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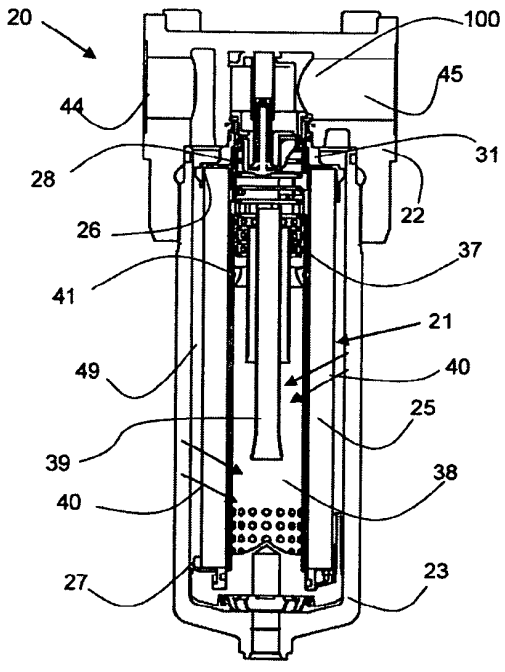
(54) **Filter assembly.**

(57) A filter assembly comprises a filter element, a filter housing for accommodating the filter element and an end cap assembly at a first end of said filter element. The end cap comprises a tubular portion open at its axial ends forming with the filter element a first fluid flow passage. Further, a filter head is removably attached to said filter housing and comprises an inlet port, an outlet port and an annular passage in fluid communication with the outlet port. The annular passage forms with the tubular portion a second fluid flow passage. A valve assembly is provided in the filter head and is operable between the annular passage and the outlet port. The valve assembly comprises a valve that is axially movable within the valve assembly between a first position allowing fluid to flow through the annular passage to the outlet port and a second position closing said passage.



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Title: Filter assembly

FIELD OF THE INVENTION

The present invention relates to a filter assembly comprising, a filter element and a filter housing for accommodating the filter element. The assembly further comprises an end cap assembly at a first end of said filter element, the end cap comprising a tubular portion open at its axial ends and forming with the filter element a first fluid flow passage. Further, the assembly comprises a filter head that is removably attachable to said filter housing and comprises an inlet port, an outlet port and an annular passage, whereby the annular passage forming with the tubular portion a second fluid flow passage. Such filters are used for removing material that is entrained in a fluid stream. In relation to the present invention fluids can comprise liquids, gasses or gaseous media, liquids containing gas etc.

BACKGROUND OF THE INVENTION

Filter assemblies have for example been employed in a variety of applications including hydraulic systems, fuel systems and engine lubrication systems. Application of filter systems for filtering gaseous media are also known. Such assemblies for example use replaceable filter elements that can be installed on a filter head for filtering fluid flowing between inlet and outlet ports in the filter head. The filter element typically is contained within a filter housing such as a can that can be screwed onto or off of the filter head. In a so-called spin-on filter, the can is discarded along with the filter element. In other arrangements, only the filter element is replaced and the filter housing is reused. During use the filter element may become clogged to the point that is causes a problem in the system, such as inadequate flow to components downstream of the filter, excessive pressure upstream of the filter element, and/or damage to the filter element allowing the accumulated contaminants to flow to components downstream of the filter element. Normally this is avoided by scheduled replacement of the filter element. It is thus necessary to replace the filter element from time to time.

Filter elements commonly have a wall of a filtration medium and an end cap with an inlet (or outlet) which can be sealed to the head part of the housing to provide a flow path for a fluid stream to be supplied to the interior or space (or to be extracted from the space) within

the filter element. The inlet (or outlet) is provided by a port or passage on an end cap of the element. The port may e.g. have an O-ring seal on its external surface which is received in a bore within the housing end cap, in which it is compressed to form a seal. Often, such a filter element has a cylindrical shape. The fluid to be filtered enters the filter assembly via the inlet, the inlet being arranged in such manner that the fluid can distribute along the outer surface of the filter element. The fluid is then forced through the filter element whereby contaminants in the fluid remain captured in the filter element and the filtered fluid is forced to an outlet of the filter assembly. As an alternative, the flow may be in opposite direction; the contaminated fluid entering the filter element axially and then being forced through the filter element thereby flowing substantially radially outward.

Filter assemblies as described can e.g. be applied to filter oil of a lubrication system or an hydraulic system of e.g. a crane. In order to maintain the fluid flowing through the system (i.e. comprising tubing and a filter assembly), a pump is required. This is due to the fact that both the tubing and the filter assembly represent a resistance for the fluid flow. In general, the pump can be driven by an electrical motor or a combustion engine such as diesel engine for example.

In order to gain access to the filter element when it has to be replaced, the head and body parts of the housing can be separated. A problem with the known filter assemblies when replacing the filter element is, that some fluid such as for example hydraulic oil or free fluid content in gasses remains in the conduit that is attached to the outlet port of the filter assembly. In case of a filter used for filtering gaseous media, the fluid content could drain out when replacing the filter element. By separating the filter housing from the filter head, this fluid may be spilled, as the filter housing is often still (partly) filled with fluid. Even if the filter housing is drained before removing it from the filter head, some fluid will flow out of the conduit attached to the outlet port due to gravitation. Spilling of fluid, in particular hydraulic fluid, constitutes on the one hand a safety hazard when it is spilled on floors, on the other hand it constitutes an environmental hazard.

OBJECT OF THE INVENTION

The present invention aims to solve the problem of unwanted spilling of fluid when separating the filter housing and the filter head when the filter element needs to be replaced.

SUMMARY OF THE INVENTION

The present invention solves this problem by providing a filter assembly comprising, a filter element and a filter housing for accommodating the filter element. The assembly further comprises an end cap assembly at a first end of said filter element, the end cap comprising a tubular portion open at its axial ends and forming with the filter element a first fluid flow passage. Further, the assembly comprises a filter head that is removably attachable to said filter housing and comprises an inlet port, an outlet port and an annular passage in fluid communication with the outlet port, whereby the annular passage forms with the tubular portion a second fluid flow passage, whereby a valve assembly is provided in the filter head and is operable between the annular passage and the outlet port. The valve assembly comprises a valve which is axially movable within the valve assembly between a first position allowing fluid to flow through the annular passage to the outlet port and a second position blocking flow through the annular passage.

By providing a valve assembly in the filter head which valve assembly has a valve which can close and open the annular passage in the filter head, any fluid remaining in the filter head and/or in a conduit attached to the outlet port is blocked from flowing out of the filter head. Hence, separating the filter housing from the filter head can be done without the risk of spilling fluid which is present downstream of the filter.

In a further aspect of the invention, the tubular portion comprises an annular wall having a radial flow passage for allowing fluid to bypass the filter element, and a bypass flow valve axially movable within the tubular portion between a first position blocking flow through the radial flow passage and a second position allowing flow through the radial flow passage. This allows for the filter element to be bypassed in case the filter element is clogged or obstructed. As a consequence thereof the pressure difference over the filter element increases and the pressure upstream of the filter element also increases. This increased pressure difference acts on the bypass flow valve and opens the valve when a certain threshold is exceeded. This means that (part of) the fluid flow will bypass the filter element.

In a further aspect of the invention the valve comprises a first valve element and a second valve element, the first and second valve element being axially movable with respect to each other, the first valve element being open toward the second valve element. The second valve element is movable between a first position abutting the first valve element so as to form a unitary valve, and a second position axially distanced from the first valve element and sealing against the tubular wall portion, blocking flow through the first fluid flow passage. The first and second valve element, because of their axial movement with respect to each other can close access to the interior of the filter element and at the same time allow fluid to flow through the first valve element. In this situation a so-called reverse flow situation is

established in which fluid flows from the outlet towards the inlet without flowing through the filter element. The latter is highly unwanted as this would remove the filtered material or debris from the filter element. It is noted that the bypass valve in such a situation must allow flow through the radial flow passage. Both the movement of the valve elements and the bypass flow valve are occasioned by a change in pressure difference over the respective valves.

Another aspect of the above embodiment of the invention is that the valve assembly can only successfully prohibit a reverse flow situation in case the end cap with the annular wall portion is sealed by the second valve element. This means that the filter assembly only operates correctly when the filter element is provided with an end cap having the features as mentioned above. In turn this means, that it is not possible to use so-called pirated filter elements that do not have the required features. This is beneficial as the use of pirated or copied filter elements will endanger the proper working of the filter assembly and eventually the proper and safe working of the system the filter assembly is part of.

A solution to the problem of pirated filter elements and in view thereof the problem these pirated filter elements can cause with respect to the rest of the system, such as a hydraulic system, is another object of the invention and is solved by the afore-mentioned embodiment, and for example also with an embodiment according a further aspect of the invention in which, the filter assembly comprises a resilient member for biasing the bypass flow valve in its first position and comprising a further end cap assembly at an opposite end of said filter element, a perforated core element extending between said end caps in an interior of the filter element and attached to said housing, said core element supporting the resilient member. In this manner any filter element that does not comprise the end cap according to the invention will not be able to work with the resilient member, which is fixed to the housing and hence always present, which will in turn interfere with the proper working of the valve element.

In yet a further aspect of the invention the filter assembly comprises a coupling assembly provided in the filter housing for detachably coupling the filter element and/or the core element to the filter housing. This coupling assembly only allows coupling with a dedicated filter element and/or core element and again assures that pirated filter elements cannot be used. Furthermore, coupling the filter element to the filter housing has the advantage that when the filter housing is separated from the filter head, that the filter element will remain attached to the filter housing upon separation.

In a further aspect of the invention, the coupling assembly comprises a leaf spring, in particular a resilient lock ring, having a peripheral edge that closely corresponds to an inner

surface of the filter housing, the leaf spring having a number of radially extending resilient elements contacting the inner surface of the filter housing and allowing a resilient deformation upon insertion of the leaf spring into the filter housing. This provides a strong coupling between the coupling assembly and the filter housing.

BRIEF DESCRIPTION OF THE DRAWINGS

Further advantageous embodiments of the filter assembly according to the invention are described in the claims and in the following description with reference to the drawing, in which:

Fig. 1	schematically depicts a cross-sectional view of an exemplary filter assembly according to the invention;
Fig. 2A	in a sectional perspective view depicts an end cap assembly in a first closed position;
Fig. 2B	in a sectional perspective view depicts the end cap assembly in a first open position;
Fig. 3A	in a sectional perspective view depicts the end cap assembly in a second closed position;
Fig. 3B	in a sectional perspective view depicts the end cap assembly in a second open position;
Fig. 4	in a sectional perspective view depicts an alternative filter head employing the end cap assembly of figure 3A;
Fig. 5A	schematically depicts in sectional view a filter head with a valve assembly in no-flow-condition;
Fig. 5B	schematically depicts in sectional view the filter head with the valve assembly in normal-flow-condition;
Fig. 5C	schematically depicts in sectional view the filter head with the valve assembly in bypass-flow-condition;
Fig. 5D	schematically depicts in sectional view the filter head with the valve assembly in reverse-flow-condition;
Fig. 5E	schematically depicts in sectional view the filter head with the valve assembly in no-element-condition;
Fig. 6	depicts in an exploded view a part of a filter housing with a coupling assembly;
Fig. 7	schematically depicts in sectional view a part of the filter housing with a lockring, and

Fig. 8 schematically depicts in sectional view a part of the filter housing with the lockring, coupling ring and end cap assembly mounted.

DETAILED DESCRIPTION OF EXAMPLES

Referring to Figure 1 an example of a filter assembly according to the present invention is depicted. A filter assembly according to the invention is generally indicated by reference numeral 20. The filter assembly 20 comprises a filter element 21, a filter housing or body 23 and a filter head 22. The filter housing 23 may also be referred to as a bowl or can.

In a manner which is known per se, the filter housing 23 may be removably attached to the filter head 22 to form an interior or interior chamber arranged to contain the filter element 21. The filter element 21 generally comprises a filter medium 25 which preferably is the form of a loop of filter medium of any suitable type. The filter element 21 is provided with an end cap assembly 26 at one end of the filter media and a further end cap assembly 27 at the opposite end of the filter media or filter element 21. The end cap assemblies 26 and 27 preferably are fixedly attached to the ends of the filter media, as by bonding with a suitable adhesive, this being a well known technique in the art.

As will be explained in more detail with respect to Figures 2A-3B, the end cap assembly 26 is located and mounted at a first end of said filter element 21. The end cap 26 comprises a tubular portion 28 open at its axial ends and forms with the filter element 21 a first fluid flow passage for the fluid to flow through. The end cap assembly 26 further comprises a bypass flow valve (see Figures 2A-3B) that allows the fluid to bypass the filter element 21 if circumstances so require.

In the illustrated embodiment, the filter housing or body 23 is removably attached to the filter head 22 by screwing the body onto the filter head. To this end, the body 23 and filter head 22 are provided with correspondingly threaded portions. The threaded portions are coaxial with the body and filter element which preferably are generally cylindrical in cross-section, as shown. The body 23, however, may be removably secured to the filter head by other suitable means, such as by clamps, fasteners, etc. Other cross-sectional shapes of the filter element and/or housing are also contemplated. The filter head 22 includes inlet and outlet ports 44 and 45 respectively that may have threaded portions for connection to other system components, such as fluid inlet and outlet lines. In most cases, the port 44 will function as an inlet since it communicates with an annular space 49 in the housing that is

present between the filter element 21 and the inner surface of the filter housing 23. The annular space 49 surrounds the filter element 21.

