

Title: Door Closer**Description**

The invention relates to a door closer according to the generic part of patent claim 1.

5 A door closer of this species is known from EP 0 756 663 B1. A cam plate unit, which partially passes through a spring, is supported in the cylindrical housing of the door closer. On the one side, this spring is bearing against a projection in the housing, and on the other side,
10 at a shoulder of the cam plate unit. Furthermore, the door closer disposes of a drive shaft, to which the door leaf to be moved is connected. The drive shaft presents an eccentrically shaped cam disc within the housing. This cam disc is placed between two rollers, which are disposed at
15 the cam plate unit and act as supporting means, respectively as a pressure element. On account of the eccentricity of the cam disc, a movement of the drive shaft results in a longitudinal movement of the cam plate unit.

Based on the state-of-the-art mentioned above, it is an
20 object of the present invention to provide a door closer, which, at the least manufacturing expense, guarantees a low-wear cooperation of the individual components.

The solution to the problem is achieved through the inventive door closer with the features of claim 1. Preferred

further developments of the invention are explained in the dependent claims 2 to 16.

According to the invention, it is intended that the door closer presents supporting means and pressure elements,
5 of which at least one is integrally connected to the cam plate unit, both made from the same material. Thus the movement of the cam disc is no longer indirectly transmitted via rollers, but directly onto the cam plate unit. It has proven to be suitable that the cam plate unit is
10 stamped out of a sheet-metal segment. The supporting means or the pressure element or both can then respectively and partially be bent up from this sheet-metal.

As a result, the inventive door closer presents a supporting means and/or a pressure element, which is integrally
15 connected to the cam plate unit and made from the same material. The term "integrally" should clarify the positive-through-material connection between the supporting means, respectively the pressure element, and the cam plate unit. As a priority, the invention comprises all
20 supporting means and/or pressure elements, which can be formed out of the cam plate unit by plastic deformation. However, supporting means and/or pressure elements are conceivable, which are connected to the cam plate unit by means of bonding, welding or soldering. These
25 configurations as well will result in a door closer in which the supporting means and/or the pressure element and the

fine-stamped segment, it may be advantageous to produce the cam plate unit and the connecting member in a single production step. Likewise, in cam plate units, which are made from fibre-glass reinforced plastic materials or
5 ceramics, an integral configuration of cam plate unit and connecting member is conceivable.

If the cam plate unit is made from metal, it has proven to be suitable, to harden the surfaces of the supporting means and/or of the pressure element in contact with the cam
10 disc. However, it is also conceivable to manufacture the entire cam plate unit from carbon steel which can be hardened. Ranges of hardness from 45 to 70 HRC have proven to be suitable, whereby in particular hardenings between 50 and 65 HRC have resulted in especially
15 durable door closers.

In the event the compression medium used is not a medium such as oil, which greases the elements rolling on each other, it may be advantageous to use material combinations for the cam disc respectively the supporting
20 means and/or the pressure element, which roll on each other in a low-wear manner. Using a sintered metal, such as sintered bronze for the cam disc would be conceivable.

In order to achieve a uniform rolling of the cam disc on the supporting means and/or on the pressure element,
25 moreover, it has proven to be suitable to provide the latter with a partial radius. The surface of the supporting

means/pressure element, which is in contact with the cam disc, has a bow-shaped form and presents a partial radius between 2 and 15 mm, in particular between 5 and 10 mm. A bending of the contact surfaces within the mentioned
5 radii will result in a uniform rolling of the cam disc.

As described above, the inventive door closer may have an energy accumulator in the shape of a spring. Depending on the intended use, this spring can be installed at different positions within the housing of the door closer. Thereby, an
10 action of force can be achieved, which pulls or pushes the cam plate unit. This will result in a respectively different rotational movement of the drive shaft and thus also of the door leaf connected thereto. It is likewise conceivable to use a gas-pressure spring as an energy accumulator,
15 instead of a helical compression spring. It has also proven to be suitable to use a combination of spring and hydraulic element as an energy accumulator.

