

Title: Door actuator

Description

- 5 The invention relates to a door actuator including a filter for
filtrating the fluid contained in the door actuator.

A door actuator of this species is described in the document DE
20 2008 005 721 U1. It has proven to be disadvantageous that
10 the fluid, in particular hydraulic oil, may become contaminated.
This contamination may be created for example by abrasion at
the sliding surfaces of the piston. This contamination may
deposit for example at the throttle valve, in particular at the
choke gap, whereby both the efficiency and the closing speed
15 of the door may be altered in an uncontrolled way.

A door operator is disclosed in the document DE 19 33 213, in
which a filter device is provided within the housing between the
piston and the channel in which the throttle valve is disposed.
20 Practice has shown that there is still potential room for
improvement of the compactness of a door actuator, while the
mode of operation has to be ensured.

It has furthermore proven to be disadvantageous that, by using
25 the known filter devices, only specific particle sizes, depending
on the size of the pores of the filter device, are eliminated.

Furthermore, it is disadvantageous that, based on the structural shape of the door actuators, the filtration surface of the filter device is limited and is therefore relatively small, which, during regular operation of the door actuator, results in the filter device
5 being quickly clogged and thus plugging up.

The object of the present invention is to further develop a door actuator of the mentioned species in that the operability, in particular a reliable filtration of the fluid is ensured.

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As a solution to the given problem, a door actuator including a filter having the features of the claim 1 is proposed. Preferred further embodiments are set forth in the dependent claims.

15 For this purpose and according to the invention, it is intended to dispose an additional filter medium at the frame so that the fluid to be filtrated at first passes through the filter medium, prior to passing through the filter fabric in the flow direction. This is advantageous in that, on account of the configuration of the filter
20 medium, a considerably larger active filtration surface is provided, which pre-filtrates the fluid to be filtrated, prior to the fluid passing through additional fabric filters.

Another advantage is that the filter medium may be configured
25 as a massive or as a flexible body. Therefore the filter medium may be manufactured from different materials which will positively affect the aspect of cost.

It is likewise advantageous if the frame has a pot-shaped or a cylindrical contour with an exterior walling and a bottom. On account of such a configured frame, the frame is easy to produce.

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It is of advantage if at least one filter fabric is disposed in the exterior walling and/or in the bottom. This configuration guarantees an inexpensive arrangement of the filter fabric at the frame.

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It is likewise advantageous if the diameter of the filter is smaller than the diameter of the housing. Thus, when assembled, a gap is guaranteed between the housing of the door actuator and the housing of the filter, which serves as space for the fluid to drain, so the filtrated fluid can get into the post-filtration chamber.

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It is likewise advantageous if the frame has a collar by means of which the filter is disposed in the housing in a sealing manner. This configuration allows for utilizing geometries of the frame as a seal and as a contact within the housing of the door.

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Advantageously, a seal is disposed on the outer circumference of the collar. The seal seals the pre-filtration chamber towards the post-filtration chamber, wherein the seal, which is preferably configured as an O-ring, can be easily disposed at the frame.

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It is advantageous if the frame has a hollow space, which, at least partially, is filled with the filter medium. The hollow space offers enough space for a filter medium in order to make a sufficiently large filtration surface available.

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It is likewise advantageous if the frame, with its contact surface, bears against the housing. The filter may be positioned with said contact surface at a predetermined location within the housing.

10 It is of advantage if the filter medium is a fabric or a non-woven fabric. Thus a filter with inexpensive materials may be utilized.

It is advantageous if the filter medium is a monofilament. Thus a suitable adaptation to the utilized fluid can be achieved.

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It is likewise advantageous if the filter medium is a foamed filter material. In this case again a flexible reaction is possible with respect to an adaptation between the utilized fluid and the foamed filter material.

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Advantageously, the section of the frame, in which the filter fabric is located, is disposed such as to surround the frame, wherein this surrounding section is spaced apart from the housing. The surrounding disposition of the filter fabric allows to
25 increase the fabric filtration surface. The distance to the housing is utilized to offer enough free space for the fluid within the pre-filtration chamber, so the fluid, on account of the dependent

movement of the piston, can flow into the filter medium and therethrough.

Advantageously, the section of the frame, in which the filter fabric is located, is disposed frontally at the frame, wherein this
5 section projects into the post-filtration chamber. It is thereby guaranteed that, prior to flowing into the post-filtration chamber, the fluid is filtrated by the filter fabric.

