

Title: Backplate for a door actuator**Description**

The invention relates to a backplate for a door actuator.

Door actuators are used for closing and/or opening doors. In particular, door closers and door drives are designated as door actuators. Generally, in a door closer, the manual opening movement charges a spring accumulator. Thereby, the stored energy is used for closing the door. For example, in the door drive, electro-mechanics or hydraulics allow for automatically open and/or close the door. Usually, door actuators are fastened to the door leaf or to the casing, respectively the wall. Most of the time, mounting plates are used for fastening the door actuators. The mounting plate is fastened to the mounting surface thereof, namely the door, casing or wall. In turn the door actuator is attached to the mounting plate.

In particular, with fire-rated doors, it should be noted that often combustible fluids, in particular hydraulic oils, are used in the door actuators. In the event of a fire, as much as possible, suitable measures should allow for preventing the fluid in the door actuator from heating up too much and potentially from igniting after escaping from the door actuator.

It is the object of the present invention to indicate a backplate for a door actuator, which fulfils dependable fastening of the

door actuator and simultaneously safety relevant requirements, in particular in the event of a fire.

The object is achieved with the features of the independent claim. Advantageous further configurations of the invention
5 are the subject matter of the dependent claims.

The invention describes a backplate, which is used instead of a conventional mounting plate for fastening the door actuator. The backplate includes at least one first mounting element and a second mounting element. The mounting
10 elements are connected to each other via at least one connecting assembly. Under corresponding thermal load, said connecting assembly loosens so that the two mounting elements separate from each other. Thereby, the door actuator detaches from the mounting surface, namely from
15 the door, casing or wall. In particular in this case, it is assumed that the door actuator is located on the side of the door facing away from the fire. The door actuator detaching from the mounting surface thereof, prevents the door actuator from heating up too much, whereby the fluid is
20 prevented from escaping from the door actuator and the fluid is prevented from igniting.

For describing directions, a mounting axis is defined at the backplate. The mounting axis is parallel to the screws, for example, which are used for screwing the backplate to the
25 mounting surface. According to an alternative definition, the mounting axis is vertical to the output axis of the door actuator. Vertical to the mounting axis are defined a

longitudinal axis and a vertical axis; in usual mounting situation, the longitudinal axis extends horizontally.

Preferably, the two mounting elements are plates or plate-shaped elements, which, for forming the backplate, are
5 disposed next to each other or in particular one within the other. In particular, it is provided the at least one first mounting element with the backside thereof is fastened, in particular screwed, to the mounting surface. A door, casing or wall forms said mounting surface. Accordingly, the
10 second mounting element is connected to the door actuator. In particular, the second mounting element has a front surface, to which the door actuator is fastened, in particular screwed. Preferably, the second mounting element is a self-contained component, to which the door actuator is
15 fastened. However, as an alternative, the second mounting element can be an integral component of the door actuator.

Furthermore, also the inverse embodiment is possible, whereby the at least one first mounting element is formed for accommodating the door actuator and the second
20 mounting element is fastened to the mounting surface.

The backplate comprises at least one connecting assembly. In particular, are provided one, two, three, four, five or more such connecting assemblies.

The connecting assembly, in the retaining position thereof,
25 keeps the two mounting elements together. In particular, this is realized by means of a form closure in the connecting

assembly. The connecting assembly is movable to a release position. In said release position, the connecting assembly does not keep the two mounting elements together anymore; in particular, the connecting assembly releases
5 the positive connection realized among the two mounting elements.

Furthermore, the backplate comprises at least one shape memory assembly. Again, said shape memory assembly comprises at least one shape memory element (e.g. wire),
10 which is made from shape memory material. In particular, said shape memory material is shape memory metal or shape memory alloy. In particular, the shape memory material is specific metal, which may exist in two different crystal structures (e.g. austenite and martensite). The shape
15 memory assembly is disposed and formed in the backplate so as, when thermally activated, to move the connecting assembly to the release position. Namely in the backplate, the shape memory assembly is used as an actuator or drive for moving the connecting assembly. In this case, it is not
20 the entire connecting assembly that needs to be moved, but it can be sufficient if a part of the connecting assembly is moved for loosening the connection between the two mounting elements.

Thermally activating is realized in particular in a temperature
25 range of 90 °C to 200 °C. In particular in this case, the shape memory assembly is formed in that activation occurs at a corresponding temperature, which is suitable for preventing

the fluid from escaping from the door actuator and preventing the fluid from following ignition. In particular, thermally activating means heating the shape memory element so the martensitic structure converts to the austenitic structure.