This set up results in a fluid flow from the inlet port 44 to the annular space 49 and through the filter element 21, i.e. a so-called outside-to-inside flow (also referred to as out-to-in flow). Consequently, the port 45 will function as an outlet passage. The opposite flow configuration is also contemplated, with the hereinafter components being configured to function under such opposite flow configuration.

In the filter head 22 a valve assembly 100 is provided, which will be explained in more detail referring to Figures 5A-5E. However, it is already mentioned here, that the valve assembly 100 can close an annular passage 31 provided in the filter head 22. The valve assembly 100 is operable between the annular passage 31 and the outlet port 45 and is arranged to open and close the annular passage 31. In particular the valve assembly 100 can close the annular passage 31 of the filter head 22 when the filter housing 23 is removed from the filter head 22 by blocking flow from the outlet port 45 towards the annular passage 31 and consequently out of the filter head 22.

Now referring to Figures 2A to 3B, the end cap assembly 26 is shown in more detail. The end cap assembly 26 comprises a flange part 32 having a generally U-shaped cross-section and is arranged to accommodate a distal end of the filter element 21 (see Figure 1). The distal end of the filter element 21 can be permanently attached to the end cap 26. The end cap assembly 26 comprises a tubular portion 28 open at its axial ends and forming with the filter element 21 a first fluid flow passage, which is generally indicated with arrow A. The tubular portion 28 comprises an annular wall 29 in which a radial flow passage 34 is provided. The radial flow passage 33 preferably comprises a number of separate flow passages that substantially cover the circumference of the annular wall 29.

Inside the end cap assembly 26, in particular telescopically movable within the tubular portion 28 and sealing against an inner surface of the annular wall 29, a bypass flow valve 35 is provided. The bypass flow valve 35 is arranged to be axially or telescopically movable within the tubular portion 28 between a first position blocking flow through the radial flow passage 34 as is depicted in Figure 2A and a second position allowing flow through the radial flow passage 34 as is depicted in Figure 2B by arrow B. In this position of the bypass flow valve 35 part or all of the fluid flowing through the filter assembly will bypass the filter element 21. Such situations may arise when the filter media is clogged with material that has to be filtered out of the fluid and consequently that the pressure drop over the filter element becomes to great. In such a situation the pressure outside the end cap assembly 26 increases, or at least the pressure difference between the interior of the end cap assembly 26

(and thus the interior of the filter element) increases, and the pressure will urge the bypass flow valve 35 in a downward direction as indicated with arrow C in Figure 2B. To achieve this, the bypass flow valve 35 comprises a pressure ridge 36 which is exposed to the fluid pressure in the inlet port 44 or upstream of the filter element 21.

To allow the bypass flow valve 35 to move from its closed to its open position, the tubular portion 28 comprises a stop member 43, shaped as an inwardly extending ridge, that limits movement in the direction of arrow A, i.e. an upward movement of the bypass flow valve 35. As can be seen in Figure 2A, further upward movement of the bypass flow valve 35 is limited when an axially extending lip 46 abuts the stop member 43. To allow downward movement, i.e. movement of the bypass flow valve 35 to its second or open position, the tubular portion 28 has a recess 47 which can guide a second axially extending lip 48 of the bypass flow valve 35.

It is to be understood that the bypass flow valve 35 should only move to its second position of Figure 2B in case the circumstances require so. Hence, unwanted movement of the bypass flow valve 35 should be avoided and the bypass flow valve 35 should be kept in its first and closed position of Figure 2A during normal use, i.e. the fluid flows through the filter element 21. In order to achieve this, a resilient member or bypass spring element 37 is provided with reference to Figure 1, which exerts a force on the bypass flow valve 35 such that the bypass flow valve 35 is biased towards its first or closed position.

The bypass spring element 37 is in the example of Figure 1 with its lower end supported by a core element 38 by means of a support ridge 41. With its upper end the spring element 37 abuts against a retention ridge 42 (see Figure 2A, 2B) which has a smaller diameter than the (preferably) circular bypass spring element 37.

The core element 38 is designed to support the filter medium of the filter element 21 and is arranged inside the filter element 21 against the inner surface thereof. The core element 38 as shown in Figure 1 comprises a tubular structure and houses a flow conduit 39 which is not part of the present invention, but which serves to reduce turbulence inside the filter element 21 to reduce power consumption of the filter assembly. The core element 38 can be a cylindrical tube of stainless steel. In the arrangement as shown the tubular structure is arranged along an inner surface of the filter medium. By doing so, the core element 38 provides support to the filter medium when an out-to-in flow (indicated by the arrows 40) occurs through the filter element 21. As such, the core element 38 substantially prevents the filter medium from deforming under the pressure difference that exists across it. Without the

provision of the core element 38, the filter element 21 could buckle under the pressure load and the filter assembly 20 would not function properly.

With reference to Figures 2A and 2B, it is noted that the configuration of the bypass flow valve 35 shown is used when the filter assembly 20 is used in the earlier mentioned out-to-in flow, i.e. the fluid flows from the inlet port 44 through the annular space 49 through the filter element 21 and the core element 38 towards the annular passage 31 and out of the filter head 22 through the outlet port 45. It is also possible however that the filter assembly works according to the in-to-out principle in which the fluid substantially flows in an opposite direction. Turning to Figure 3A, this is indicated with arrow D. This means however that the bypass flow valve 35 as shown in Figures 2A and 2B is no longer working correctly as the higher pressure in the filter assembly 20 will be found in the interior of the end cap assembly 26 which would urge the bypass flow valve downwards (see Figure 2B) in its open position.

To this end the end cap assembly 26 and in particular the axially movable bypass flow valve 35 can be adjusted such that the bypass flow valve 35 moves upwards in Figure 3A, i.e. in a direction as indicated with arrow E in Figure 3B, thus opening the radial flow passage 34 when the filter element 21 gets clogged and a bypass flow condition is required.

To achieve this double working feature of the bypass flow valve 35, the bypass flow valve 35 can be turned inside the tubular portion 28 in a clockwise direction (arrow F) starting from the position as shown in Figure 2A to arrive at the position shown in Figure 3A. In this position the axially extending lip 46 is aligned with a recess 50, which allows the lip 46 to move beyond the stop member 43. It is noted that several lips and recesses can be provided.

While turning the bypass flow valve 35 as described above, the second lip 48 is rotated also and is positioned over a second stop member 51 which is shaped as an inwardly extending ridge. The second stop member 51 prohibits any downward movement of the bypass flow valve 35.

As mentioned with reference to Figures 2A and 2B, the bypass flow valve 35 should in normal use be biased in its closed position. To achieve this with the embodiment of the bypass flow valve 35 as shown in Figure 3A and 3B, the bypass flow valve 35 should be biased downward. Hence, an alternative bypass spring member is required which acts in an opposite direction as the bypass spring element 37 of Figure 1. This is shown in Figure 4.

Referring now to Figure 4, the filter head 22 is shown in a spatial cut-away view in a situation wherein the filter assembly is working according to the in-to-out flow principle. This is

schematically indicated with arrows 60. Figure 4 again shows the end cap assembly 26 and the filter element 21. Figure 4 further shows the bypass spring element 37 which is mounted inside the filter head 22 and is arranged to exert a force on the bypass flow valve 35 that biases is in its closed position.

Referring now to Figure 5A, the filter head 22 of the filter assembly is shown in a cross-sectional view. The filter element 21 and the filter housing 23 are not shown to improve clarity of the drawing. In the filter head 22 a valve assembly 100 is provided which is mainly seated in the annular passage 31 provided in the filter head 22. The annular passage 31 is located between the inlet port 44 and the outlet port 45 and accommodates the upper part of the end cap assembly 26, more in particular the upper part of the tubular portion 28. The annular passage 31 comprises an annular wall section 52 which encloses the upper part of the tubular portion 28. Between the tubular portion 28 and the annular wall section 52 a seal 53 is provided, which may be an O-ring for example.

The valve assembly 100 is operable between the annular passage 31 and the outlet port 45 and is arranged to open and close the annular passage 31. In particular the valve assembly 100 can close the annular passage 31 of the filter head 22 when the filter housing 23 is removed from the filter head 22 by blocking flow from the outlet port 45 towards the annular passage 31 and consequently out of the filter head 22.

The valve assembly 100 comprises a valve housing or gage 101. The gage 101 is tubular in design and has a radial flow passage 102 which is open towards the outlet port 45. The radial flow passage 102 spans about a quarter to about half of the circumference of the gage 101 to allow the fluid to flow through the valve assembly 100 and towards the outlet port 45 with as low a flow resistance as possible. The gage 101 comprises a tubular guide 103 for telescopically guiding a stem 104 of a first valve element 105. The stem 104 in turn is a tubular element which telescopically guides a second stem 106 of a second valve element 107. Hence, the first valve element 105 and the second valve element 107 are axially movable with respect to each other.

Between the gage 101 and the first valve element 105 and located around the tubular guide 103, a first compression spring 108 is provided which rests on a flange 109 of the first valve element 105, thus biasing the first valve element 105 downwards in Figure 5A such that an upper annular rim 110 the first valve element 105 seats on an annular seal ring 118 (see Figure 5E). As can be seen in Figure 5A, the second stem 106 of the second valve element 107 is located inside the tubular stem 104 of the first valve element 105 and a second compression spring 111 is provided between an end part 112 of the second stem 106 and an inner portion of the flange 109. The second compression spring 111 biases the second valve

element 107 upwards in Figure 5A such that a rim 113 of the second valve element 107 seats against a lower edge 114 of the first valve element 105.

The first valve element 105 and the second valve element 107 substantially form a single valve in the situation shown in Figure 5A because of the force exerted by the second compression spring 111. Furthermore, in the situation of Figure 5A, the rim 113 of the second valve element 107 seats on a inner rim 115 of the bypass flow valve 35 such that the annular passage 31 is closed and no fluid can flow through the valve assembly 100 in either direction. Furthermore, the bypass flow valve 35 is in its closed or first position, blocking flow through the radial flow passage 34 as was explained with reference to Figures 2A-3B. Hence, the position of the valve element 100 and the bypass flow valve 35 of Figure 5A can be denoted as no-flow-condition.

During normal use of the filter element, which can be denoted as normal-flow-condition, the fluid to be filtered will flow through the filter element (out-to-in flow) and through the valve assembly 100 towards the outlet port 45. This situation is shown in Figure 5B.

In comparison with the no-flow-condition of Figure 5A, the first valve element 105 and the second valve element 107 have moved upward in Figure 5B (indicated with arrow Y) as a single valve under the influence of an increased fluid pressure, wherein said increased fluid pressure must be large enough to overcome the force exerted by the first compression spring 108. In the normal-flow-condition of Figure 5B, the fluid will flow through the tubular portion 28, pass the closed bypass flow valve 35 and along a profiled flow guide surface 116 of the second valve element 107 towards the outlet port 45.

When the first valve element 105 and the second valve element 107 move upwards as indicated in Figure 5B, fluid that will be present in the tubular guide 103, which is open at its distal end, can be pushed out via said open distal end by the provision of a radially extending flow channel 119, causing a damping function of the valve (see Figure 5A).

As explained with reference to Figures 2A-3B, in certain circumstances it is required that the fluid flow may bypass the filter element. This situation is denoted as bypass-flow-condition and is shown in Figure 5C.

In comparison with the normal-flow-condition shown in Figure 5B, the bypass flow valve 35 has been moved in a downward direction in Figure 5C (indicated with arrow Z) due to an increased pressure outside of the end cap assembly 26 and against the bias force of bypass spring element 37. The fluid is now able to bypass the filter element as is indicated

with arrow G. It is noted here, that the length of the bypass spring element 37 can be adjusted by changing the position of the retention ridge 41 (see Figure 1). By increasing the length of the bypass spring element 37, the hysteresis of the spring element 37 can be reduced and a better and more accurate control of the opening and closing of the bypass flow valve 35 can be achieved.

In certain exceptional circumstances a flow condition denoted as reverse-flow-condition is present in the filter assembly according to the invention. This reverse-flow-condition is shown in Figure 5D. In this situation the fluid flows from the outlet port 45 towards the inlet port 44 and should do so without flowing through the filter element. The latter is highly unwanted as this would remove the filtered material or debris from the filter element. In the reverse-flow-condition the radial flow passage 34 must hence be open, but the fluid must not be able to reach the interior of the filter element.

To achieve this, the increased pressure in the outlet port 45 will move the first valve element 105 and the second valve element 107 in a downward direction (indicated with arrow Z). Downward movement of the first valve element 105 is limited by a stop member 117 on which the upper rim 110 of the first valve element 105 seats. The lower part of the first valve element 105 is designed as a spider case and comprises axial flow passages that allow fluid to flow through the lower part of the first valve element 105. Hence, in the reverse-flow-condition the increased fluid pressure will push against the second valve element 107 such that it is also moved in a downward direction against the force exerted by the second compression spring 111. In its downward movement, the second valve element 107 will push the bypass flow valve 35 via its inner rim 115 downward also, opening the radial flow passage 34 while at the same time blocking flow through the annular passage 31. It is noted that the pressure that is required to push both the second valve element 107 and the bypass flow valve 35 downwards will be lower that the pressure required to only move the bypass flow valve 35 into its second position (opening the radial flow passage 34), because the combined area of the second valve element 107 and the bypass flow valve 35 is larger than the area of the inner rim 115 of the bypass valve element 35.

