

Title: DOOR OPERATOR AND METHOD FOR PRODUCING SAME

Description

The present invention relates to a door operator with a housing, in which a piston, loaded by a fluid and/or by a spring, is disposed and guided to be displaceable in a piston compartment, wherein the housing, at its front side, is sealed and closed off by a closure element.

The state-of-the-art discloses door operators, in which a screwed sealing plug is used, which closes the door operator at its front side. This screwed sealing plug has a groove, in which a seal is inserted for sealing the piston compartment, wherein the screwed sealing plug is screwed into the housing of the door operator by means of a provided thread.

The state-of-the-art has the disadvantage that a groove for the required seal as well as a thread for screwing the screwed sealing plug into the housing of the door operator need to be provided at the screwed sealing plug, wherein a corresponding counter-thread needs to be provided at the housing of the door operator, which are expensive in manufacturing.

Another disadvantage of the known door operators is that, when mounting the door operator, the working step of screwing the screwed sealing plug into the housing of the door operator requires a certain period of time, which results in considerable mounting costs when calculating the annual amount of door operators.

Therefore, it is the object of the present invention to provide a closure element for a housing of a door operator, which has a simple structure, is inexpensive to manufacture and easy to mount in a sealing manner.

This problem is solved based on a door operator according to the generic part of claim 1 in conjunction with the characterizing features. Advantageous further developments of the invention are indicated in the dependent claims.

In this case, the invention is based on the idea that the closure of a door operator, after mounting the required structural components, is realized by a cover, which is mounted by means of a tool and a seal in a leakage-free position, in which the functions of the door operator remain unaffected.

The invention includes the technical teaching that a closure element is configured as a dome-shaped cover, which, on

account of plastic deformation, sealingly closes the housing of the door operator.

The inventive embodiment has the advantage that a geometrically simply configured and thus inexpensive structural element can be utilized for closing the housing of the door operator.

It is likewise advantageous, if the housing has an opening with a diameter which forms a cylindrically shaped surface within the housing. For installing the cover, simply configured tools can be used, wherein the cover is disposed to be recessed in the housing and the closure element of the door operator does therefore not include any protruding portions at the door operator.

It is likewise advantageous, if the piston compartment, in which the piston is disposed, has a diameter which forms a cylindrically shaped surface within the housing. Thus a geometry, which is required for the door operator, is utilized for mounting the cover, whereby the functions of the door operator are guaranteed.

It is furthermore advantageous, if a surrounding groove for a seal is disposed at the transition of the opening to the piston compartment. The thus disposed groove allows for mounting the required seal in a simple manner.

It is likewise advantageous, if the diameter of the opening is larger than the diameter of the piston compartment. In this way, the cover is retained in position for closing.

It is likewise advantageous, if a surrounding surface, which serves as a support for the cover, is disposed at the transition of the groove to the piston compartment. It is thereby easy to insert the cover into the opening and to bear against the surrounding surface.

It is advantageous, if the cover rests on the surface and, after the plastic deformation, protrudes with its border at least partially into the groove and thereby deforms the seal. On account of the plastic deformation of the cover, the external diameter of the cover, which becomes larger, extends into the groove, whereby the seal is deformed by the cover in a sealing manner.

Another preferred embodiment is, if the cover consists of a metallic material. Internal pressures prevail in an operating door operator, which need to be absorbed durably by the cover, in order to ensure the leakage-free functioning of the door operator, which fact is guaranteed with a metallic material in conjunction with the appropriate characteristics and dimensions of the cover.

It is furthermore advantageous, if the seal has different shapes, preferably an O-ring or a seal with 4 edges. Therefore a cost-advantageous sealing can be utilized.

It is likewise advantageous, if the tool can be at least partially introduced into the opening. The closure is thereby disposed to be recessed in the housing of the door operator, whereby protruding structural elements are avoided at the housing of the door operator and, which is to be preferred for visual reasons.