Further measures and advantages of the invention will result from the dependent claims, the following description
20 and the drawings. The invention is illustrated by way of example in the drawings and in two exemplary embodiments, in which:

Figure 1: shows a longitudinal section of the inventive door closer in a diagrammatical illustration,

Figure 2: shows the cam plate unit formed from sheet-metal in a diagrammatical illustration,

Figure 3: shows the cam plate unit composed of two segments in a diagrammatical illustration, and

5 Figure 4: shows the inventive cam plate unit in a second configuration in a diagrammatical illustration.

According to the invention, the supporting means and/or the pressure element should be integrally connected to the cam plate unit and both made from the same material. In
10 the illustrated exemplary embodiments here, only the supporting means is shaped from the cam plate unit. This circumstance should not be interpreted as a restriction of the inventive door closer, but instead only as one of the options described in the patent claims.

15 Figure 1 illustrates a longitudinal section through the inventive door closer 10. The housing 20 thereof has a frontal area 23, as well as a rear area 24. The cam plate unit 25 is disposed in the frontal area 23. A connecting member 26, which projects into the rear area 24 of the
20 housing 20, is mounted to the cam plate unit. In this case, the connecting member 26 penetrates through the spring 30, which is supported in the cylindrical area 24. On the one hand, this spring 30 is bearing against an edge of the door closer housing 20 and, on the other hand, against a
25 piston 29.

The piston 29 is fixed at the connecting member 26 by means of a piston pin. The housing 20 is subdivided by the piston 29 into two areas 21, 22. For certain applications, the housing can be filled with a compression medium. In
5 that case, the housing 20 forms a hydraulic damping device in which the piston 29 separates the compartments for the compression medium. Via non illustrated connection channels within the piston 29, the compression medium can flow between the pressure compartment 22 and the
10 unpressurized compartment 21.

If a door, charged by the inventive door closer, is opened, the movement of the door leaf results in a rotation of the drive shaft 11. Through an aperture 41 in the cam plate unit 25, this drive shaft 11 projects into the housing 20. The
15 rotation is transferred to the cam disc 12. A force F 42 is introduced into the cam plate unit 25 through the positive contact between the cam disc 12 and the pressure element 13. The force F 42 results in a displacement of the cam plate unit 25 into the direction of the housing end 50. In
20 order to achieve a movement of the cam plate unit 25, the force introduced by the cam disc 12 must be greater than the force of the spring 30, acting in the opposite direction. Furthermore, the flow resistance of the compression medium must be overcome. On account of the movement
25 of the piston 29 into the direction of the housing end 50, the compression medium is pressed from the one pressure compartment 21 into the other pressure compartment 22.

This inflow can be ensured by not illustrated valves in the piston 29.

Should the user leave the door leaf open once she/he has passed through the door, the inventive door closer 10
5 returns this door leaf back into the initial position thereof. The door closer 10 draws the force required to do so from the relaxation of the previously compressed spring 30. The latter introduces a force F' , into the direction of the arrow of force 43 into the cam plate unit, which force is transferred
10 onto the cam disc 12 by means of the pressure element 13. Through pivoting 40 the cam disc 12, the door leaf, connected to the drive shaft 11, is as well pivoted back into the initial position. The movement of the piston 29 into the direction of the housing end 51 presses the compression
15 medium from the pressure compartment 22 into the unpressurized compartment 21. In this case, the return speed of the piston 29 can be controlled through a corresponding selection of the return valve.

In the event the user would like to close the door
20 himself/herself, the force introduced into the door leaf by the user and the force of the spring 30 add up. The closing speed achieved by the door closer 10 is limited through the flow speed of the compression medium from the pressure compartment 22 into the unpressurized compartment 21. If
25 the moving speed, introduced into the door by the user, is higher than the return speed of the piston 29, the cam disc

12 does no longer bear against the pressure element 13, but against the supporting means 14. An additional force is thereby introduced into the cam plate unit and thus into the piston 29. The higher pressure in the pressure
5 compartment 22 arising therefrom thus results in a faster outflow of the compression medium from this compartment 22 into the unpressurized compartment 21.

Figure 2 illustrates an integral combination of cam plate unit 25 and connecting member 26. The frontal area of the
10 cam plate unit 25 there are two circular holes 52. These holes 52 serve as a reception for the pressure elements 13, formed as rollers in this exemplary embodiment. Likewise known is the use of only one pressure element 13, which is located in one line with the supporting means
15 14 and the drive shaft 11. An opening 41 has been cut into the cam plate unit 25. The drive shaft 11 passes through this opening 41. In the here illustrated exemplary embodiment, the combination of cam plate unit 25 and connecting member 26 is an integral sheet-metal-like
20 segment 27. This segment 27 can be produced with high precision, in particular in a fine-stamping procedure. At the end of the opening 41, further incisions are provided in order to be able to bend up the supporting means 14 from the surface of the segment 27. In this case, the supporting
25 means 14 is bent up as far out of the plane of the segment 27 that it can positively cooperate with the cam disc 12.