Preferably, the shape memory element is formed as wire, rod or spring. In particular, the spring is a spiral spring. When thermally activated, the shape memory element changes the length thereof; in particular it shortens. Thereby, by thermally activating the shape memory element, a force, in particular a tensile force, can be exerted on an element of the connecting assembly. Thus, the force, in particular the tensile force, can be used for releasing the connections of the connecting assembly.

In the backplate, preferably at least partially, the shape memory element is disposed in a receiving groove and/or in a completely closed channel. In particular, the receiving groove or the channel is located in the first mounting element. Said arrangement in the receiving groove or the channel allows for a protected position of the relatively thin shape memory element so as to not damaging the wire when mounting the backplate, for example. Preferably, the receiving groove or the channel extends over at least 50 % of the length of the shape memory element. Furthermore hereby, it is achieved that the heat transport from the mounting surface to the shape memory element is particularly quick and thus the backplate is able to react as

quickly as possible to a dangerous temperature increase of the mounting surface.

Preferably, the first mounting element comprises a baseplate, which in particular is provided for resting at the mounting surface. In particular, the baseplate is screwed to the mounting surface via corresponding fastening holes.

Preferably, the second mounting element is formed as a plate. In particular, said plate includes at least one receiving recess. In particular, the receiving recess is continuous from the front side as far as to the backside. The first mounting element is disposed in the receiving recess. In particular, the second mounting element is frame-shaped and thus completely surrounds the at least one receiving recess.

Also several receiving recesses can be provided in the second mounting element, respectively for disposing a first mounting element.

With this embodiment, the at least one first mounting element is incorporated into the plate-shaped second mounting element and provides for a space-optimized structural construction.

Preferably, the backplate has a maximum thickness of 6 mm, in particular of a maximum of 4 mm. Said relatively thin embodiment results in an appearance just like a normal mounting plate. In particular, the thickness is measured from the backside to the front side, namely parallel to the mounting axis. Potential positioning extensions or other

elements, on which the door actuator is fitted, remain disregarded.

In this preferred embodiment, it is provided for the connecting assembly to comprise at least one bar element.

5 Said bar element is disposed mobile at the first mounting element and can be moved from the retaining position thereof to a release position. In particular, the first mounting element is the component to be screwed to the mounting surface (door, wall or casing).

10 In the default condition, namely when the shape memory assembly is not thermally activated, the bar element is in the retaining position thereof and, in this case, retains the second mounting element. In the release position, the bar element releases the second mounting element, such that
15 the two mounting elements can detach from each other. Thereby, the door actuator also detaches from the mounting surface.

The movement of the bar element to the release position thereof is realized by the shape memory assembly, which,
20 upon thermal activation, exerts a corresponding force on the bar element of the connecting assembly.

The connection between the shape memory assembly, in particular the shape memory element, and the at least one bar can be direct or indirect. Also, the positive connection
25 between the bar element and the second mounting element can be direct or indirect. For example, a variant is presented,

in which a swivel bar is disposed between the bar element and the second mounting element, which swivel bar the bar element initially blocks and which is able to rotate in the release position for thus releasing the form closure to the
5 second mounting element.

Basically, the shape memory assembly is disposed and formed for moving the bar element. The bar element can be disposed linearly mobile or rotationally mobile at the first mounting element, in particular at the baseplate of the first
10 mounting element. In this case, the bar element is either linearly mobile parallel to the longitudinal axis or parallel to the vertical axis and thus vertically to the mounting axis. In the rotationally mobile arrangement, it is in particular provided the corresponding bar axis of rotation is parallel to
15 the mounting axis.

According to said different arrangements of the bar element, the shape memory assembly is disposed and formed, in particular, for pulling, rotating or deforming the bar element. In this case, deforming can go hand in hand with a pulling
20 and/or rotating movement of the bar element.

Preferably, it is provided that the backplate includes at least two counter-directional bar elements. In particular, the two bar elements are counter-directional in that, when moving, they are moved towards each other, in particular parallel to
25 the longitudinal axis, to the release position thereof. In this case preferably, the two ends of the at least one shape memory assembly are connected to the two counter-

directional bar elements so that, upon thermal activation, the shape memory assembly contracts and thereby simultaneously moves the two bar elements towards each other to the release position.

- 5 As an alternative, it is also possible for coupling the two counter-directional bar elements to one respective shape memory assembly. In particular, then one end of the shape memory assembly is connected to the associated bar element and the other end of the shape memory assembly
10 is connected to the first mounting element, in particular the baseplate. Upon thermal activation, the shape memory assemblies contract again and thereby pull the associated bar element to the desired release position.