As has been explained above, the filter element 21 needs to be periodically replaced and the filter head 22 and filter housing 23 can be separated. To avoid unwanted spilling of fluid when separating the filter housing 23 and the filter head 22 when the filter element 21 needs to be replaced the valve assembly 100 is arranged to close the annular passage 31 such that any fluid remaining in the filter head 22 and/or in a conduit attached to the outlet port 45 is blocked from flowing out of the filter head 22. Hence, separating the filter housing 23 from the filter head 22 can be done without the risk of spilling fluid which is present

downstream of the filter assembly 20. The condition in which the filter housing 23 and with it the filter element 21 has been separated from the filter head 22 is denoted as no-element-condition and is shown in Figure 5E.

The no-element-condition is shown in Figure 5E, which condition mainly corresponds to the no-flow-condition as explained with reference to Figure 5A except that the end cap assembly 26 is no longer present. As can be seen in Figure 5E the annular passage 31 is closed as the first valve element 105 and the second valve element 107 form a single or unitary valve under the influence of compression spring 111. The actual closing of the annular passage 31 is achieved by pushing the upper rim 110 of the first valve element 105 by means of the compression spring 108 onto an annular seal ring 118 which is fixedly mounted to the wall section 52.

In the example of a filter head 22 shown in Figures 5A-5E, the inlet port 44 and the outlet port 45 are located on opposite sides of the filter head 22, or in other words, the inlet port 44 and the outlet port 45 are substantially co-axial. It is however also possible to arrange the inlet port 44 and the outlet port 45 differently in the filter head 22, depending on for example the availability of space in a hydraulic system or a specific layout of flow lines. As an example it can be contemplated to arrange the inlet port 44 and the outlet port 45 on one side of the filter head 22, in particular the outlet port 45 may be arranged above the inlet port 44. This would mean, that the valve assembly 100 does not have to divert the flow direction of the fluid flowing through the valve assembly 100, but the fluid follows a generally straight line through the valve assembly 100. This can be achieved, for example, by providing the valve housing (or cage) 101 with an open structure, e.g. by providing the valve housing 101 with axial flow passages.

To further improve the filter assembly according to the invention it is convenient that upon separation of the filter housing and the filter head, the filter element is detached from the filter head at the same time and remains in the filter housing, so that the filter can be replaced at a convenient location and/or to eliminate the risk of fluid coming out of the filter element while it is still attached to the filter head, i.e. dripping of the filter element while the filter housing is gone to collect the dripping fluid. To achieve this further improvement a way of detachably coupling the filter element to the filter housing is provided and explained in more detail with reference to Figure 6 and 7.

Figure 6 shows in an exploded spatial view part of the filter housing 23 and in particular its bottom part. In the example of Figure 6 (and of Figure 1) the filter assembly is arranged to be connected to a conduit system while the filter assembly extends in a

downward direction. For that reason the filter housing 23 is provided with a discharge opening 120 in the bottom part of the filter housing 23 that allows draining of the fluid from the filter housing 23. Normally the discharge opening 120 would be provided with a plug, which is not shown in the drawing.

As mentioned above, the filter element comprises and end cap assembly 27 located opposite the end cap assembly 26 that comprises the bypass flow valve. In Figure 6 the end cap assembly 27 is shown without the filter element. Similarly to the design of the other end cap assembly, the end cap assembly 27 comprises a generally U-shaped flange part 121 for attaching the filter element thereto. Further, the end cap assembly 27 comprises a tubular portion 122 which encloses the core element 38.

A coupling assembly 200 is provided in the filter housing 23 for detachably coupling the filter element and/or the core element 38 to the filter housing 23. The coupling assembly 200 comprises a coupling member 201 which is preferably designed as a leaf spring, in particular a resilient lock ring 201, having a peripheral edge that closely corresponds to an inner surface of the filter housing 23. The leaf spring 201 comprises a number of radially extending resilient elements 202 contacting the inner surface of the filter housing 23 and allowing a resilient deformation upon insertion of the leaf spring into the filter housing 23. The lock ring 201 has a concave cross-section that does allow introduction into the filter housing 23 because the resilient elements 202 can flex upward while pushing the lock ring 201 downward in Figure 6, but extraction will cause the lock ring 201 to bend in the opposite direction which urges the resilient elements 202 against the inner surface of the filter housing 23, locking it in place. When the lock ring 201 is fully inserted into the filter housing 23, a number of support legs 205 support the lock ring 201. This is shown in more detail in Figure 7.

The coupling assembly 200 and in particular the lock ring 201 comprises a number of grip members 203 or latches that can grip an intermediate coupling ring 204 that is part of the coupling assembly 200 and which comprises recesses 206 (see Figure 8) into which the latches 203 can be inserted. The latches 203 are angled upwardly and are resilient, such that the intermediate coupling ring 204 and therewith the filter element and/or the core element 38 are biased in an upward direction in Figure 8. An alternative solution to bias the intermediate coupling ring 204 in an upward direction is shown with reference to Figure 9, wherein a compression spring 220 is shown that is operable between the filter housing 23 and the intermediate coupling ring 204. Further, the intermediate coupling ring 204 can be provided with additional coupling means, such as coupling fingers 225 (see Figure 8) that extend

through coupling openings 226 in the coupling member 201 However, other solutions for coupling the intermediate coupling ring 204 .

The intermediate coupling ring 204 has a peripheral wall portion 207 which extends in a longitudinal direction of the filter housing 23. The wall portion 207 has a guide surface 208 which lies in a plane which is non-perpendicular, i.e. angled, with respect to said longitudinal direction. The wall portion 207 comprises a recess 209 in that part that is closest to the coupling member 201.

The guide surface 208 is designed to co-operate with a notch 210 provided on the end cap assembly 27 and extending radially outwards from the flange part 121. The notch 210, upon introduction of the filter element into the filter housing 23 will have an arbitrary rotational position with respect to the intermediate coupling ring 204. To assure and simplify coupling of the end cap assembly 27 to the coupling ring 204, the notch 210 will be guided along the guide surface 208 until the notch 210 engages the recess 209. Furthermore, to ensure an even better coupling a further notch 211 provided on the end cap assembly 27 is provided to engage a further recess 212. This is also shown in Figure 8, wherein it is shown how the coupling assembly 200 is coupled with the filter housing 23.

As can be further seen in Figures 6 and 8, the core element 38 is clamped between the annular portion 122 of the end cap assembly 27 and an upwardly directed flow guide means 213 provided on the coupling ring 204. The flow guide means 213 is arranged to guide the fluid in an upward direction and reduces turbulence in the lower part of the filter assembly. It is noted that it is also possible to permanently couple the core element 38 to the coupling ring 204, such that it is not possible to discard the core element 38 by accident or on purpose such that pirated filter elements can be used.

Separation of the filter housing 23 from the filter head 22 with the embodiment shown in Figure 8 will result in the combined separation of the filter housing 23 and the filter element as the filter element is (detachably) coupled with the filter housing. This thus results in a very clean way of removing the filter element as housing that encloses the filter element is the only part of the filter assembly that is physically handled.

The end cap assembly 27 and the intermediate coupling ring 204 are sealed against each other to assure that dirty or contaminant-loaded fluid cannot reach the clean side of the filter element. This is particularly true as the contaminant-loaded fluid is able to reach that part of the filter housing 23 that contains the discharge opening 120. For the conytaminant-loaded fluid to be able to reach the discharge opening 120, the peripheral wall portion 207 is

at its tallest part provided with flow passages 221. For the same reason the intermediate coupling ring 204 has an open structure to allow fluid to reach the discharge opening 120.The problem associated with the possibility that dirty fluid can reach the discharge opening 120 is, that in principle that fluid is able to squeeze between the end cap assembly 27 and the intermediate coupling ring 204 (out-to-in flow as shown in Figure 8, but the same is true for the in-to-out flow configuration). Hence, a seal is provided between the end cap assembly 27 and the intermediate coupling ring 204.

In the example of Figure 8 such a seal comprises an annular groove 222 in which an O-ring 223 is housed. The annular groove 222 is provided on an inner surface of the end cap assembly 27. The annular groove 222 with the O-ring 223 seals against a peripheral rim 224 provided on an outer surface of the intermediate coupling ring 204. The peripheral rim 224 is also inclined with respect to the longitudinal axis H-H and the inclination of the annular groove 222 and the peripheral rim 224 correspond. One advantage of providing both the annular groove 222 and the peripheral rim 224 with the shown inclination is, that when the filter element is placed in the housing 23 a smooth lead-in to create the O-ring seal is guaranteed. Another advantage is that it is not possible to use pirated filter elements in the filter assembly according to the invention. Such pirated filter elements will not have the proper inclined annular groove 222 and consequently as such pirated filter elements will not provide a proper seal and contaminated fluid will be able to flow from the contaminant-loaded side of the filter element towards the contaminant-free side of the filter element.

It is noted here that the arrangement of the inclined annular groove 222 comprising the O-ring 223 is not limited to the combination with an inclined guide surface 208. The inclined annular groove 222 requires the presence of an inclined peripheral rim 224 on the intermediate coupling ring 204 that among others couples the core element 38, to make sure that only dedicated filter elements comprising an end cap assembly that is provide with the inclined annular groove can be used in the filter assembly according to the invention. As explained earlier, the reason for not allowing non-dedicated filter elements is necessary to avoid possible problems with the performance of the filter assembly.

In an alternative embodiment shown in Figure 9, the annular groove 222 comprising the O-ring 223 is provided on an outer surface of the end cap assembly 27 and seals against an inner surface of the peripheral wall 204.

It is to be understood, that the manner of coupling the intermediate coupling ring 204 with the end cap assembly 27 is not limited to the examples shown. In particular, coupling arrangements not comprising the inclined guide surface 208 can also be used. However, the

use of an inclined guide surface is advantageous, as this will always ensure a correct (radial) positioning of the end cap assembly 27 with respect to the intermediate coupling ring 204, which in turn ensures proper working of the seal between the end cap assembly 27 and the intermediate coupling ring 204. However, other means of establishing a coupling that achieve a proper coupling between the end cap assembly 27 and the intermediate coupling ring 204 are possible, such as a bayonet locking or the use of threading.

It is noted that the above invention is not limited to the above-described examples of filter assemblies. In particular it is noted that the invention is also applicable to filter assemblies which are used for filtering gaseous media in which particles are entrained. In such applications it is also relevant that when the filter element needs to be exchanged, that flow of the gaseous media is prohibited when separating the filter housing from the filter head. Furthermore, easy separation of the filter element from the filter head is also relevant for gaseous media, as the filter may be contaminated with particles that are for example greasy. However, other reasons why the filter element should be removed from the filter head together with the filter housing are equally applicable.

It is further noted that the filter housing, filter element or other elements of the filter assembly that have been described as having a circular or tubular cross-section, do not necessarily have to be circular or tubular. Any other convenient and suitable cross-section can be used, such as for example a non-circular filter element or non-circular filter housing.

Conclusies

1. Een filtersamenstel, omvattende:

- een filterelement,
- een filterbehuizing voor het onderbrengen van het filterelement,
- een eindkapsamenstel aan een eerste uiteinde van het filterelement, waarbij de eindkap een buisvormig deel omvat dat open is aan zijn axiale uiteinden en dat met het filterelement een eerste fluïdumstroomdoorlaat vormt,
- een filterkop die afneembaar bevestigbaar is aan de filterbehuizing en die een inlaatpoort, een uitlaatpoort en een ringvormige doorlaat in verbinding met de uitlaatpoort omvat, waarbij de ringvormige doorlaat met het buisvormig deel een tweede fluïdumstroomdoorlaat vormt,

gekenmerkt door een klepsamenstel verschaft in de filterkop en die operationeel is tussen de ringvormige doorlaat en de uitlaatpoort, waarbij het klepsamenstel een klep omvat die axiaal verplaatsbaar is in het klepsamenstel tussen een eerste positie waarin fluïdum door de ringvormige doorlaat kan stromen en een tweede positie waarin stroming door de ringvormige doorlaat is geblokkeerd.

2. Filtersamenstel volgens conclusie 1, waarbij het buisvormig deel een ringvormige wand omvat met een radiale stromingsdoorlaat opdat fluïdum het filterelement kan omlopen, en een omloopstroomklep die axiaal verplaatsbaar is in het buisvormig deel tussen een eerste positie waarin stroming door de radiale stroomdoorlaat wordt geblokkeerd en een tweede positie waarin stroming door de radiale stroomdoorlaat mogelijk is.

3. Filtersamenstel volgens conclusie 1 of 2, waarbij het klepsamenstel een klepbehuizing omvat die een zich axiaal uitstrekkend buisvormig geleidingsorgaan draagt voor een telescopische beweging van een steel van de klep daarin, waarbij het buisvormig

geleidingsorgaan open is aan een distaal uiteinde daarvan en stromingsmiddelen omvat voor het toestaan dat fluïdum het buisvormig geleidingsorgaan binnenkomt en verlaat.