Advantageously, the inventive cam plate unit 25 may consist of a combination of two sheet-metal-like segments 27 shown in Figure 2. This is illustrated in Figure 3. Here, two sheet-metal-like segments 27 are shown, which are mirror-symmetrically disposed to each other and form both, the cam plate unit 25 and the connecting member 26. In this case, the cam plate unit 25 is slightly bent out of the plane of the connecting member 26, in order to achieve an interspace. Both, the two pressure elements 13 and the supporting means 14 can be placed into this interspace. In this case, the axles, on which the pressure rollers 13 are supported, extend through the circular holes 52. The integral supporting means 14, which is bent up from the cam plate unit 25 and made from the same material, is located at the other end of the cam plate unit 25. The positive abutting of the two supporting means 14 at each other is a result of an appropriate selection of the thickness for the cam plate unit material and the height of the bent of the cam plate unit 25 out of the plane of the connecting member 26.

In order to achieve a smooth rolling of the cam disc 12 on the supporting means 14, the latter has a partial radius according to the invention. As can be seen in the Figures 1 and 2, the supporting means 14, which is bent up from of the cam plate unit 25, has an arched termination at its frontal edge. Depending on the overall dimension of the door closer 10, the radius of this arched termination is

between 2 and 15 mm, in particular between 5 and 10 mm. Most of the commonly used cam discs 12 will roll readily and at minimal wear on the inventive supporting means 14, which have a radius within this range.

5 In another advantageous configuration of the inventive door closer 10, the contact areas of the supporting means 14 with the cam disc 12 are hardened. In this case, a hardness of 45 to 70 HRC, in particular of 50 to 65 HRC has proven to be advantageous. This hardening can be
10 achieved through heat treatment or by appropriately selecting the material of the overall cam plate unit 25. Furthermore, the materials selected for the cam disc 12 and for the supporting means 14 should roll on each other at the lowest possible wear.

15 Another advantageous configuration of the inventive door closer 10 is revealed in Figure 4. As this exemplary embodiment is analogue to the previously described cam plate unit 25, the same reference numerals are used to identify the same structural units. In case of variations,
20 these are identified by the corresponding reference numeral having an apostrophe.

Unlike the exemplary embodiment illustrated in Figure 3, in this case, the connecting member 26 and the cam plate unit 25' are not integrally formed. They are on the contrary
25 separate components. The cam plate unit 25' illustrated in Figure 4 has an opening 41 as well, through which the

drive shaft 11 extends. On the one side, the reception holes 52 for the pressure elements 13 and, on the other side, the supporting means 14 are machined into the remaining webs 28'.

- 5 As already in the cam plate unit 25 illustrated in Figure 3, another inventive cam plate unit 25' can be manufactured through a combination of two segments 27'. A mirror-symmetrical disposition of the sheet-metal-like segments 27' results in a cam plate unit 25', which is heavy-duty and
10 inexpensive as a result of using the same structural components, and to which only a connecting member 26 needs to be mounted.

In the door closer 10 illustrated in Figure 1, the connecting member 26 penetrates a spring 30, which serves as an
15 energy accumulator. In an advantageous configuration of the inventive door closer 10, the energy accumulator 30 could be a hydraulic element. Depending on the application type, it could be likewise advantageous to integrate the energy accumulator 30 between the piston 29 and the rear
20 end 51 of the housing 20. This would result in a reversal of forces acting upon the cam plate unit 25.

The exemplary embodiments of the inventive door closer illustrated in the Figures have a supporting means 14 integral with the cam plate unit 25, 25' and made from the
25 same material. Obviously, the pressure means 13 could likewise be shaped and integrally connected to the cam

plate unit 25, 25' and consist of the same material as the latter. However, depending on the application purpose, it could be advantageous to shape the form of both or of just the supporting means or of the pressure means.