- In a third variant, at least two synchronous bar elements are
15 provided, wherein the two synchronous bar elements together with a shape memory assembly, in particular a shape memory element, are force-transmitting connected. Thereby, upon thermal activation, the one shape memory assembly is able to simultaneously move both elements. In
20 this case, it is provided in particular the shape memory assembly being fastened with one end to the first mounting element, in particular the baseplate, and the other end of the shape memory assembly is connected to one of the two bar elements. Force transmission to the further bar element can
25 be realized via an element for force transmission, for example a bushing. In this case preferably, the shape memory element extends through the bushing.

Particularly preferred, it is provided that an end piece is disposed at least at one end, preferably at both ends of the respective shape memory element. In particular, said end piece is an element crimped to the shape memory element.

5 With such end pieces, the shape memory assembly is connected to the associated bar element and/or to the baseplate of the first mounting element, for example by hooking to a corresponding receiving fork. As an alternative, the shape memory element can be connected to the
10 corresponding element of the device by clamping or directly by material connection (e.g. laser welding point).

For improving the sliding movement between bar element and first or second mounting element, preferably at least one rolling body is provided. Such rolling body is located
15 between the bar element and the first mounting element and/or between bar element and second mounting element.

Preferably, the rolling body is a cylinder (for example a rod) or a sphere. Such rolling bodies can be inserted in one of the mounting elements or the bar element without
20 complicated attachment.

As explained, the bar element can be supported linearly mobile at the first mounting element. In particular in this case, it is provided for the bar element to include at least one guide. In particular, said guide is an oblong guide hole or a
25 guide groove. From the first mounting element, a guide extension protrudes into the guide for thus guaranteeing the linear mobile guiding of the bar element with regard to the

first mounting element. The guide extension can be an integral component of the baseplate of the first mounting element or for example a screw, which is inserted into the baseplate.

- 5 Furthermore preferably, it is intended that a swivel bar is disposed between the bar element and the second mounting element. In particular, the swivel bar is rotationally mobile supported at the first mounting element. Preferably, the swivel axis is vertical to the mounting axis; in particular
10 parallel to the longitudinal axis or parallel to the vertical axis.

- In particular, the swivel bar comprises two branches, wherein the swivel bar axis of rotation is disposed between the two branches. The one branch of the swivel bar rests positively directly or indirectly at the second mounting
15 element. The other branch rests positively directly or indirectly at the bar element in the retaining position thereof. As long as the bar element is in the retaining position thereof, the swivel bar is prevented from rotating about the swivel bar axis and the positive connection to the second
20 mounting element remains is kept.

- A transverse element, in particular in the shape of a rod-shaped rolling body, can be disposed between the bar element and the swivel bar. When moving the bar element to the release position, said transverse element is pulled out
25 underneath the branch of the swivel bar.

Furthermore, as already explained, it is intended that the bar element is supported rotationally mobile at the first mounting element. In this case, the shape memory assembly can be connected directly or indirectly to the bar element for rotating
5 the bar element about the bar element axis of rotation thereof.

In particular, a transfer rod is provided, which the shape memory assembly pulls upon thermal activation. Preferably, the transfer rod is disposed linearly mobile parallel to the
10 longitudinal axis.

Again, the transfer rod is connected in such a way to the at least one rotatable bar element so that the linear movement of the transfer rod is converted to a rotary movement of the at least one bar element.

15 In the rotatable embodiment, in the retaining position the bar element is positively connected to the second mounting element and formed so as to being preferably released during a rotation of less than 360° , preferably of less than 180° . In particular for this purpose, the bar element has a
20 cam or otherwise eccentric arrangement, which extends vertically to the bar axis of rotation and engages in the positive connection with the second mounting element.

Particularly preferred, at least at one area of the circumference, the rotatable bar element includes a conical
25 surface, which cooperates with a complementary conical surface of the second mounting element so that, upon a

rotation to the release position, the two cooperating conical surfaces push the second mounting element away from the mounting surface so that the door actuator moves away from the mounting surface.

- 5 Furthermore preferably, it is intended that the shape memory assembly is disposed and formed for deforming the at least one bar element. In this case, the bar element is in particular deformed so that the positive connection is loosened between bar element and second mounting
10 element.

In particular, the deformable bar element has a U-shape or V-shape with two converging branches, Preferably, the shape memory assembly pulls on the bar assembly centrally between said two branches so that, for loosening the
15 connection, the two branches move towards each other or away from each other.