10 It is likewise advantageous if the filter medium is disposed at the frontal side at the frame and projects into the pre-filtration chamber, while the frame is configured in a ring-shape and a filter fabric is preferably disposed in the central area of the frame. A filter medium may be affixed to the frame in a simple
15 way, wherein the outside diameter of the filter medium may be determined such that the latter, inside the housing of the door actuator, leans against a housing walling and, in addition to being disposed at the frame, is supported inside the housing. Thereby a simple and inexpensively structured filter is provided.
20 The ring-shaped configuration of the frame lends itself to utilize the central area for a fabric filter.

Further advantages, features and details of the invention will result from the following description, in which, reference being
25 made to the drawings, several embodiments of the invention are described in detail. In this case, the features mentioned in

the claims and in the description may be relevant for the invention, individually or arbitrarily combined.

In the Figures:

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Figure 1: shows a filter in a sectional view,

Figure 2: the filter of Figure 1 in a sectional view inserted into a housing of a door actuator,

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Figure 3: another embodiment of a filter in a sectional view inserted into a housing of a door actuator,

Figure 4: another embodiment of a filter in a sectional view inserted into a housing of a door actuator,

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Figure 5: another embodiment of a filter in a sectional view inserted into a housing of a door actuator,

20 Figure 6: another embodiment of a filter in a sectional view inserted into a housing of a door actuator,

Figure 7: another embodiment of a filter in a sectional view inserted into a housing of a door actuator.

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In Figure 1 an embodiment of a filter 10a is illustrated in a sectional view. The filter 10a has a frame 20, which has a pot-

shaped or a cylindrical contour with an exterior walling and a bottom, wherein the pot-shaped or cylindrical contour has a diameter D2. The pot-shaped or cylindrical contour is open at the frontal side, wherein a collar is configured at the open side, which collar consists of a contact surface 25 and of a sealing surface 35. The collar has a diameter D1, wherein the diameter D1 is larger than the diameter D2. In one area the sealing surface 35 has a surrounding seal 45, preferably configured as an O-ring. On the circumferential surface, which forms the diameter D2, the frame 20 has at least one opening, in which a filter fabric 40 is disposed. On the side opposite the open side of the frame 20, at least one opening is provided, in which a filter fabric 50 is disposed. From the open side of the frame 20 as far as to the opening, in which the filter fabric 50 is disposed, the frame is configured to be hollow, wherein this hollow space is at least partially filled with a filter medium 30.

Figure 2 shows the filter 10a of Figure 1 in a position inserted into a housing 60 of a door actuator. The contact surface 25 of the frame 20 bears partially against a corresponding surrounding surface of the housing 60, wherein the seal 45 seals a pre-filtration chamber 70 and a post-filtration chamber 80, containing fluid, with regard to each other. Inside, the housing 60 has a diameter D1, which corresponds to the diameter D1 of the filter 10a, wherein the diameter D1 of the filter 10a is configured such that filter 10a can be inserted into the bore of the housing 60 with the diameter D1 and positioned

therein. Furthermore, the housing 60 has an additional inside diameter D3, wherein the transition area of the diameter D1 to the diameter D3 is configured in the inside of the housing 60 at a location where the contact surface 25 of the filter 10a partially
5 bears against a corresponding surface of the housing 60. The diameter D3 of the housing 60 is larger than the diameter D2 of the filter 10a, which thereby offers sufficient space between the housing 60 and the filter 10a for the filtrated fluid to drain into the post-filtration chamber 80. Depending on a piston, which is
10 disposed to be displaceable in the door actuator, fluid flows in the flow direction 90 from the pre-filtration chamber 70 initially through the filter medium 30, prior to flowing through the filter fabric 40, 50 into the post-filtration chamber 80 according to the flow direction 100a, 100b, 100c, and 100d.

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Figure 3 shows another embodiment of the filter 10a, mounted in a housing 60 of the door actuator, in which embodiment the frame 20 corresponds to the frame of Figure 1. Figure 3 illustrates that the filter medium 30 fills the hollow space of the
20 frame 20 and projects from the frontal side opening of the frame 20 into the pre-filtration chamber 70. Depending on the piston, which is disposed to be displaceable within the door actuator, the fluid flows in the flow direction 90 from the pre-filtration chamber 70 initially through the filter medium 30, prior to
25 flowing through the filter fabric 40, 50 into the post-filtration chamber 80.

Figure 4 shows another embodiment of the filter 10a, mounted in a housing 60 of the door actuator, wherein the frame 20 has a cone-like configuration, wherein the filter fabric 40 is disposed at least in an opening of the circumferential surface. The filter medium 30 fills the hollow space of the frame 20 and terminates flush with the exterior border of the frame 20. Depending on the piston, disposed to be displaceable within the door actuator, fluid flows in the flow direction 90 from the pre-filtration chamber 70 initially through the filter medium 30, prior to flowing through the filter fabric 40 into the post-filtration chamber 80.