The invention of a preferred embodiment will be illustrated in more detail based on the following Figures and the description thereof, in which:

Figure 1: shows a diagrammatic illustration of the housing of a door operator with a tool for deforming the cover,

Figure 2: shows a detailed view X of Figure 1,

Figure 3: shows a diagrammatic illustration of the housing of a door operator, in which the tool has started to deform the cover,

Figure 4: shows a detailed view Y of Figure 3,

Figure 5: shows a diagrammatic illustration of the housing of a door operator, in which the tool has reached its end position and has thereby plastically deformed the cover,

Figure 6: shows a detailed view Z of Figure 5.

The end area of the housing 40 of the door operator is illustrated in Figure 1 and 2. The housing 40 may be configured as a round, oval or rectangular hollow cylinder, in which a piston 20 is disposed and guided to be displaceable, whereby it is loaded by fluid and/or by a spring. The piston compartment, in which the piston 20 is disposed, has a diameter B. At one end, the housing 40 has an opening 50 with a diameter A.

At the end of the housing 40 in the area of the opening 50, a surrounding groove 35 is machined into the wall of the housing 40. A seal 30 is inserted into this groove 35. The diameter A of the opening 50 is larger than the diameter B of the piston compartment. A ring-shaped surface 45 is thereby created at the groove, at the front side towards the opening 50, which surface serves as an abutment for a cover 10.

For closing the door closer housing, the cover 10 is placed into the opening 50 on the surface 45. The cover 10 is

dome-shaped in a convex manner towards the outside – namely towards the opening 50.

The cover 10 is plastically deformed by means of a tool 25 in such a way that the diameter of the cover 10 becomes larger and the cover with its border penetrates, at least partially, into the groove 35. In this case, the tool 25 is guided towards the dome-shaped surface 15 of the cover 10, until it contacts the cover 10. For an additional support of the cover 10, the piston 20 is positioned such that its front surface is disposed in the area of the ring-shaped surface 45. Thereby, the deformation operation is assisted in that the cover 10 is prevented from slipping through – caused by an abrupt reversion of the dome-shaped cover 10 – wherein the cover 10 may abut against the piston 20.

In Figures 3 and 4, the force F of the tool 25 has started to act upon the dome-shaped surface 15 of the cover 10, wherein the border of the cover 10 already partially extends into the groove 35 and thereby deforms the seal 30.

In Figures 5 and 6, the tool 25 has reached its end position and has plastically deformed the cover 10. The cover 10 may abut against the piston 20, wherein the cover 10 deforms the seal 30 such that the seal 30, in conjunction with the cover 10, achieves a leakage-free sealing of the piston compartment, the housing 40 and the opening 50.

Subsequently, the tool 25 is guided out of the opening and removed from the door closer.

Prior to closing the housing 40, initially the required structural components of the door operator, which are necessary for the proper functioning of the door operator, are mounted into the existing housing 40 of the door operator. Finally the front side of the housing 40 is closed off. In the area of the piston compartment, the housing 40 has a surface 45, which is formed by the groove 35 and by the piston compartment, in which the piston 20 is disposed to be translationally movable, as well as by the opening 50 into which the cover 10 is inserted. In this case, with one of its front sides, the piston 20 is positioned on a level with the surface 45 and is maintained in this position. Once the seal 30, preferably an O-ring, is inserted into the groove 35, the dome-shaped and thus preformed cover 10 is inserted through the opening 50 of the housing 40 as far as to the plane of the surface 45. The preformed cover 10 has a dome-shaped surface 15, wherein the cover 10 is inserted onto the surface 45 of the housing 40 in such a way that the dome-shaped surface 15 protrudes at least partially from the housing 40 to the outside. The preformed contour of the cover 10 is required so as to be able to place the cover 10 through the opening 50 of the housing 40 onto the surface 45, because the external diameter of the dome-shaped cover 10 is smaller than the opening 50 of the housing 40. Subsequently, a tool 25 is moved towards the