4. Filtersamenstel volgens conclusie 3, waarbij de klep een veerwerking heeft om de klep naar zijn tweede positie voor te spannen.

5. Filtersamenstel volgens conclusie 2, waarbij de klep een eerste klepelement en een tweede klepelement omvat, waarbij het eerste en tweede klepelement axiaal verplaatsbaar ten opzichte van elkaar zijn, waarbij het eerste klepelement open is naar het tweede klepelement, waarbij het tweede klepelement verplaatsbaar is tussen een eerste positie grenzend aan het eerste klepelement teneinde een geheel vormende klep te vormen, en een tweede positie die zich op een axiale afstand van het eerste klepelement bevindt en die afdicht tegen het buisvormig wanddeel, waardoor stroming door de eerste vloeistofstroomdoorlaat is geblokkeerd.

6. Filtersamenstel volgens conclusie 5, waarbij het eerste klepelement een zich axiaal uitstrekkend buisvormig geleidingsorgaan draagt voor een telescopische beweging van een steel van het tweede klepelement daarin.

7. Filtersamenstel volgens conclusie 5 of 6, waarbij het tweede klepelement een veerwerking heeft om het tweede klepelement naar zijn eerste positie voor te spannen.

8. Filtersamenstel volgens een van de conclusies 2-7 voorts omvattende een verend orgaan om de omloopstroomklep naar zijn eerste positie voor te spannen.

9. Filtersamenstel volgens conclusie 8 voorts omvattende een verder eindkapsamenstel aan een tegenoverliggend uiteinde van het filterelement, een geperforeerd kernelement dat zich in hoofdzaak tussen genoemde eindkappen in een inwendige van het filterelement uitstrekt, waarbij genoemd kernelement het verend orgaan draagt.

10. Filtersamenstel volgens conclusie 8, waarbij het verend orgaan in de filterkop is gemonteerd.

11. Filtersamenstel volgens een van de conclusies 8-10, waarbij het verend orgaan een veer, in het bijzonder een drukveer is.

12. Filtersamenstel volgens een van de voorgaande conclusies voorts omvattende een koppelsamenstel verschaft in de filterbehuizing voor het losneembaar koppelen van het filterelement en/of het kernelement aan de filterbehuizing.

13. Filtersamenstel volgens conclusie 12, waarbij het koppelsamenstel grijporganen omvat voor het grijpen van het verdere eindkapsamenstel en/of het kernelement.

14. Filtersamenstel volgens conclusie 12 of 13, waarbij het koppelsamenstel een bladveer, in het bijzonder een verende sluitring, omvat met een omtreksrand die is ingericht voor het grijpen van een binnenkant van de filterbehuizing.

15. Filtersamenstel volgens conclusie 14, waarbij de bladveer een aantal zich radiaal uitstrekkende verende elementen heeft die met de binnenkant van de filterbehuizing in contact staan en een verende vervorming mogelijk maken bij plaatsing van de bladveer in de filterbehuizing.

16. Filtersamenstel volgens een van de conclusies 12 tot en met 15, waarbij het koppelsamenstel een aantal draagpoten omvat voor het dragen van het koppelsamenstel vanuit een bodemdeel van de filterbehuizing.

17. Filtersamenstel volgens conclusie 14, 15 of 16, waarbij het koppelsamenstel een tussenliggend koppelorgaan omvat voor het koppelen met de bladveer en het losneembaar koppelen met de verdere eindkap en/of het kernelement.

18. Filtersamenstel volgens conclusie 17, waarbij het tussenliggend koppelorgaan een omtrekwanddeel heeft dat zich in een

lengterichting van de filterbehuizing uitstrekt, waarbij het wanddeel een hellend geleidingsvlak ten opzichte van de lengterichting heeft.

19. Filtersamenstel volgens conclusie 18, waarbij het wanddeel verder een inkeping heeft in dat deel daarvan dat zich dichtst bij het koppelorgaan bevindt en dat is aangepast om samen te werken met een nok die op het verdere eindkapsamenstel is verschaft.

20. Filtersamenstel volgens een van de conclusies 12 tot en met 19, waarbij het verdere eindkapsamenstel een ringvormige groef omvat voor het onderbrengen van een afdichtorgaan voor het afdichten tegen het koppelsamenstel.

21. Filtersamenstel volgens conclusie 20, waarbij genoemde ringvormige groef hellend is ten opzichte van de lengterichting.

22. Filtersamenstel volgens een van de conclusies 17 tot en met 19, waarbij het verdere eindkapsamenstel een ringvormige groef omvat voor het onderbrengen van een afdichtorgaan voor het afdichten tegen het tussenliggend koppelorgaan.

23. Filtersamenstel volgens conclusie 22, waarbij het tussenliggend koppelorgaan een hellende omtrekrand omvat waartegen het afdichtorgaan afdicht.