In particular in the embodiments with linearly mobile bar element, it is intended that an inclined plane is formed between bar element and first mounting element and, when
20 moving to the release position, the bar element moves over said inclined plane whereby the bar element moves vertically to the mounting surface and thus is able to exert pressure force onto the door actuator. In this case, the bar element can either push away the second mounting element
25 or directly the door actuator. Thereby assisting in detaching the door actuator.

In alternative embodiments without bar element, preferably it is intended that the connecting assembly comprises at least one form closure assembly between the two mounting elements. In particular, said form closure assembly
5 comprises form closure elements directly connected to the first and second mounting elements or integrally formed therewith, which, in the retaining position, positively engage in each other. By moving at least one of the two mounting elements by means of the shape memory assembly, said
10 form closure elements of the form closure assembly can be moved in relation to each other, whereby the loosening the connection between the mounting elements.

According to a first variant, upon thermal activation by the shape memory assembly, the second mounting element is
15 displaceable in relation to the first mounting element to the release position, whereby the form closure elements of the form closure assembly detach from each other.

According to a second variant, it is intended that the form closure assembly is disposed and formed for deforming at
20 least one of the two mounting elements, in particular of the first mounting element. In this case, the corresponding mounting element is deformable so that the form closure assembly loosens between the two mounting elements.

In case deforming the first mounting element is intended, the
25 first mounting element is screwed to the mounting surface preferably via oblong holes, so that the first mounting

element is able to move in relation to the screws via said oblong holes.

Independently of the configuration of the connecting assembly, preferably it is intended that the backplate
5 comprises at least one detaching element. The detaching element is thermally intumescent material, for example a swell pad or a corresponding spring. The detaching element is disposed such that it pushes the door actuator away from the mounting surface. In this case, the detaching element
10 can act directly onto the door actuator or onto the corresponding mounting element.

Furthermore, the backplate can include a thermally activatable blocking element. For example, the blocking element is made from thermally intumescent material or is a
15 glass vial filled with fluid, such as known from sprinkler systems. Furthermore, the blocking element can be made as well from any other material, which melts or deforms at a corresponding temperature.

The blocking element is disposed such that it blocks a
20 movement of the connecting assembly to the release position. Only upon thermal activation, at best before activating the shape memory assembly, the blocking element detaches and thereby releases the movement of the connecting assembly.

25 Furthermore, the invention comprises an assembly, comprising the described backplate and a door actuator. In

this case, in particular the door actuator is fastened to the second mounting element. Preferably, the backplate is fastened to a mounting surface, in particular door, casing or wall.

5 The invention is now described in more detail based on exemplary embodiments. In this case, it shows:

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| | Figure 1 | an inventive assembly with inventive backplate according to all exemplary embodiments, |
| 10 | Figure 2 | the inventive backplate according to a first exemplary embodiment, |
| | Figure 3 | the section A - A identified in Figure 2, |
| | Figures 4 to 6 | different details of the inventive backplate according to the first exemplary embodiment, |
| 15 | Figure 7 | the inventive backplate according to a second exemplary embodiment. |
| | Figure 8 | the section B – B identified in Figure 7, |
| | Figure 9 | a detail of the inventive backplate according to the second exemplary embodiment. |
| 20 | Figures 10 & 11 | a first variant of the inventive backplate according to the second exemplary embodiment, |
| 25 | Figure 12 | a second variant of the inventive backplate according to the second exemplary embodiment, |

- Figure 13 the inventive backplate according to a third exemplary embodiment.
- Figure 14 a detail to Figure 13,
- Figure 15 a variant of the inventive backplate
5 according to the third exemplary embodiment,
- Figure 16 a front side of the inventive backplate according to a fourth exemplary embodiment,
- 10 Figure 17 a backside of the inventive backplate according to the fourth exemplary embodiment,
- Figure 18 details of the inventive backplate according to the fourth exemplary
15 embodiment,
- Figure 19 a variant of the inventive backplate according to the fourth exemplary embodiment,
- Figure 20 a front side of the inventive backplate
20 according to the fifth exemplary embodiment,
- Figure 21 a detail of the inventive backplate according to the fifth exemplary embodiment,
- 25 Figure 22 the section E – E identified in Figure 20,
- Figure 23 a first variant of the inventive backplate according to the fifth exemplary embodiment,