Figure 5 shows another embodiment of the filter 10a, mounted in a housing 60 of the door actuator, in which the filter 10a has the same structure as the filter 10a of Figure 4 with the difference that the filter medium 30, other than filling the hollow space of the frame 20, additionally projects into the area of the pre-filtration chamber 70. Depending on the piston, which is disposed to be displaceable within the door actuator, the fluid flows in the flow direction 90 from the pre-filtration chamber 70 initially through the filter medium 30, prior to flowing through the filter fabric 40 into the post-filtration chamber 80.

Figure 6 shows another embodiment of a filter, the filter 10b, which is disposed in a housing 60 of the door actuator. The frame 20 is configured to be ring-shaped, wherein the filter medium 30 is disposed frontally at the side of the frame 20, which is oriented to the pre-filtration chamber 70. The filter 10b

is disposed inside the housing 60 in the same way as described in Figure 2. The housing 60 of Figure 6 has an additional diameter, which is larger than the diameter D1 of the filter 10b, wherein said larger diameter of the housing 60 is disposed in the area of the pre-filtration chamber 70. The filter medium 30 is configured such that it has, at least partially, the same diameter as the diameter D1 of the frame 20. Thus the filter medium 30, at least partially, bears against the housing walling of the diameter D1 of the housing 60, in order to receive more support in the housing 60 in addition to being disposed at the frame 20. The filter medium 30 is preferably configured to be cylindrical and, from the frame 20, projects as far as into the pre-filtration chamber 70 such that the filter medium 30 projects into the area of the larger bore. On account of the ring-shaped configuration of the frame 20, a fabric filter 50 is disposed in the central opening of the frame. Depending on the piston, which is disposed to be displaceable within the door actuator, in the flow direction 90, the fluid flows from the pre-filtration chamber 70 initially through the filter medium 30, prior to flowing through the filter fabric 50 into the post-filtration chamber 80.

Figure 7 shows another embodiment of a filter 10b, wherein the frame 20 has the same structure as the one described already in Figure 6, wherein the embodiment of the housing 60 has the same individual diameters as the those described in Figure 2. As described in Figure 6, the filter medium 30 is disposed at the frontal side of frame 20, wherein the filter 30 has a cylindrical

and a conical section. The cylindrical section has, at least partially, the same diameter as the diameter D1 of the frame 20, wherein the conical section tapers from the diameter D1 and projects into the pre-filtration chamber 70. Depending on the piston, which is disposed to be displaceable within the door actuator, the fluid flows in the flow direction 90 from the pre-filtration chamber 70 initially through the filter medium 30, prior to flowing through the filter fabric 50 into the post-filtration chamber 80.

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In a door actuator which is adapted to open and/or close a door with a closer shaft, which can be coupled to the door, having at least one piston in operative connection with the closer shaft, and being disposed in the housing 60 to be displaceable, fluid is provided, preferably hydraulic oil, wherein the fluid is provided in conjunction with a throttle valve for damping the piston within the housing 60 of the door actuator. On account of the displaceable disposition of the piston within the housing 60, particles are produced by abrasion, which are existent in the fluid in an uncontrolled way and result in malfunctioning of the door actuator, unless retained by increased filtration in such a way that a reliable functioning of the door actuator is guaranteed.

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25 For this purpose filtrating the fluid is realized by a filter 10a, 10b, which is disposed inside the housing 60. For this purpose, two bores of different sizes are provided within the housing 60,

which preferably have the same longitudinal axis as the piston which is disposed to be displaceable within the housing 60. Said two bores have different diameters D1, D2, wherein the diameter D1 is larger than the diameter D2.

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The filter 10a, 10b has a frame 20, which preferably has a cylindrical shape, wherein the filter 10a has a collar, which consists of a contact surface 25 and of a sealing surface 35. At the frontal side, in the area of the collar, the cylindrical shape of the frame 20 is configured to be open, such that the frame is hollow.