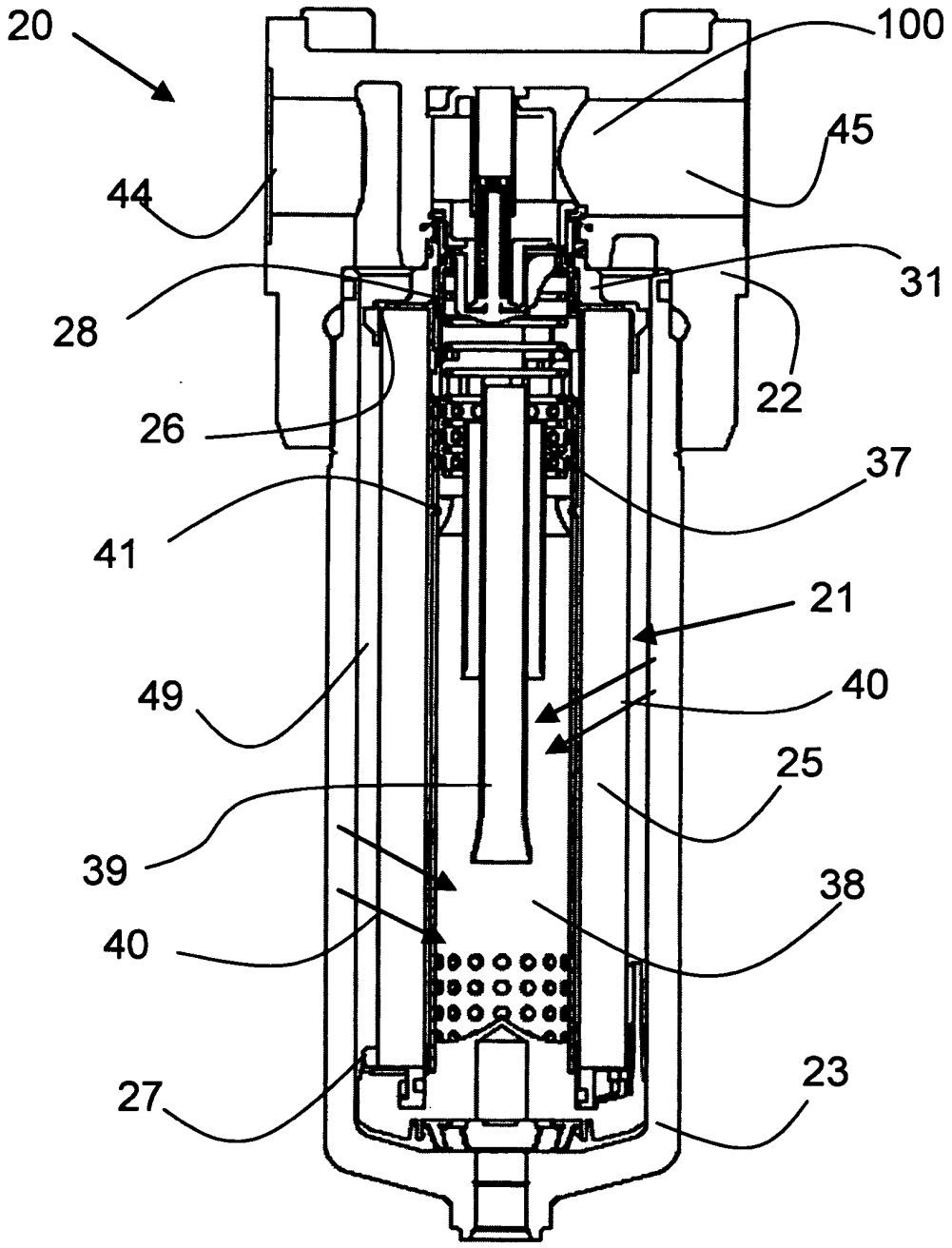

Fig. 1

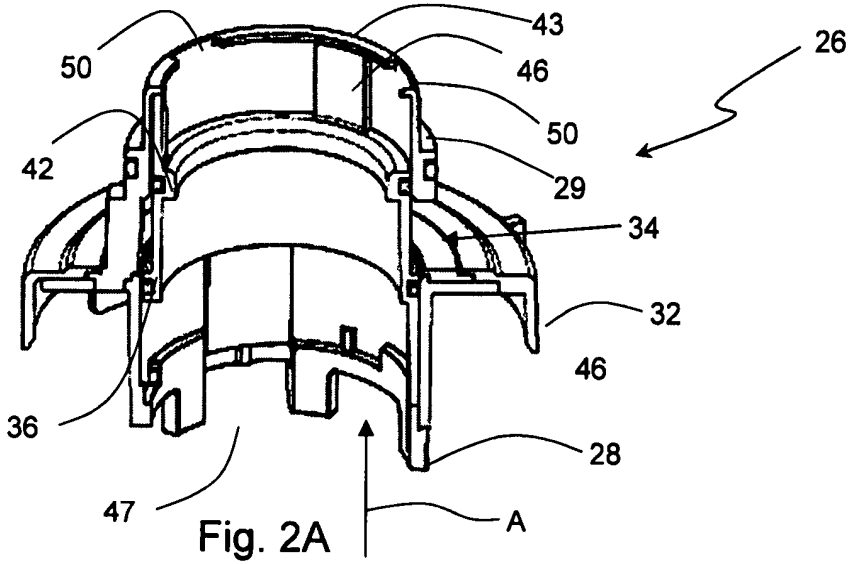

Fig. 2A

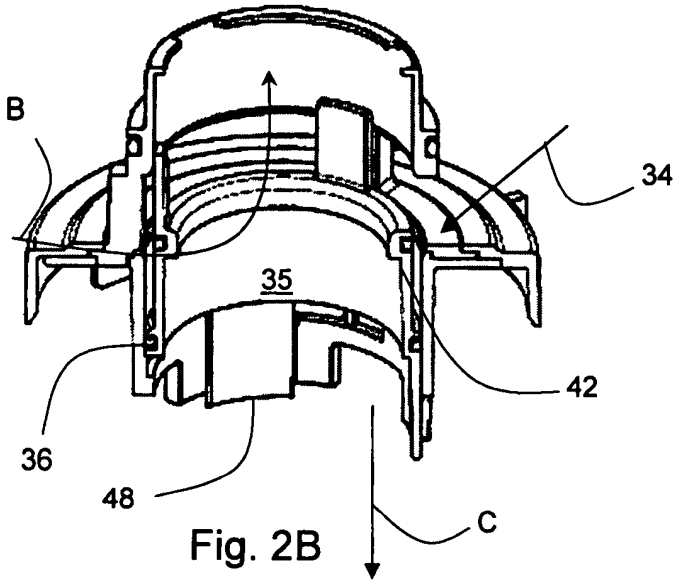

Fig. 2B

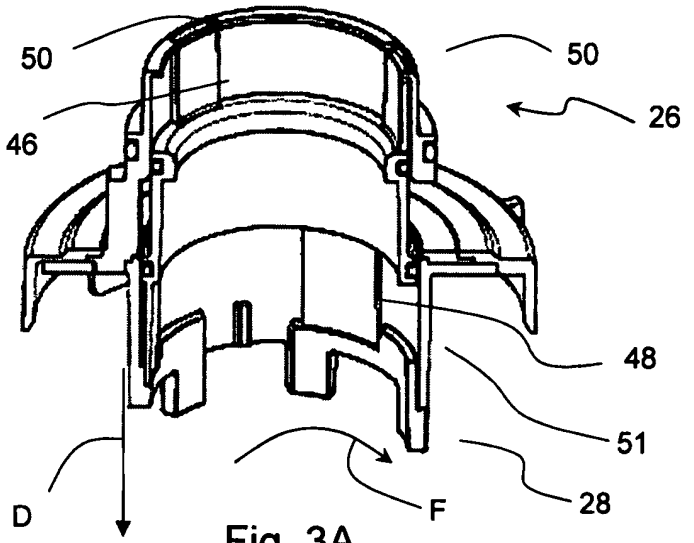

Fig. 3A

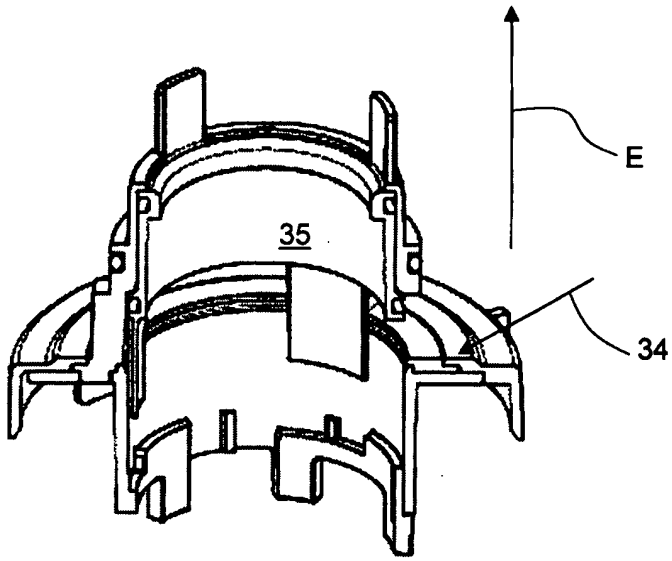

Fig. 3B

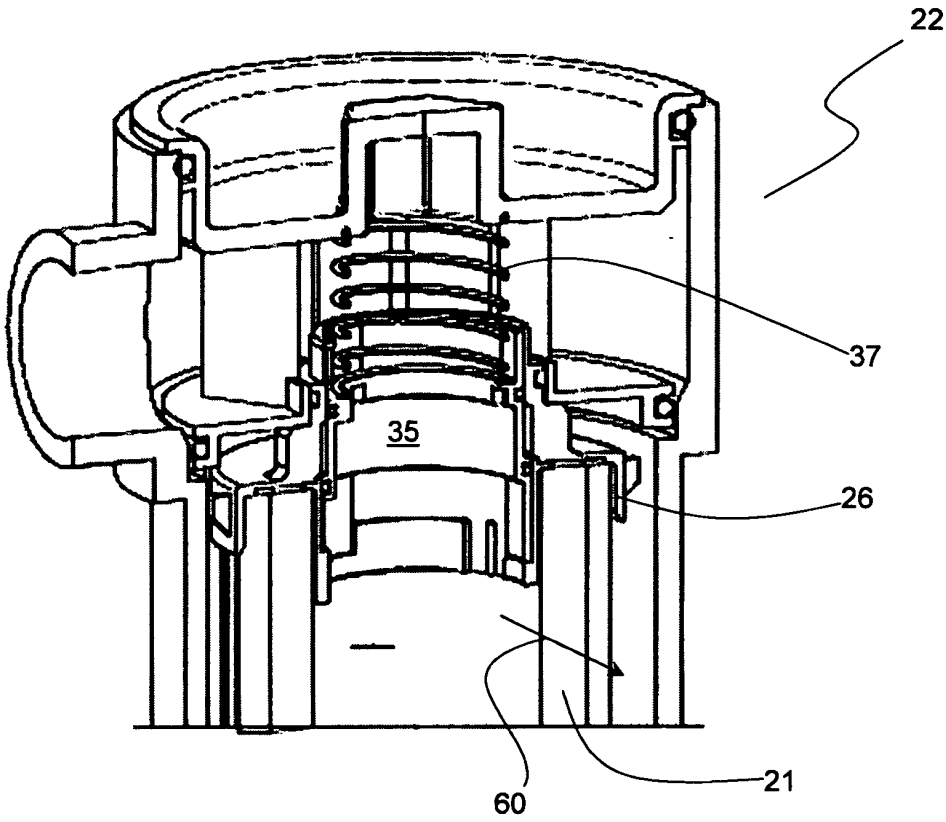

Fig. 4

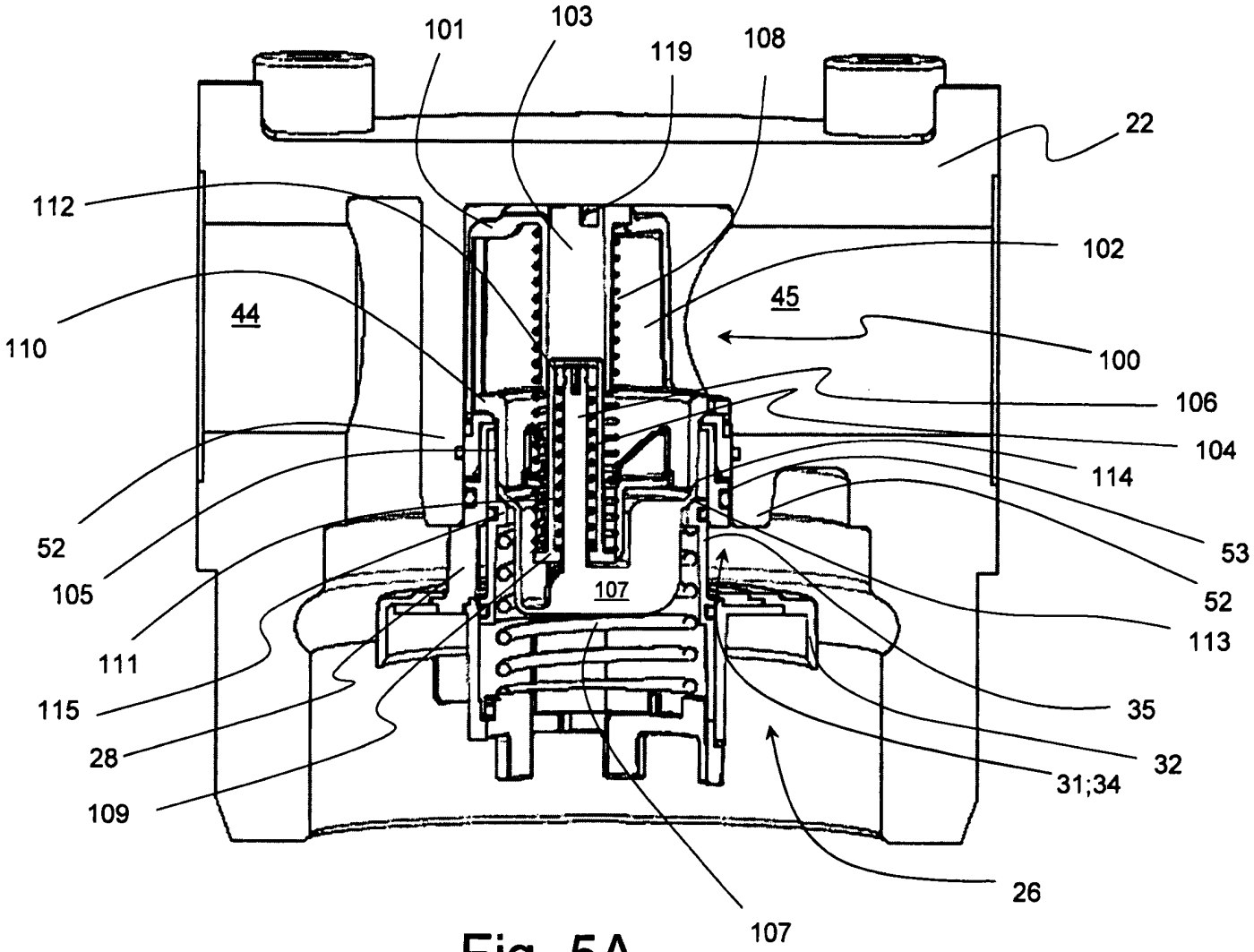
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Fig. 5A