- Figure 24 a second variant of the inventive backplate according to the fifth exemplary embodiment,
- 5 Figure 25 a third variant of the inventive backplate according to the fifth exemplary embodiment,
- Figure 26 the inventive backplate according to a sixth exemplary embodiment in retaining position,
- 10 Figure 27 the inventive backplate according to the sixth exemplary embodiment in release position,
- Figure 28 a detail of the inventive backplate according to the sixth exemplary embodiment,
- 15 Figure 29 the inventive backplate according to a seventh exemplary embodiment,
- Figure 30 the inventive backplate according to an eighth exemplary embodiment,
- 20 Figure 31 a detail of the inventive backplate according to all exemplary embodiments, and
- Figure 32 a detail of the inventive backplate according to all exemplary embodiments.
- 25 In the following, an assembly 100 as well as a backplate 1 are described in detail based on the Figures. Figure 1 shows purely diagrammatically a mounting surface 101 of the

assembly 100 for all exemplary embodiments. A door, casing or wall forms said mounting surface 101, for example. A mounting axis 2 is defined vertically to the mounting surface 101. A longitudinal axis 10 is defined vertically to the mounting axis 2 and horizontally. A vertical axis 11 is defined
5 vertically to the longitudinal axis 10 and vertically to the mounting axis 2. The longitudinal axis 10 and the vertical axis 11 are illustrated in Figure 2, for example.

The door actuator 102 is mounted on the backplate 1. The
10 door actuator 102, herein formed as a door closer, includes an output axis 103. The output axis 103 is vertical to the mounting axis 2 and parallel to the vertical axis 11.

In all exemplary embodiments, the backplate includes a first mounting element 3 and a second mounting element 4. The
15 first mounting element 3 is inserted into a recess 12 of the plate-shaped and frame-shaped second mounting element 4.

In this case in particular, it is intended that, seen from the thickness, namely parallel to the mounting axis 2, the first
20 mounting element 3 does not extend considerably further than the second mounting element 4. Thus, the entire thickness 43 of the backplate 1 is determined by the thickness of the second mounting element 4.

The backplate 1 has a backside 6, which is to face the
25 mounting surface 101. A front side 7, to which the door actuator 102 is placed, is defined on the opposite side. In

particular, on said front side 7, the door actuator 102 is fastened, in particular screwed, to the second mounting element 4. However, the second mounting element 4 can be an integral component of the door actuator 102, and thus
5 form the backside of the door actuator 102.

In the exemplary embodiments, the first mounting element 3 has at least one base plate 6. Essentially, the base plate 8 extends in the plane spanned by the longitudinal axis 10 and vertical axis 11. Fastening holes 9 are provided in the base
10 plate 11 for fastening the base plate 8 to the mounting surface 101. In particular, said fastening holes 9 are countersunk at the front side 7 so that the screw heads can be inserted flush.

All the exemplary embodiments have one or more shape
15 memory assemblies 20. The respective shape memory assembly comprises at least one shape memory element 21, which herein is respectively formed as shape memory wire from a corresponding shape memory metal alloy.

The shape memory element 21 can have end pieces 22 at
20 one end or both ends. In particular, said end pieces 22 are thicker area, for example elements crimped onto the wire.

The backplate 1 comprises one respective connecting assembly 5 for positively connecting the two mounting elements 3, 4. The shape memory assemblies 20 allow for
25 moving the connecting assembly 5 from the retaining position to the release position.

In the following are explained details of the different exemplary embodiments. Same, respectively functionally same or similar structural components are always identified with the same reference signs. Unless otherwise stated,
5 reference is always made to all the Figures of the respective exemplary embodiment.

Figures 2 to 6 show the first exemplary embodiment: Herein the connecting assembly 5 comprises two bar elements 13. From the illustrated retaining position to the release position
10 thereof, the two bar elements 13 are movable counter-directional towards each other. Parallel to the longitudinal axis 10 guides 14 are provided for the linear mobility of the two bar elements 13. Herein, the guides 14 are formed by oblong holes, open to one side, in the bar elements 13.

15 One respective guide extension 15, herein formed by a screw and projecting from the base plate 8, protrudes into said guides 14. Simultaneously, with the heads thereof, said guide extensions 15 serve for fastening the bar elements 13 on the base plate 8.

20 As in particular shown in section A-A in Figure 3, the second mounting element 4 has a shoulder 17 in the receiving recess 12. The associated bar element 13 engages in a positive connection with said shoulder 17 so that, in the retaining position shown, the second mounting element 4
25 cannot detach from the first mounting element 3. By pulling on both bar elements 13, in the exemplary embodiment 1 shown by the two bar elements 13 moving towards each

other, the connecting assembly 5 loosens, and the second mounting element 4 can be moved away from the mounting surface 101.