In one area, the sealing surface 35 has a surrounding seal 45, preferably configured as an O-ring, wherein the sealing surface 35 has a diameter D1, which corresponds to the diameter D1 of the housing 60 in order to suitably assemble the housing 60 and the filter 10a, 10b. The contact surface 25 partially bears against the corresponding surface of the housing 60, which is configured at the transition area of the two differently sized bores with the diameters D1 and D2. On the circumferential surface, forming the diameter D2, the frame 20 has at least one opening, in which a filter fabric 40 is disposed. On the side opposite the open side of the frame 20, at least one opening is provided in which a filter fabric 50 is disposed. From the open side of the frame 20 as far as to the opening, in which the filter fabric 50 is disposed, the frame 20 is configured to be hollow,

wherein this hollow space is at least partially filled with a filter medium 30.

Such a disposition of the filter 10a results in fluid-filled chambers forming on both sides of the seal 45, which chambers are sealed with regard to each other by the seal 45. The displaceably disposed piston and non-filtrated fluid are located in a first chamber, the pre-filtration chamber 70, whereas filtrated fluid is located in a second chamber, the post-filtration chamber 80.

Another embodiment of the filter is given with the filter 10b, which has a frame 20 configured as a ring, wherein the outside diameter of the frame 20 corresponds to the diameter D1 of the housing 60. On its circumferential surface, said frame 20 has a seal 45, which is preferably configured as an O-ring. A filter fabric 50 is preferably disposed in the centre of the frame 20. A filter medium 30 is disposed frontally at the frame 20, wherein the filter 10b is disposed in the housing 60 such that the filter medium 30 points into the direction of the piston and thus in the direction of the pre-filtration chamber 70. As described in Figure 6, other than the diameters D1 and D2, the housing 60 has an additional diameter which is larger than the diameter D1, wherein positioning the filter 10b is realized at the transition area of the diameters D1 and D2. The larger diameter is required to offer to the filter medium 30 free space in which the fluid to be filtrated can flow towards the filter medium 30 in order

- to utilize more filtration surface of the filter medium 30 for
filtrating the fluid. In this embodiment of the filter 10b, the filter
medium 30 is preferably configured to be cylindrical, wherein a
partial area of the filter medium 30 bears against the formed
5 cylindrical surface of the diameter D1 of the housing 60,
whereby the filter medium 30, in addition to being disposed at
the frontal side at the frame 20, is supported by the diameter
D1.
- 10 Another embodiment of the filter 10b differs from the already
described filter 10b by the filter medium 30, which, in
continuation of its cylindrical configuration, has an additional
conical shape, which projects into the pre-filtration chamber. A
third diameter within the housing 60, such as described in the
15 first mentioned embodiment of the filter 10b, can be foregone
with this embodiment of the filter 10b, because the conical
shape of the filter medium 30 offers enough filtration surface for
the fluid to be filtrated.
- 20 On account of the seal 45, the filter 10b as well forms chambers
on both its sides of the seal, in which fluid is present, and the
seal 45 seals said chambers with regard to each other. The
displaceably disposed piston as well as non-filtrated fluid is
provided in the first chamber, the pre-filtration chamber 70,
25 whereby the filtrated fluid is provided in the second chamber,
the post-filtration chamber 80.

If, depending on the piston disposed to be displaceable within the door actuator, fluid is pressed in the flow direction 90 from the pre-filtration chamber 70 into the post-filtration chamber 80, initially the fluid to be filtrated is forcibly guided through the filter medium 30, prior to the fluid flowing through the filter fabric 40, 50 into the post-filtration chamber 80 according to the flow direction 100a, 100b, 100c, and 100d. Said fluid flowing in the flow direction 90 is illustrated in the Figures 2 and 3, whereas in the Figures 4 and 5, the fluid flows in the flow direction 90 from the pre-filtration chamber 70 into the post-filtration chamber 80 initially forcibly guided through the filter medium 30 and subsequently through the filter fabric 40 into the post-filtration chamber 80. However, in Figures 6 and 7, the fluid flows in the flow direction 90 initially forcibly guided through the filter medium 30 and subsequently through the filter medium 30 into the post-filtration chamber 80.

With the filter medium 30, an additional filter for the fluid to be filtrated is placed downstream the fabric filters 40, 50, which filter is configured to offer a considerably larger active filtration surface, whereby increased particle absorption is realized within the filter medium 30 thus reducing clogging of the filter 10a, 10b to a high degree. The fabric filters 40, 50, which, in the flow direction 90, filtrate the fluid, which was pre-filtrated by the filter medium 30, ensure that potential fibres detached from the filter medium 30 are prevented from reaching the throttle valve and the choke gap.

Thus in the flow direction 90 of the fluid, which depends on the movement of the piston, which is disposed to be displaceable within the door actuator, a filter medium 30 is disposed upstream the filter fabric 40, 50, wherein the entire fluid to be
5 filtrated initially flows through the filter medium 30, prior to reaching the post-filtration chamber 80 through the filter fabric 40, 50.