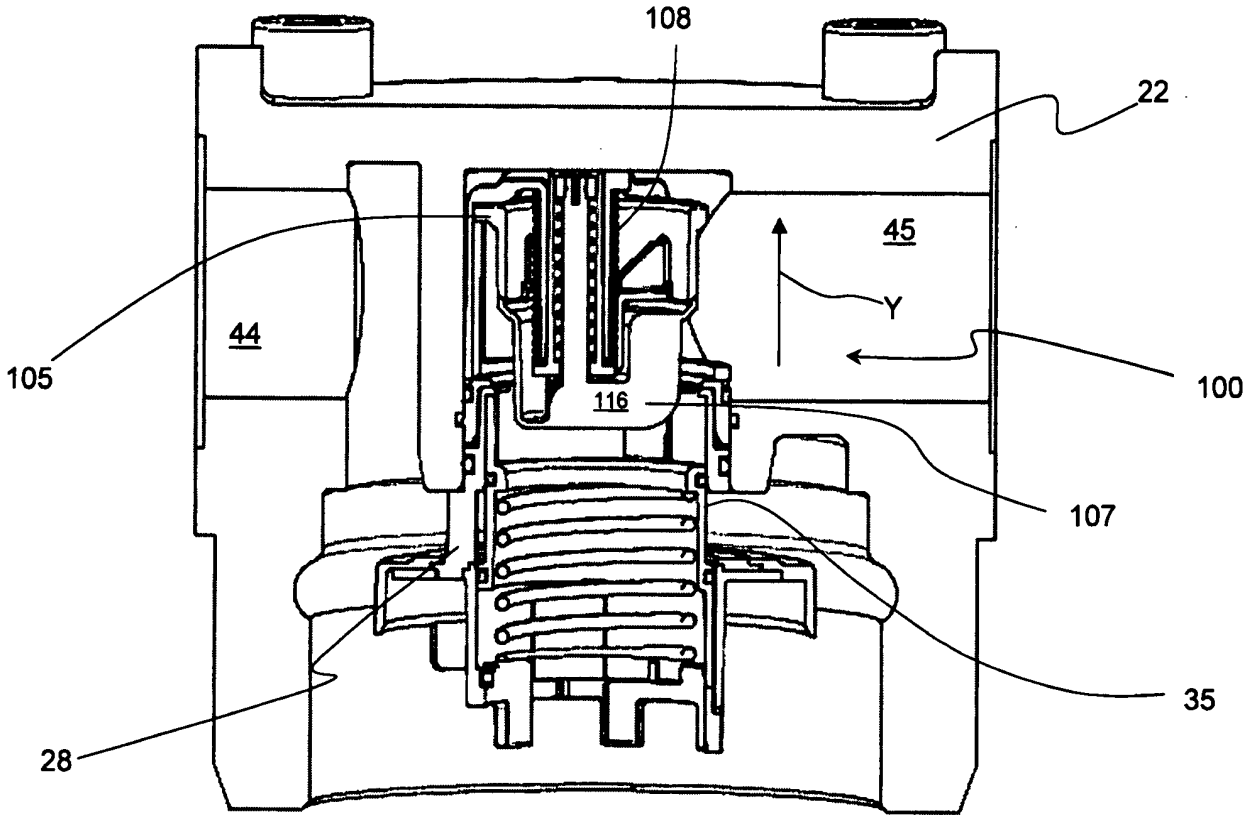

Fig. 5B

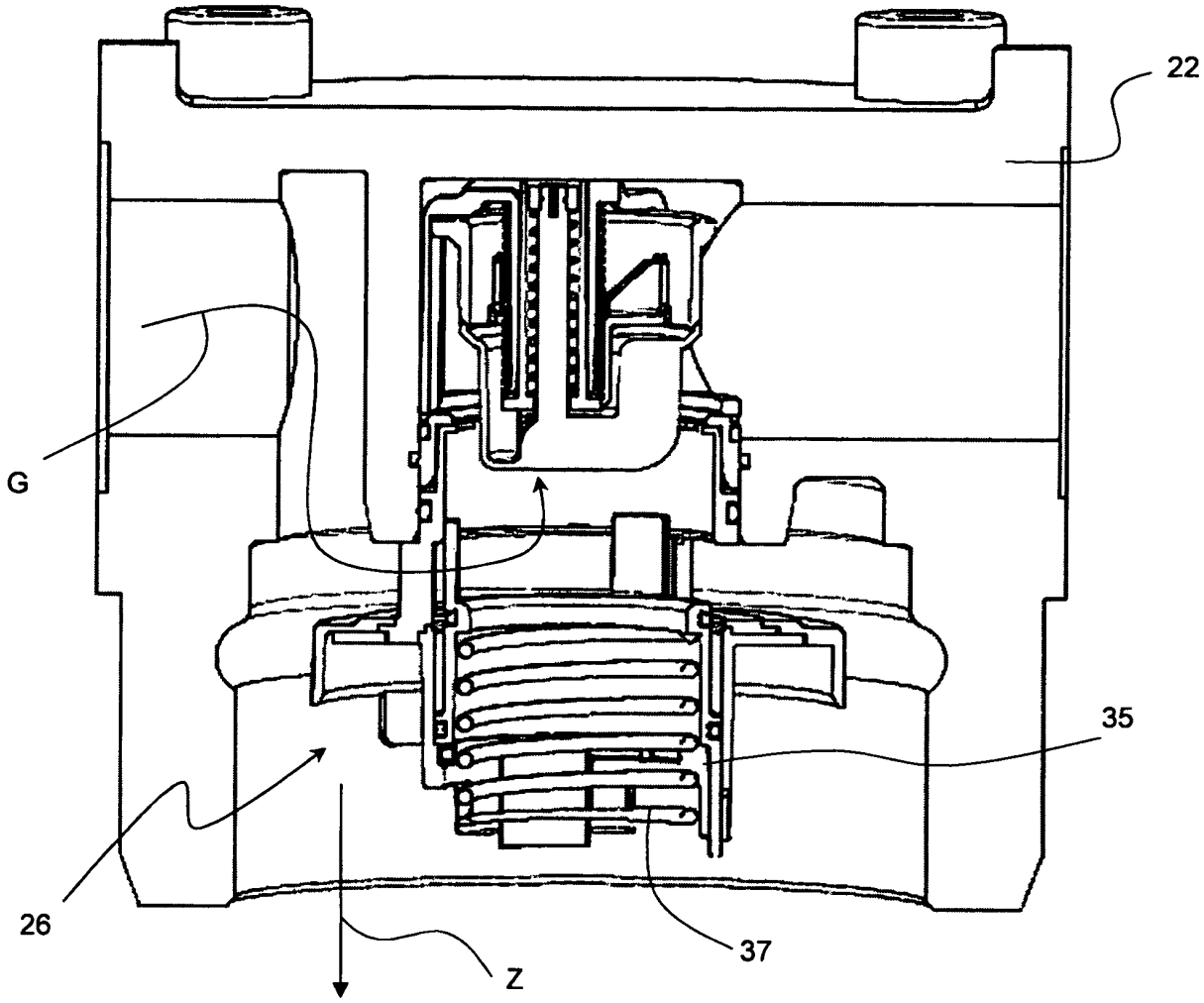

Fig. 5C

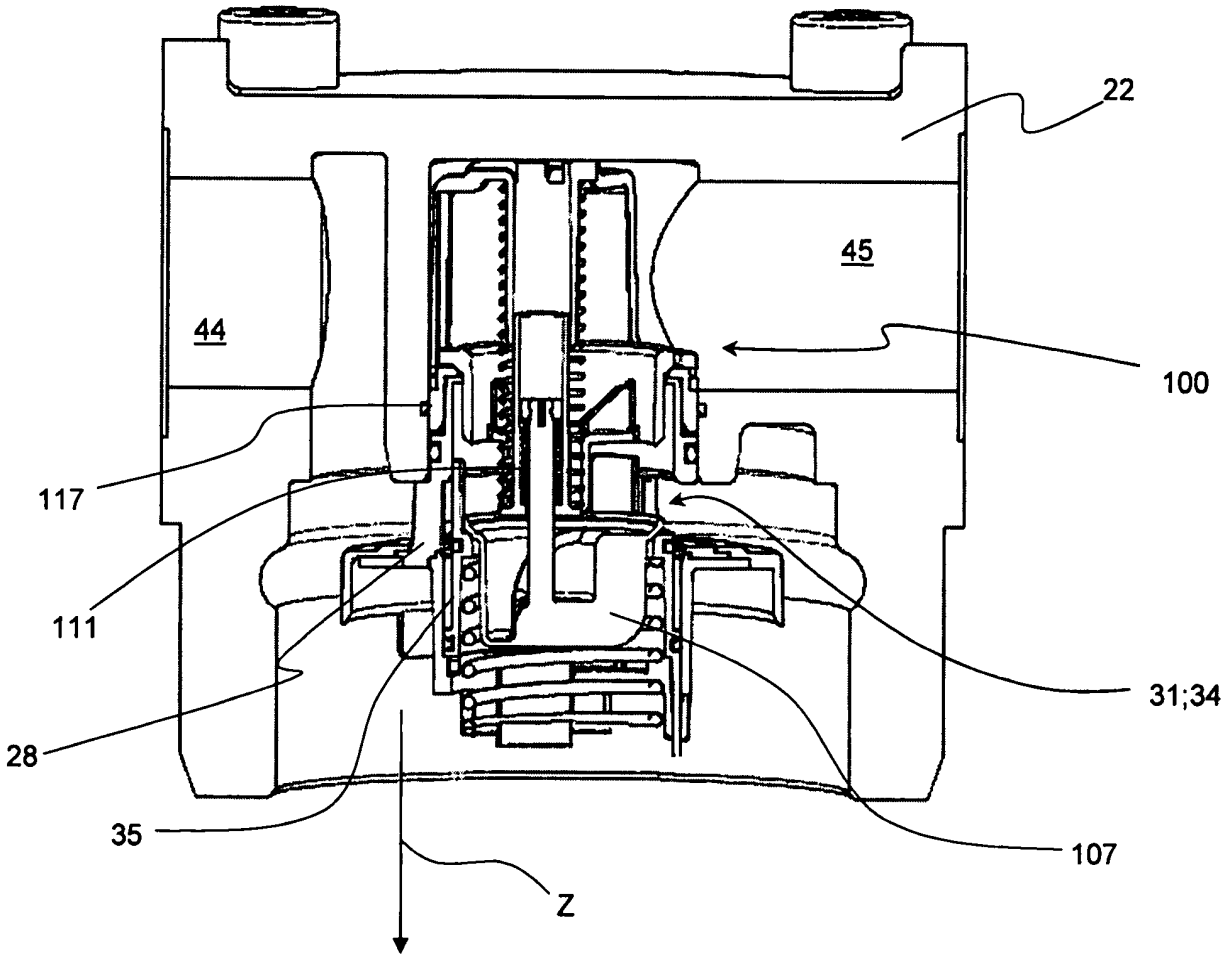

Fig. 5D

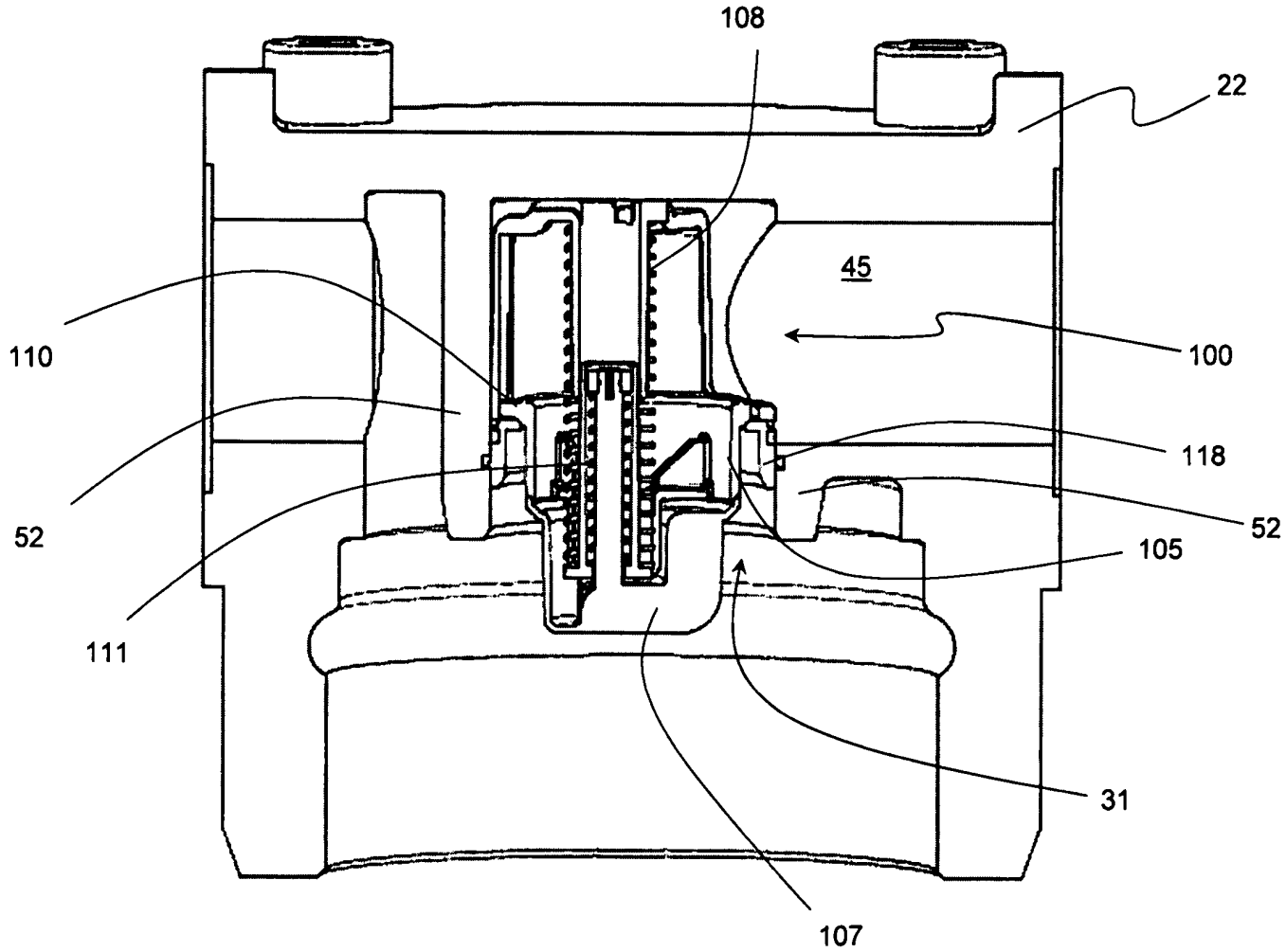

Fig. 5E

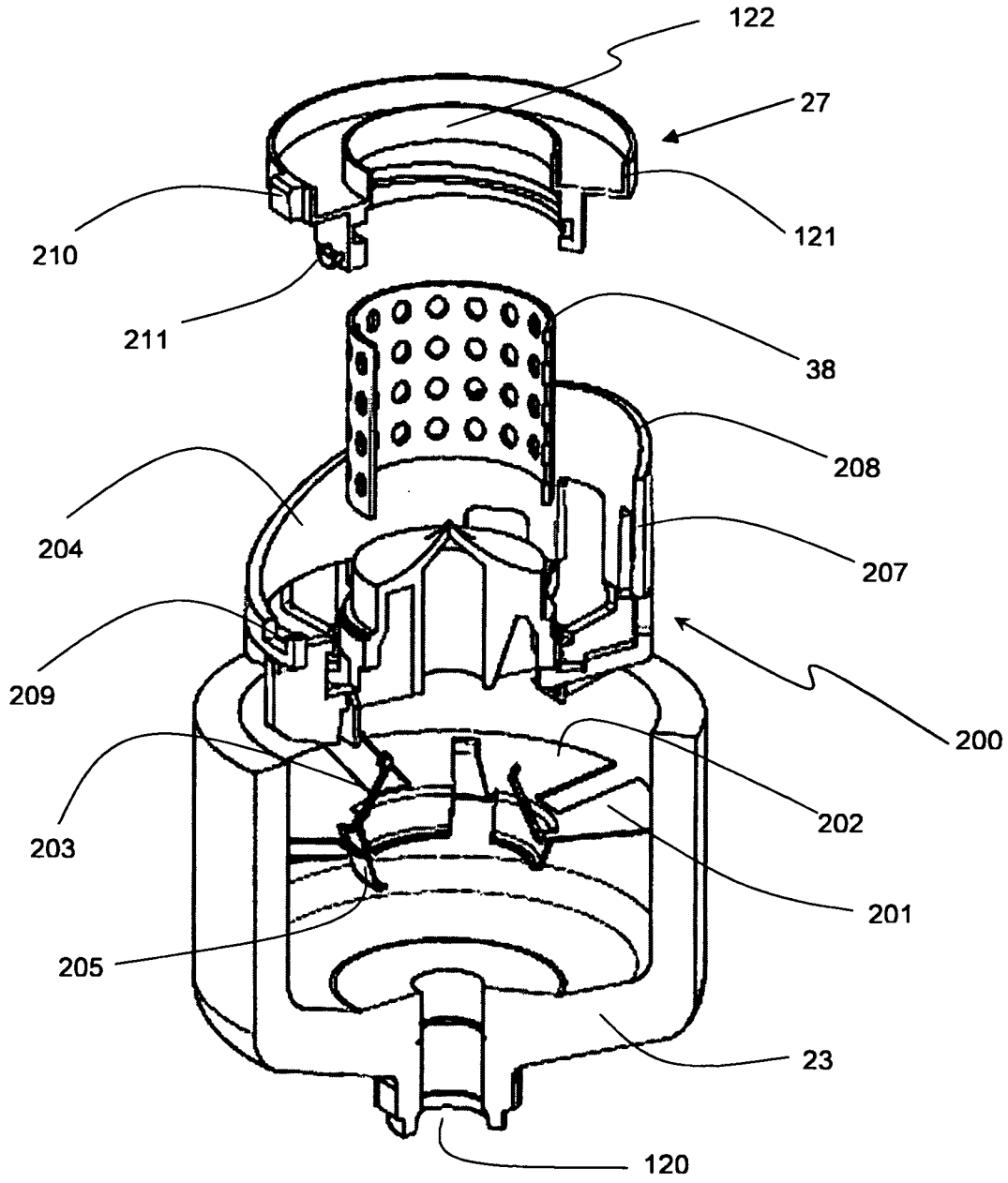

Fig. 6

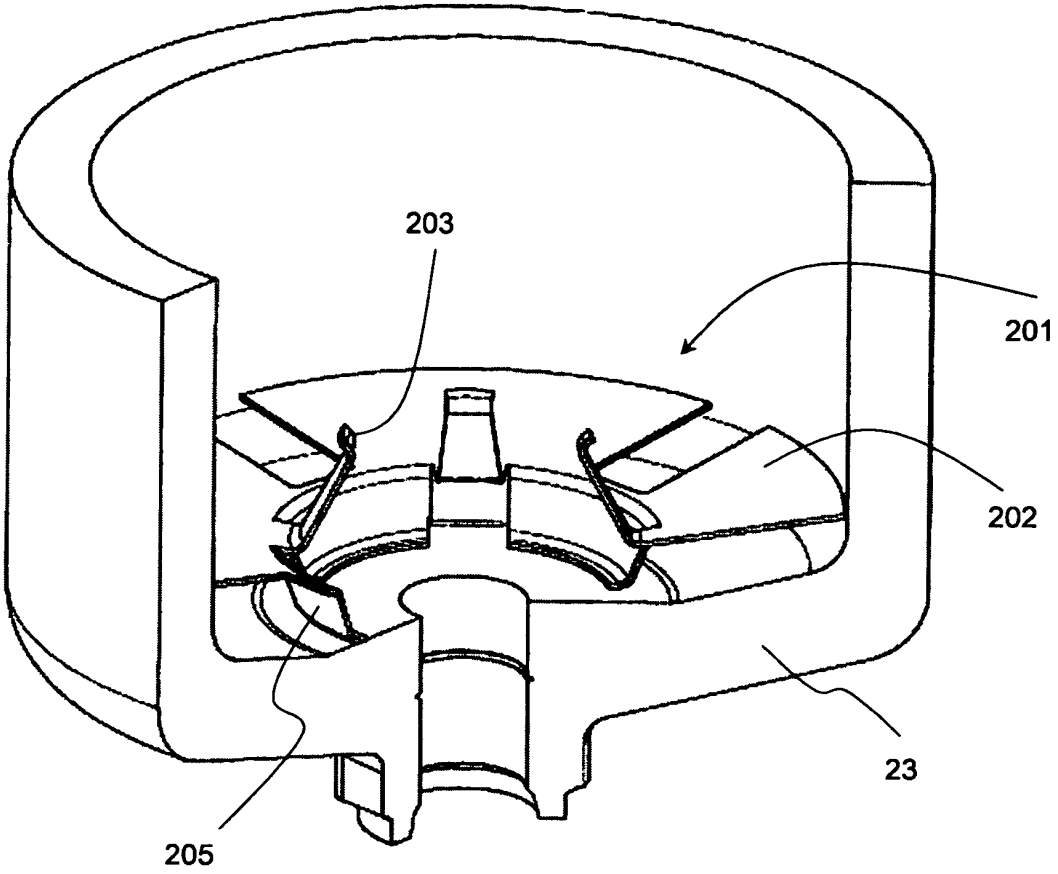

Fig. 7

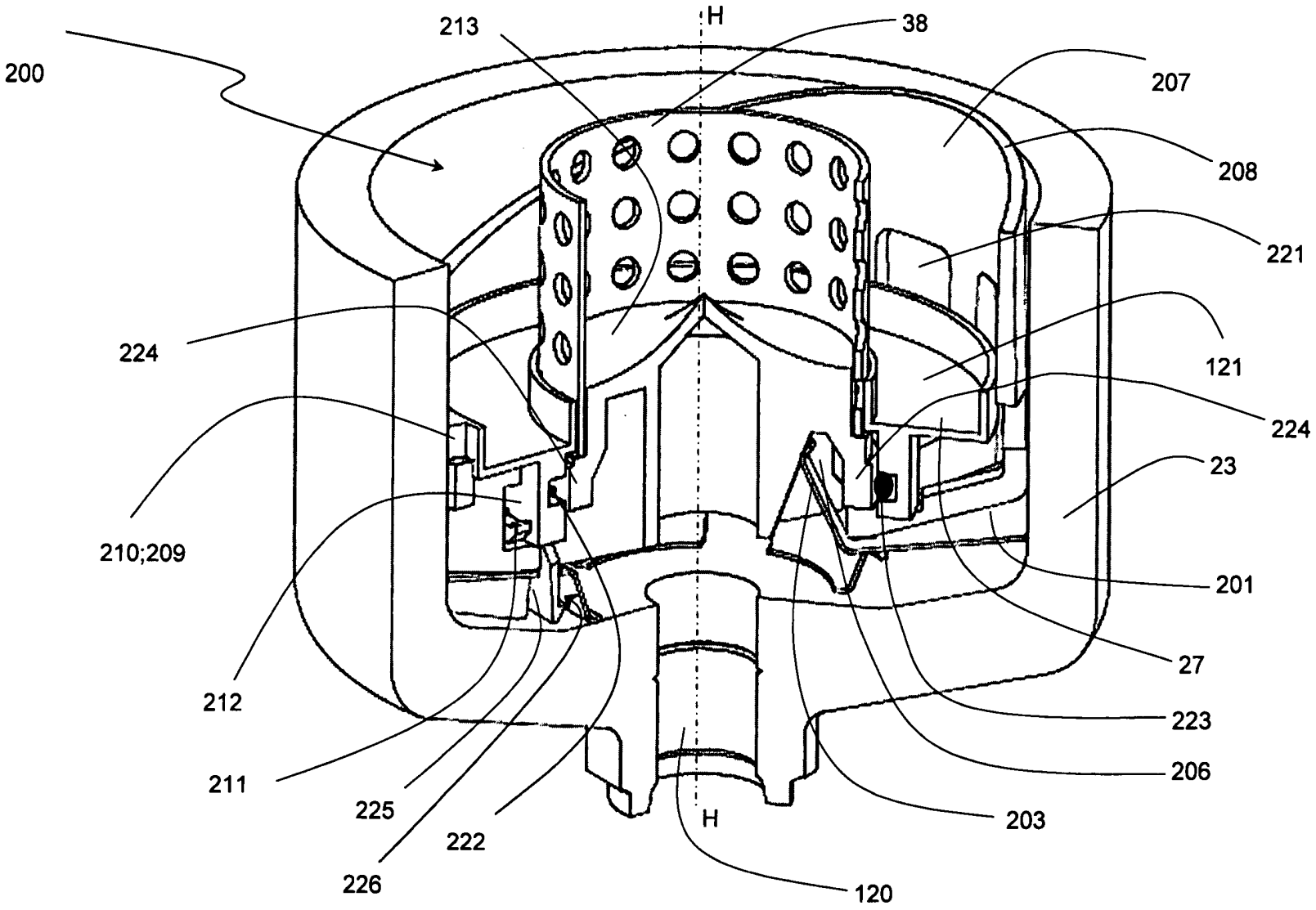
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Fig. 8

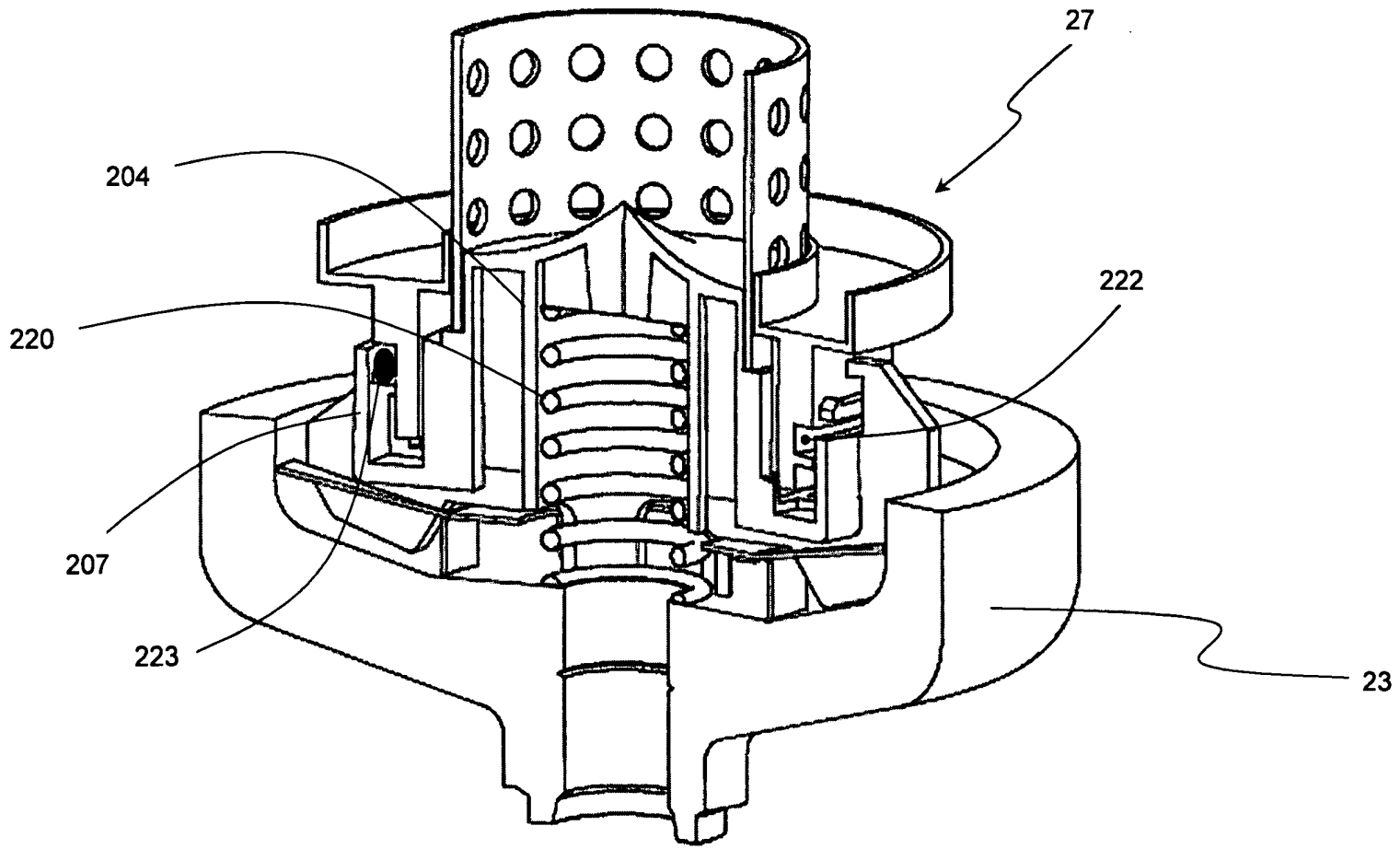

Fig. 9

20017709

SAMENWERKINGSVERDRAG (PCT)

RAPPORT BETREFFENDE NIEUWHEIDSONDERZOEK VAN INTERNATIONAAL TYPE

IDENTIFICATIE VAN DE NATIONALE AANVRAGE	KENMERK VAN DE AANVRAGER OF VAN DE GEMACHTIGDE
	P29414NLOO
Nederlands aanvraag nr. 2001709	Indieningsdatum 20-06-2008
	Ingeroepen voorrangsdatum
Aanvrager (Naam) Parker Filtration B.V.	
Datum van het verzoek voor een onderzoek van internationaal type 30-09-2008	Door de Instantie voor Internationaal Onderzoek aan het verzoek voor een onderzoek van internationaal type toegekend nr. SN 51033

I. CLASSIFICATIE VAN HET ONDERWERP (bij toepassing van verschillende classificaties, alle classificatiesymbolen opgeven)

Volgens de internationale classificatie (IPC)

B01D29/15 B01D29/96 B01D29/23 B01D35/147
B01D35/153 B01D35/30

II. ONDERZOCHTE GEBIEDEN VAN DE TECHNIEK

Onderzochte minimumdocumentatie

Classificatiesysteem	Classificatiesymbolen
IPC 8	B01D

Onderzochte andere documentatie dan de minimum documentatie, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen

III.	☐	GEEN ONDERZOEK MOGELIJK VOOR BEPAALDE CONCLUSIES	(opmerkingen op aanvullingsblad)