Rolling bodies 16, herein in the shape of rods, are inserted
5 for improving the sliding movement of the respective bar element 13. The one rolling body 16 is inserted at the shoulder 17 into a groove of the second mounting element 4. Another rolling body 16 is inserted into the bar element 13 and is in rolling contact with the front side 7 of the base plate
10 8.

In the first exemplary embodiment are provided two shape memory assemblies 20. Each shape memory assembly 20 has a shape memory element 21. Respective end pieces 22 are disposed at both ends of the respective shape memory
15 element 21.

Two parallel receiving grooves 23 are provided in the base plate 8. The shape memory elements 21 extend through said receiving grooves 23. On both sides, the receiving grooves 23 lead into the base plate recesses 25. The end
20 pieces 22 find space in said base plate recesses 25.

As revealed in the combined view of the Figures 4, 5 and 6, with one end piece 22, the respective shape memory element 21 rests in the base plate recess 25 at the base plate 8 and, with the opposite end piece 22, at the
25 associated bar element 13. Upon thermal activation, the

length of the shape memory element 21 shortens, whereby the bar element 13 is pulled.

As a connection between shape memory element 21 or end piece 22 and bar element 13, the respective bar element 13
5 has a receiving fork 24, into which the shape memory element 21 is to be inserted, and at which rests the end piece 22.

For a more space saving design, the base plate recess 25 is formed so that the receiving fork 24 of the bar element 13
10 can protrude into the base plate recess 25 and can move in the base plate recess 25; as illustrated in Figure 5.

Figures 7 to 12 show the second exemplary embodiment in different variants.

Just like the first exemplary embodiment, the second
15 exemplary embodiment shows counter-directional bar elements 13, which, with the shape memory assemblies 20, can be moved towards each other for thus loosening the form closure to the second mounting element 4.

Figures 7, 8 and 9 show a construction of the first mounting
20 element 3, in particular of the base plate 8 and the two bar elements 13 made from bent sheet-metal. Herein again, like in the first exemplary embodiment, the bar elements 13 are guided linearly mobile at the base plate 8 via corresponding guide extensions 15 and guides 14.

A bridge 30, which is screwed to the second mounting element 4, is located at the shoulder 17 in the receiving recess 12. Between said bridge 30 and the shoulder 17, the associated bar element 13 extends to the retaining position.

5 Figure 10 and the associated detail in Figure 11 show a variant of the second exemplary embodiment. Herein are provided two counter-directional bar elements 13. In this case, the bar elements are charged with play compensating springs 31 in the retaining position thereof, so that a play-free connection is given between the two mounting elements
10 3, 4. Such a play compensating spring 31 can be employed in all shown exemplary embodiments, in particular in the exemplary embodiments with at least one bar element 13. Furthermore herein, a cone, which guarantees a play-free
15 position of the bar element 13 in the second mounting element 4, can be provided between the bar element 13 and the associated surface at the second mounting element 4.

Figure 12 shows a further variant to the second exemplary embodiment. Herein, four bar elements 13 are provided,
20 which respectively are formed by the end pieces 22 thereof of the shape memory element 21.

Herein, in detail are provided four shape memory assemblies 20. The four shape memory elements 21, with the centrally located end pieces 22 thereof, are connected to the base
25 plate 8 in the centre of the backplate 1. On the outsides, in corresponding receiving grooves 23 or channels, the end pieces 22 in the retaining position protrude simultaneously

into the first mounting element 3 and the second mounting element 4. Thereby, realizing a positive connection between the two mounting elements 3, 4. Upon thermal activation, the four shape memory elements 21 contract, whereby the end
5 pieces 22, which are located on the outside, are pulled out of the second mounting element 4.

Figures 13 to 15 show the third exemplary embodiment in different variants: In the third exemplary embodiment, the bar elements 13 are both linearly mobile and deformable.
10 Said deforming of the respective bar elements 13 makes the bar elements 13 detach from the second mounting element 4 and thus loosen the connecting assembly 5.

Furthermore, the third exemplary embodiment reveals how only one shape memory assembly 20 and thus only one
15 shape memory element 21 can rectify and simultaneously move several bar elements 13.

Figure 13 shows two U-shaped configured bar elements 13; in particular as flat sheet-metal parts. The respective bar element 13 has two branches, which, with the ends thereof,
20 positively engage into the second mounting element 4. In the illustration shown according to Figure 13, upon thermal activation, the shape memory assembly 20 can pull the bar elements 13 to the right, whereby the branches move inwards. Thereby causing the bar elements 13 to deform.
25 For promoting said inward movement of the branches, herein, the guides 14 and the associated guide extensions 15 are correspondingly disposed. The diagrammatic

illustration in Figure 14 clarifies the movement to the release position and thus the deformation of the bar element 13.

