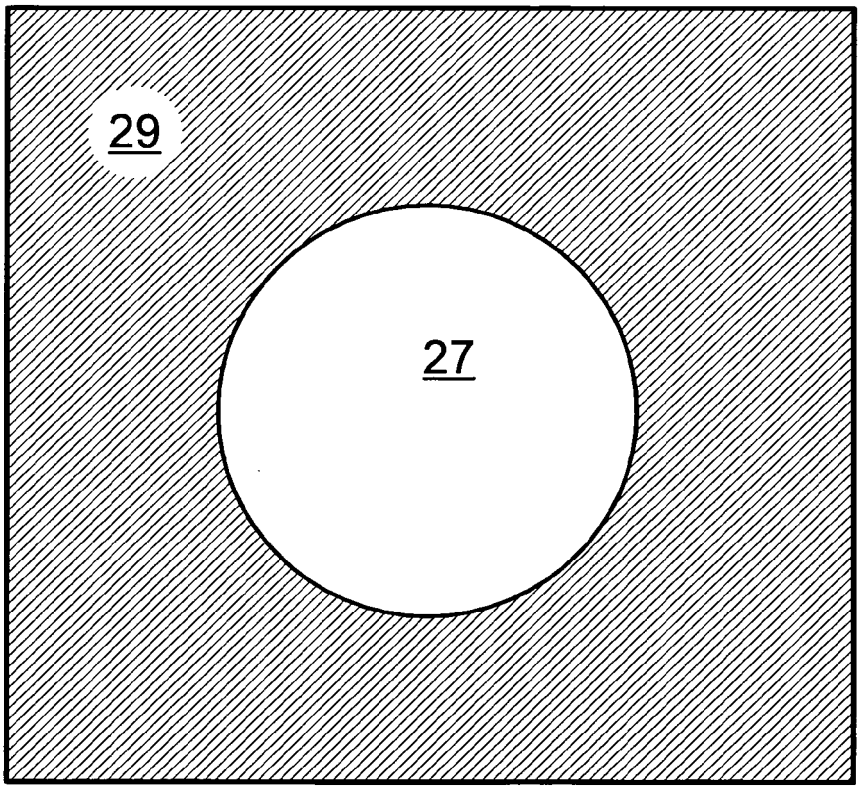


Fig. 5



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EUROPEAN SEARCH REPORT

Application Number
EP 07 42 5746

DOCUMENTS CONSIDERED TO BE RELEVANT

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X	DE 197 16 549 A1 (COMPAIR DRUCKLUFTTECHNIK GMBH [DE]) 5 November 1998 (1998-11-05) * figure 7 * * column 1, lines 25-35 *	1-10	
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	10 April 2008	Biloen, David

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