IV.	☐	GEBREK AAN EENHEID VAN UITVINDING	(opmerkingen op aanvullingsblad)

ONDERZOEKSRAPPORT BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE

Nummer van het verzoek om een onderzoek naar de stand van de techniek
NL 2001709

A CLASSIFICATIE VAN HET ONDERWERP
INV. B01D29/15 B01D29/96 B01D29/23 B01D35/147 B01D35/153
B01D35/30

Volgens de internationale Classificatie van octrooien (IPC) of zowel volgens de nationale classificatie als volgens de IPC

B ONDERZOCHTE GEBIEDEN VAN DE TECHNIEK

Onderzochte minimum documentatie (classificatie gevolgd door classificatiesymbolen)
B01D

Onderzochte andere documentatie dan de minimum documentatie, voor dergelijke documenten, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen

Tijdens het onderzoek geraadpleegde elektronische gegevensbestanden (naam van de gegevensbestanden en, waar uitvoerbaar, gebruikte trefwoorden)
EPO-Internal

C. VAN BELANG GEACHTE DOCUMENTEN

Categorie *	Geciteerde documenten, eventueel met aanduiding van speciaal van belang zijnde passages	Van belang voor conclusie nr.
	EENHEID VAN UITVINDING ONTBREEKT zie aanvullingsblad B	
X	US 4 657 040 A (TORRES JORGE [US]) 14 april 1987 (1987-04-14) het gehele document	1-11
X	DE 200 04 431 U1 (MANN & HUMMEL FILTER [DE]) 21 juni 2000 (2000-06-21) bladzijde 5, laatste alinea - bladzijde 7, laatste alinea; figuren 1,2	1-11
X	EP 1 479 427 A (ARVIN TECHNOLOGIES INC [US]) 24 november 2004 (2004-11-24) alineas [0009] - [0032]; figuren 3,8-11	1-11
	-/--	

[X] Verdere documenten worden vermeld in het vervolg van vak C.