The filter medium 30 may be configured as a massive or as a
10 flexible body, wherein the filter medium 30 may have different contours, such as a cylindrical contour. However, it is important that the filter medium 30 fills the hollow space of the frame 20 at least partially such that the entire fluid to be filtrated, on account of the piston which is disposed to be displaceable within the
15 door actuator, initially flows through the filter medium 30, prior to reaching the post-filtration chamber 80 through filter fabric 40, 50.

Thus the differently sized particles are kept away from the
20 throttle valve, which guarantees a reliable functioning of the door actuator.

The illustrated embodiments are examples, wherein the embodiment of the filter 10a, 10b offers additional possibilities.
25 It is important that the fluid in the flow direction 90 initially flows through a filter medium 30 with additional filtration surface, prior to flowing through additional fabric filters 40, 50 in the flow

direction 90, wherein the filter 10a, 10b, on account of its positioning within the housing 60, forms a pre-filtration chamber 70 and a post-filtration chamber 80.

List of Reference Numerals

	10a	filter
	10b	filter
5	20	frame
	25	contact surface
	30	filter medium
	35	sealing surface
	40	filter fabric
10	45	seal
	50	filter fabric
	60	housing
	70	pre-filtration chamber
	80	post-filtration chamber
15	90	flow direction
	100a	flow direction
	100b	flow direction
	100c	flow direction
	100d	flow direction
20	D1	diameter
	D2	diameter
	D3	diameter

Patent claims

1. A door actuator for opening and/or closing a door including a closer shaft, which can be coupled to the door, and including a piston, which is disposed to be displaceable within a housing (60) and is in operative connection with a closer shaft, wherein the piston is in operative connection with a hydraulic damping device, and including a filter (10a, 10b) for cleaning a fluid inside the door actuator, wherein the filter (10a, 10b) has a frame (20), in which at least one filter fabric (40, 50) is disposed, and fluid is transported by means of the displaceable piston in at least one flow direction (90, 100a, 100b, 100c, 100d), **characterized in that** another filter medium (30) is disposed at the frame (20) such that the fluid to be filtrated initially flows through the filter medium (30), prior to flowing through the filter fabric (40, 50) in the flow direction (90, 100a, 100b, 100c 100d).
2. The door actuator according to claim 1, **characterized in that** the filter medium (30) is configured as a massive body.
3. The door actuator according to claim 1, **characterized in that** the filter medium (30) is configured as a flexible body.

4. The door actuator according to claim 1, **characterized in that** the frame (20) has a pot-shaped or a cylindrical contour with an exterior walling and a bottom.
- 5 5. The door actuator according to claim 4, **characterized in that** at least one filter fabric (40, 50) is disposed in the exterior walling and/or in the bottom.
6. The door actuator according to claim 1, **characterized in that** the diameter (D2) of the filter (10a, 10b) is smaller than the diameter (D3) of the housing (60).
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7. The door actuator according to claim 1 and 4, **characterized in that** the frame (20) has a collar by means of which the filter (10a) is disposed in a sealing manner within the housing (60).
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8. The door actuator according to claim 7, **characterized in that** a seal (45) is disposed on the outer circumference of the collar.
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9. The door actuator according to claim 1 and 3, **characterized in that** the frame (20) has a hollow space, which is at least partially filled with the filter medium (30).
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10. The door actuator according to claim 1, **characterized in that** the contact surface (25) of the frame (20) bears against the housing (60).
- 5 11. The door actuator according to claim 1, **characterized in that** the filter medium (30) is a fabric or a non-woven fabric.
- 10 12. The door actuator according to claim 1, **characterized in that** the filter medium (30) is a monofilament.
13. The door actuator according to claim 1, **characterized in that** the filter medium (30) is foamed filter material.
- 15 14. The door actuator according to claim 1 and 3, **characterized in that** the section of the frame (20), in which the filter fabric (40) is located, is disposed to surround the frame (20), wherein said surrounding section has a distance to the housing (60).
- 20 15. The door actuator according to claim 1 and 3, **characterized in that** the section of the frame (20), in which the filter fabric (50) is located, is disposed frontally at the frame (20), wherein said section is
- 25 oriented towards the post-filtration chamber (80).

16. The door actuator according to claim 1, **characterized in that** the filter medium (30) is disposed frontally at the frame (20) and is oriented towards the pre-filtration chamber (70), wherein the frame (20) is configured to be ring-shaped and a filter fabric (50) is disposed preferably in the central area of the frame (20).
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