dome-shaped surface 15, wherein the tool 25 exerts a force F onto the dome-shaped surface 15, which ensures that the cover 10 is plastically deformed. In this case, up to a final position, the tool 25 exerts a force F onto the cover 10, wherein the final position of the tool 25 is reached, as soon as the cover 10 is plastically deformed and has deformed the seal 30 in the groove 35 in a sealing manner, wherein the cover 10 may find support at the piston 20. The tool 25 has an external diameter, which is conceived in that this external diameter can pass through the opening 50 of the housing 40. In this case, the cover 10 extends at least partially into the groove 35, because on account of the action of the force of the tool 25, the external diameter of the cover 10 becomes larger, wherein this external diameter is then larger than the opening 50 of the housing 40. The cover 10 is thus plastically deformed so that its tendency to revert to the preformed contour is prevented. The enlargement of the external diameter of the cover 10 in conjunction with the depth of the groove 35 results in the cover 10 deforming the seal 30, which is located in the groove 35, wherein the seal 30 and the cover 10 seal the piston compartment in a leakage-free manner.

The cover 10, as a closure of the door closer, is permanently disposed in this position, wherein an inexpensive cover 10 is utilized and mounting requires very little time.

Obviously, this type of closure can be likewise utilized at the side of the door operator where the spring compartment of the door operator is located. Thus, the spring compartment of a door operator can be sealed and closed off in a leakage-free manner by means of a cover 10 in conjunction with a seal 30 disposed in a corresponding groove 35.

List of reference numerals

10	cover
15	dome-shaped surface
20	piston
25	tool
30	seal
35	groove
40	housing
45	surface
50	opening
A	diameter
B	diameter

Patent claims

1. A door operator including a housing (40), in which a piston (20), loaded by fluid and/or a spring, is disposed and guided to be displaceable in a piston compartment, wherein the housing (40) at the front side is closed off and sealed by means of a closure element, **characterized in that** the closure element is configured as a dome-shaped cover (10), which, on account of plastic deformation, closes the housing (40) in a sealing manner.
2. A door operator including a housing (40) according to claim 1, **characterized in that** the housing (40) has an opening (50) with a diameter (A).
3. A door operator including a housing (40) according to claim 2, **characterized in that** the diameter (A) forms a cylindrically shaped surface within the housing (40).
4. A door operator including a housing (40) according to claim 1, **characterized in that** the piston compartment, in which the piston (20) is disposed, has a diameter (B).

5. A door operator including a housing (40) according to claim 4, **characterized in that** the diameter (B) forms a cylindrically shaped surface within the housing (40).
6. A door operator including a housing (40) according to claim 2, **characterized in that** a surrounding groove (35) for a seal (30) is disposed at the transition of the opening (50) to the piston compartment.
7. A door operator including a housing (40) according to claim 2 and 4, **characterized in that** the diameter (A) is wider than the diameter (B).
8. A door operator including a housing (40) according to claim 6, **characterized in that** a surrounding surface (45), which serves as a support for the cover (10), is disposed at the transition of the groove (35) to the piston compartment.
9. A door operator including a housing (40) according to claim 1 and 8, **characterized in that** the cover (10) rests on the surface (45) and, after the plastic deformation protrudes at least partially into the groove (35) with its border and thereby deforms the seal (30).

10. A method for closing the front side of a housing of a door operator according to the claims 1 to 9, **characterized in that**
- the dome-shaped cover (10) is placed onto the surface (45),
 - the piston (20) is positioned such that the front surface thereof is located in the area of the surface (45),
 - a tool (25) plastically deforms the cover (10),
 - such that the border thereof, at least partially, penetrates into the groove (35) and deforms a seal (30) disposed therein.
11. A method according to claim 10, **characterized in that** the cover (10) consists of a metallic material.
12. A method according to claim 10, **characterized in that** the seal (30) has different shapes, preferably an O-ring or a seal with 4 edges.
13. A method according to claim 10, **characterized in that** the tool (35) can be introduced into the opening (50).