[X] Leden van dezelfde octrooifamilie zijn vermeld in een bijlage

* Speciale categorieën van aangehaalde documenten

"A" niet tot de categorie X of Y behorende literatuur die de stand van de techniek beschrijft

"D" in de octrooiaanvrage vermeld

"E" eerdere octrooi(aanvrage), gepubliceerd op of na de indieningsdatum, waarin dezelfde uitvinding wordt beschreven

"L" om andere redenen vermelde literatuur

"O" niet-schriftelijke stand van de techniek

"P" tussen de voorrangsdatum en de indieningsdatum gepubliceerde literatuur

"T" na de indieningsdatum of de voorrangsdatum gepubliceerde literatuur die niet bezwarend is voor de octrooiaanvrage, maar wordt vermeld ter verheldering van de theorie of het principe dat ten grondslag ligt aan de uitvinding

"X" de conclusie wordt als niet nieuw of niet inventief beschouwd ten opzichte van deze literatuur

"Y" de conclusie wordt als niet inventief beschouwd ten opzichte van de combinatie van deze literatuur met andere gecteerde literatuur van dezelfde categorie, waarbij de combinatie voor de vakman voor de hand liggend wordt geacht

"&" lid van dezelfde octrooifamilie of overeenkomstige octrooipublicatie

Datum waarop het onderzoek naar de stand van de techniek van internationaal type werd voltooid	Verzenddatum van het rapport van het onderzoek naar de stand van de techniek van internationaal type
19 Februari 2009	
Naam en adres van de instantie European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	**De bevoegde ambtenaar** Wolf, Gundula

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Formulier PCT/ISA/201 (tweede blad) (Januari 2004)

ONDERZOEKSRAPPORT BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE

Nummer van het verzoek om een onderzoek naar de stand van de techniek
NL 2001709

C.(Vervolg) VAN BELANG GEACHTE DOCUMENTEN

Categorie *	Geciteerde documenten, eventueel met aanduiding van speciaal van belang zijnde passages	Van belang voor conclusie nr.
E	WO 2008/128150 A (PARKER HANNIFIN CORP [US]; LUTHER KENNETH M [US]; CELLA ALBERT F [US]) 23 oktober 2008 (2008-10-23) het gehele document	1-11

GEBREK AAN EENHEID VAN UITVINDING

Octrooiaanvrage Nr.:
SN 51033
NL 2001709

AANVULLINGSBLAD B

De Instantie belast met het uitvoeren van het onderzoek naar de stand van de techniek heeft vastgesteld dat deze aanvrage meerdere uitvindingen bevat, te weten:

1. conclusies: 1 (part), 2-11

Klepsamenstel in de filterkop

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2. conclusies: 1 (part), 12-23

Koppelsamenstel voor het koppelen van filterelement en/of kernelement aan de filterbehuizing

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Het vooronderzoek werd tot het eerste onderwerp beperkt.

ONDERZOEKSRAPPORT BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE

Informatie over leden van dezelfde octrooifamilie

Nummer van het verzoek om een onderzoek naar de stand van de techniek
NL 2001709

In het rapport genoemd octrooigeschrift	Datum van publicatie	Overeenkomend(e) geschrift(en)	Datum van publicatie
US 4657040	A 14-04-1987	GEEN	
DE 20004431	U1 21-06-2000	AT 291152 T	15-04-2005
		EP 1136666 A2	26-09-2001
		US 2001035376 A1	01-11-2001
EP 1479427	A 24-11-2004	BR 0304799 A	17-05-2005
		JP 2004346929 A	09-12-2004
		MX PA04000423 A	25-11-2004
		US 2004232063 A1	25-11-2004
WO 2008128150	A 23-10-2008	GEEN	

OCTROOICENTRUM NEDERLAND

WRITTEN OPINION

File No.	Filing date *(day/month/year)*	Priority date *(day/month/year)*	Application No.
SN51033	20.06.2008		NL2001709

International Patent Classification (IPC)
INV. B01D29/15 B01D29/96 B01D29/23 B01D35/147 B01D35/153 B01D35/30

Applicant
Parker Filtration B.V. te Arnhem

This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☒ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☒ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☒ Box No. VI Certain documents cited
- ☒ Box No. VII Certain defects in the application
- ☐ Box No. VIII Certain observations on the application

	Examiner
	Wolf, Gundula

Application number

WRITTEN OPINION

NL2001709

Box No. I Basis of this opinion

1. This opinion has been established on the basis of the latest set of claims filed before the start of the search.

2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the application and necessary to the claimed invention, this opinion has been established on the basis of:

   a. type of material:

   ☐ a sequence listing

   ☐ table(s) related to the sequence listing

   b. format of material:

   ☐ on paper

   ☐ in electronic form

   c. time of filing/furnishing:

   ☐ contained in the application as filed.

   ☐ filed together with the application in electronic form.

   ☐ furnished subsequently for the purposes of search.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

WRITTEN OPINION

Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

The questions whether the claimed invention appears to be novel, to involve an inventive step, or to be industrially applicable have not been examined in respect of

☐ the entire application

☒ claims Nos. 12-23

because:

☐ the said application, or the said claims Nos. relate to the following subject matter which does not require a search *(specify)*:

☐ the description, claims or drawings *(indicate particular elements below)* or said claims Nos. are so unclear that no meaningful opinion could be formed *(specify)*:

☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed *(specify)*:

☒ no search report has been established for the whole application or for said claims Nos. 12-23

☐ a meaningful opinion could not be formed as the sequence listing was either not available, or was not furnished in the international format (WIPO ST25).

☐ a meaningful opinion could not be formed without the tables related to the sequence listings; or such tables were not available in electronic form.

☐ See Supplemental Box for further details.

Box No. IV Lack of unity of invention

1. The requirement of unity of invention is not complied with for the following reasons:

   see separate sheet

2. This report has been established in respect of the following parts of the application:

   ☐ all parts.

   ☒ the parts relating to claims Nos. (see Search Report)

Application number
NL2001709

WRITTEN OPINION

Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty	Yes:	Claims	
	No:	Claims	1-11
Inventive step	Yes:	Claims	
	No:	Claims	1-11
Industrial applicability	Yes:	Claims	1-11
	No:	Claims	

2. Citations and explanations

see separate sheet

Box No. VI Certain documents cited

☒ Certain published documents

see the Search Report

☐ Non-written disclosures

Box No. VII Certain defects in the application

see separate sheet

Reference is made to the following documents:

D1: US-A-4 657 040

D2: DE 200 04 431 U1

D3: EP-A-1 479 427

Re Item IV

Lack of unity of invention

1 It is considered that there are 2 inventions covered by the claims indicated as follows:

Group I: Claims 1 (part) and 2-11,

directed to a valve assembly solving the problems of undesired reverse flow and pressure rise in the filter element and spilling upon exchange of the filter element

Group II: Claims 1 (part) and 12-23,

directed to a coupling assembly between filter element and/or support core to the filter housing, solving the problem of the use of pirated filter elements.

The reasons for which the inventions are not so linked as to form a single general inventive concept are as follows:

1.1 Prior art document D1 discloses (the references in parentheses applying to this document):
Een filtersamenstel (18) , *omvattende een filterelement* (36) , *een filterbehuizing* (30) , *een eindkapsamenstel* (Fig. 2: upper endcap of filter element 36) *aan het eerste uiteinde van het filterelement, waarbij de eindkap een buisvormig deel omvat dat open is aan zijn axiale uiteinden* (upper endcap is integral with core of filter element, which is tubular and is axially open towards its upper end) *en dat met het filterelement een eerste fluïdumstroomdoorlaat vormt, een filterkop die afneembaar bevestigbaar is aan de filterbehuizing en die een inlaatport, een uitlaatport en een ringvormige doorlaat in verbinding met de uitlaatport omvat* (Fig. 2: filter head with conduits 32 and 34 and annular opening with fitting 52 through which fluid indicated by arrow 40 flows; filter head is threaded to housing 30) , *waarbij de ringvormige doorlaat met het buisvormig deel een tweede fluïdumstroomdoorlaat vormt* (Fig. 2: annular opening with fitting 52 and upper tubular part of endcap form a flow channel) , *gekenmerkt door een klepsamenstel* (56, 80) *verschaft in de filterkop tussen de ringvormige doorlaat en de uitlaatport, waarbij het klepsamenstel een klep* (80) *omvat die axiaal verplaatsbar is in het klepsamenstel tussen een eerste positie waarin fluïdum door de ringvormige doorlaat kan stromen en een tweede positie waarin stroming door de ringvormige doorlaat is geblokkeerd* (Fig. 4, 5; col. 5, l. 43-66) .

D1 therefore discloses the subject matter of independent claim 1 of the current application.

1.2 If an independent claim does not avoid prior art, then the question whether there is still an inventive link between the dependent claims needs to be considered.

Dependent claims 2-11 are directed to a valve assembly, which serves to enable bypass flow upon pressure increase in the filter and to avoid unwanted reverse flow through the filter, as well as spilling upon changing the filter element (see description, p. 3, l. 14-28 and p. 3, l. 36-p. 4, l. 4).

Dependent claims 12-23 are directed to a coupling assembly between the filter element/support tube and the filter housing, which solves a different problem, namely how to avoid the use of pirated filter elements (see description, p. 4, l. 29-35).

Therefore, dependent claims 2-23 are not so linked as to form a single common inventive concept. Consequently, the application is divided into two groups of inventions, as mentioned under point 1 above.

1.3 The search opinion under Item V below relates only to searched inventions, i.e. invention group I.

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

2 The present application does not meet the criteria of patentability, because the subject - matter of independent claim 1 is not new.

2.1 The document D1 anticipates the subject matter of claim 1, see point 1.1 above.

2.2 The document D2 discloses (the references in parentheses applying to this document, in particular to Fig. 1):

Een filtersamenstel, omvattende een filterelement (17, 18) , *een filterbehuizing* (11) , *een eindkapsamenstel* (32) *aan het eerste uiteinde van het filterelement, waarbij de eindkap een buisvormig deel omvat dat open is aan zijn axiale uiteinden* (Fig. 1: upper part of endcap 32, which contains O-ring 26) *en dat met het filterelement een eerste fluïdumstroomdoorlaat vormt, een filterkop* (10) *die afneembaar bevestigbaar is aan de filterbehuizing* (p. 6, 3rd paragraph) *en die een inlaatport* (15) , *een uitlaatport* (13) *en een ringvormige doorlaat* (14) *in verbinding met de uitlaatport omvat, waarbij de ringvormige doorlaat met het buisvormig deel een tweede fluïdumstroomdoorlaat* (27) *vormt, gekenmerkt door een klepsamenstel* (20, 22, 28, 29, 30, 31, 33, 34)

verschaft in de filterkop tussen de ringvormige doorlaat en de uitlaatport, waarbij het klepsamenstel een klep (20) *omvat die axiaal verplaatsbar is in het klepsamenstel tussen een eerste positie waarin fluïdum door de ringvormige doorlaat kan stromen en een tweede positie waarin stroming door de ringvormige doorlaat is geblokkeerd* (Fig. 4, 5; col. 5, l. 43-66) .

D2 therefore anticipates the subject matter of independent claim 1.

2.3 The document D3 discloses (the references in parentheses applying to this document, in particular to Figs. 8-11):

Een filtersamenstel, omvattende een filterelement (38) , *een filterbehuizing* (20) , *een eindkapsamenstel* (188) *aan het eerste uiteinde van het filterelement, waarbij de eindkap een buisvormig deel* (180) *omvat dat open is aan zijn axiale uiteinden en dat met het filterelement een eerste fluïdumstroomdoorlaat vormt, een filterkop* (18) *die afneembaar bevestigbaar is aan de filterbehuizing* (paragraph 11) *en die een inlaatport* (24, Fig. 3) , *een uitlaatport* (36) *en een ringvormige doorlaat* (30) *in verbinding met de uitlaatport omvat, waarbij de ringvormige doorlaat met het buisvormig deel een tweede fluïdumstroomdoorlaat vormt, gekenmerkt door een klepsamenstel* (156) *verschaft in de filterkop tussen de ringvormige doorlaat en de uitlaatport, waarbij het klepsamenstel een klep* (182, 184, 194) *omvat die axiaal verplaatsbar is in het klepsamenstel tussen een eerste positie waarin fluïdum door de ringvormige doorlaat kan stromen en een tweede positie waarin stroming door de ringvormige doorlaat is geblokkeerd* (Fig. 10, 11; paragraph 23) .

D3 therefore anticipates the subject matter of independent claim 1.

3 Dependent claims 2-11 do not appear to contain any features which, in combination with the features of any claim to which they refer, meet the requirements of novelty and/or inventive step, see documents D1-D3 and the corresponding passages cited in the search report.

Re Item VI

Certain documents cited

Certain published documents

Application No **Patent No**	**Publication date** ***(day/month/year)***	**Filing date** ***(day/month/year)***	**Priority date *(valid claim)*** ***(day/month/year)***
WO2008/128150	23/10/2008	14/04/2008	13/04/2007

Re Item VII

Certain defects in the application

4 The relevant background art disclosed in the documents D1-D3 is not mentioned in the description, nor are these documents identified therein.

5 The features of the claims are not provided with reference signs placed in parentheses.

6 In the description, p. 7, lines 25 and 26 two different reference signs (33 and 34) have been used for the flow passage, whereby reference sign 33 is not present in the figures.