List of reference numerals

	10	door closer
	11	drive shaft
	12	cam disc
5	13	pressure element
	14	supporting means
	20	housing
	21	unpressurized compartment
10	22	pressure compartment
	23	frontal housing section
	24	rear housing section
	25/25'	cam plate unit
	26	connecting member
15	27/27'	sheet-metal-like segment of 25/25'
	28/28'	frame-shaped web
	29	piston
	30	energy accumulator
20	40	direction of movement of the cam disc 12
	41	opening
	42	direction of movement of the cam plate unit towards 50
	43	direction of movement of the cam plate unit towards 51
25		
	50	frontal end of the housing 20

- 51 rear end of the housing 20
- 52 opening in the cam plate unit 25/25'

Patent claims

1. A door closer (10) having a drive shaft (11), which is connectable to a door leaf and rotatably (40) supported, the drive shaft (11) being
5 connected to a cam disc (12) within a housing (20), the cam disc (12) being disposed between at least one supporting means (14) and at least one pressure element (13) and positively cooperating with at least one of them, the
10 supporting means (14) and the pressure element (13) being located at a cam plate unit (25, 25') at which a connecting member (26) is disposed, which is connected to an energy accumulator (30), and the energy accumulator
15 (30), on the one side, cooperating with the connecting member (26) and, on the other side, with the housing (20),

characterized in that

the supporting means (14) and/or the pressure
20 element (13) is integrally connected to the cam plate unit (25, 25') and made from the same material as the latter.
2. A door closer (10) according to claim 1,
25 characterized in that the supporting means (14) and/or the pressure element (13) are

respectively partially bent up from the cam plate unit (25, 25').

3. A door closer (10) according to any of the claims 1 or 2, characterized in that the cam plate unit (25, 25') consists of two sheet-metal-like segments (27, 27') and that the supporting means (14) and/or the pressure element (13) is disposed between these segments.
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4. A door closer (10) according to claim 3, characterized in that two sheet-metal-like segments (27, 27') of the cam plate unit (25, 25') are disposed mirror-symmetrically towards each other.
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5. A door closer (10) according to any of the claims 3 or 4, characterized in that frame-shaped webs (28, 28') are cut out of the sheet-metal-like segments (27, 27') of the cam plate unit (25, 25').
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6. A door closer (10) according to claim 5, characterized in that the supporting means (14) and/or the pressure element (13) are disposed between the webs (28, 28') forming the cam plate unit (25, 25').
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7. A door closer (10) according to any or the claims 4 or 5, characterized in that partial
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bendings of the webs (28, 28') form the supporting means (14) and/or the pressure element (13).

- 5 8. A door closer (10) according to any of the claims 1 to 7, characterized in that the cam plate unit (25, 25') and the connecting member (26) are integral.
- 10 9. A door closer (10) according to any of the claims 1 to 8, characterized in that the connecting member (26) has a piston (29), against which the energy accumulator (30) bears, the energy accumulator (30) being a spring and/or a hydraulic element.
- 15 10. A door closer (10) according to any of the claims 1 to 9, characterized in that the energy accumulator (30) pushes the connecting member (26) into the direction of the drive shaft (11) or pulls the connecting member (26) away from the drive shaft (11).
- 20 11. A door closer (10) according to any of the claims 1 to 10, characterized in that the supporting means (14) and/or the pressure element (13), at least portionwise, have a partial radius between 2 and 15 mm, in particular
- 25 between 5 and 10 mm.

12. A door closer (10) according to any of the claims 1 to 11, characterized in that the cam plate unit (25, 25') and/or the supporting means (14) and/or the pressure element (13) are fine-stamped components.
13. A door closer (10) according to any of the claims 1 to 12, characterized in that at least areas of the supporting means (14) and/or of the pressure element (13) are hardened, and have a hardness of 45 to 70 HRC, in particular of 50 to 65 HRC.
14. A door closer (10) according to any of the claims 1 to 13, characterized in that the cam disc (12) rolls in a low-wear manner on the supporting means (14) and/or the pressure element (13).
15. A door closer (10) according to any of the claims 1 to 14, characterized in that the cam plate unit (25, 25') has a maximum lift of 15 to 35 mm, in particular of 20 to 30 mm.
16. A door closer (10) according to any of the claims 1 to 15, characterized in that the piston (29), which is connected to the cam plate unit (25, 25') subdivides the housing into two pressure compartments (21, 22) and in that the

housing (20) is filled with a compression medium.