Independently of the given exemplary embodiment, Figures 13 and 14 explain that a shape memory element 21 can
5 move both bar elements 13. In the illustration of Figure 13, with the right end piece 22, the shape memory element 21 is fastened to the base plate 8. The shape memory element 21 extends parallel to the longitudinal axis 10 through the right bar element 13 or past the right bar element 13 as far
10 as to the left bar element 13. With the left end piece 22, the shape memory element 21 is connected to the left bar element 13 and thus can pull the left bar element 13. A bushing 32 is provided for transferring force onto the right bar element 13. The wire-shaped shape memory element 21
15 passes through said bushing 32. The bushing 32 rests at the two bar elements 13 and thus, can transmit the force from the left bar element 13 to the right bar element 13.

Figure 15 explains a variant, in which the two bar elements 13 are not formed U-shaped with two branches, but the bar
20 element 13 as a bendable part, for example sheet metal part, extends parallel to the vertical axis 11 and thereby, at the top and at the bottom, protrudes into the second mounting element 4. Herein again, pulling only one shape memory element 21 can achieve bending both bar elements
25 13, whereby the connecting assembly 5 is able to loosen.

Figures 16 to 19 show the fourth exemplary embodiment in different variants: Figure 16 shows the front side 7 of the

backplate 1. Figure 17 shows the backside 6 of the backplate 1. In a diagrammatic illustration with the sections C-C and D-D, Figure 18 shows the movement of the connecting assembly 5 from the retaining position to the release position.

In the fourth exemplary embodiment are provided two counter-directional bar elements 13 movable towards each other. However herein, the bar elements 13 do not directly positively engage in the second mounting element 4, but, via a transverse element 35, block a swivel movement of a swivel bar 33. In turn the swivel bar 33 positively engages on the shoulder 17 in the receiving recess 12 of the second mounting element 4.

As explained in Figures 16 to 18, two swivel bars 33 are disposed on both sides at the base plate 8. The swivel bars 33 are rotatable about one respective swivel bar axis 34. Herein the swivel bar axis 34 is parallel to the vertical axis 11.

As Figure 17 reveals, the two bar elements 13 are movable towards each other by two shape memory elements 21. With the end pieces 22, which are located in the centre, the shape memory elements 21 are fastened to the base plate 8. Obviously herein, the two shape memory elements 21 can travel parallel past each other, as it is the case in the first exemplary embodiment. Furthermore herein, only one shape memory element 21 can move the two mounting elements 13 towards each other.

As clarified in Figure 18, the bar element 13 can pull the transverse element 35 inwards, which herein is formed as a rolling rod. Thereby, the swivel bar 33 can rotate about the swivel bar axis of rotation 34, whereby the form closure to
5 the second mounting element 4 loosens.

As revealed in the third illustration in Figure 18, the bar element 13 travels over an inclined plane 36. Said inclined plane 36 effects that during the movement thereof to the release position, the bar element 13 is moved parallel to the
10 mounting axis 2 and in this case in the direction of the door actuator 102. Thus, the inclined plane 36 and the correspondingly moving bar element 13 exert a force onto the door actuator 102 for pushing the same away from the mounting surface 101.

15 The movement of the bar element 13 parallel to the mounting axis 2 via the inclined plane 36 is clarified by way of example in this fourth exemplary embodiment, however, can be applied as well to the other exemplary embodiments with mobile bar element.

20 Figure 19 clarifies a variant of the fourth exemplary embodiment, in which four bar elements 13 are used, which are mobile parallel to the vertical axis 11. Furthermore, four swivel bars 33 are used, the swivel bar axis of rotation 34 being parallel to the longitudinal axis 10. Via a common
25 shape memory assembly 20, the four bar elements 13 are moved to the release position and thereby again pull the

transverse elements 35 from underneath the branches of the swivel bars 33.

Figures 20 to 25 show various variants of the fifth exemplary embodiment. In the fifth exemplary embodiment, the bar elements 13 are not linearly mobile, but rotationally mobile.
5 The associated bar axes of rotation 38 are parallel to the mounting axis 2.

Figure 20 shows the front side 7 of the backplate 1. In Figure 21, for the sake of clarity, the base plate 8 is masked. Figure
10 22 shows the section E-E identified in Figure 20.

As in particular Figure 21 clarifies, herein, a transmission rod 37 is provided, which extends parallel to the longitudinal axis 10 and, with the shape memory assembly 20, is movable parallel to the longitudinal axis 10. In particular, the shape
15 memory element 21 protrudes through the transmission rod 37 and, at one end, is connected with a corresponding end piece 22 to the transmission rod 37. In particular, the other end piece 22 is connected to the base plate 8.

The transmission rod 37 and the rotatable bar elements 13
20 are connected to each other such as to convert the linear movement of the transmission rod 37 to a rotary movement of the bar elements 13.

The section in Figure 22 clarifies that the corresponding bar element 13, herein at the top side, has a conical cam 39,
25 which, in the retaining position, is positively connected to the second mounting element 4. By rotating the bar element 13

by a few degrees, said positive connection to the second mounting element 4 loosens.

The conical cam 39 and the conical surface, which is complementary thereto, at the second mounting element 4, allow for a play-free connection of the two mounting elements 3, 4.

Figure 23 shows a variant of the fifth exemplary embodiment, in which the two bar elements 13 are provided, and each bar element 13 positively engages in the second mounting element 4 both at the top side and at the underside thereof. Again herein, the two bar elements 13 are rotated with the transmission rod 37, which is linearly moved by means of at least one shape memory assembly 20.

Figure 24 shows a further variant of the fifth exemplary embodiment, in which, just as in Figure 23, interlocking is realized via four points. Herein, a rotatable bar forms the respective bar element 13 and, in the retaining position, extends along the vertical axis 11. In this case, the bar element 13 is positively connected at the top and bottom to the second mounting element 4.

For loosening the connection, two shape memory assemblies 20 are provided for rotating the two bar elements 13.

By way of example for all exemplary embodiments, Figure 24 clarifies that at least one blocking element 40 can be employed in the backplate 1. In the herein shown example,

the blocking element 40 is a glass vial filled with fluid, which is destroyed upon corresponding thermal activation. The blocking element 40 allows for retaining the connecting assembly 5, in particular the bar element 13, in the retaining position. It is only upon thermal activation of the blocking element 40 that the blocking thereof loosens, and the connecting assembly 5 can be moved to the release position.

Figure 25 shows a further variant of the fifth exemplary embodiment. It is shown herein, that the transmission rod 37 can have a toothed rack. Correspondingly, the rotatable bar elements 13 are formed as toothed wheels, which mesh with the toothed rod. This way as well allows for converting the linear mobile transmission rod 37 to a rotatable movement of the bar elements 13.

Figures 26 to 28 show a sixth exemplary embodiment of the backplate 1: This sixth exemplary embodiment does not provide for standalone bar elements 13. Rather, the connecting assembly 5 is formed directly by corresponding shaping of the two mounting elements 3, 4 as a form closure assembly 41. As clarified in Figures 26 and 27, the form closure assembly 41 comprises a plurality of toothed form closure elements between the base plate 8 and the inner border of the second mounting element 4, which elements engage in each other for forming the form closure assembly 41.

Figure 27 shows the release position, in which, compared to Figure 26, the second mounting element 4 was moved to the left. Two shape memory assemblies 20 perform this movement. With the right end pieces 22 thereof, the two
5 shape memory assemblies 20 are fastened to the second mounting element 4. The left end pieces 22 are connected to the right mounting element 3. Thereby, when the shape memory elements 21 contract, the second mounting element 4 can be moved; the first mounting element 3 is
10 firmly screwed to the mounting surface 101.

The form closure assembly 41 is formed such that it loosens upon relative movement between the two mounting elements 3, 4.

Figures 26 and 27 also show diagrammatically how one
15 blocking element 40, for example formed as a fluid-filled glass vial, is able to block the movement or the loosening of the connecting assembly 5.

Figure 28 clarifies that an inclined plane 36 can be used even without bar element 13 for generating a movement,
20 herein of the second mounting element 4, parallel to the mounting axis 2, simultaneously with the loosening of the connecting assembly 5, for promoting detaching of the door actuator 102 from the mounting surface 101.

Figure 29 shows a seventh exemplary embodiment of the
25 backplate 1. In this seventh exemplary embodiment, the first mounting element 3 is formed bent and the shape memory

assembly 20 is disposed so as to deform the first mounting element 3. As Figure 29 clarifies, the shape memory element 21, with both end pieces 22, is connected to the first mounting element 3. In case the length of the shape memory element 21 shortens based on thermal activation, the first mounting element 3 contracts and thereby deforms. Herein, the fastening holes 9 are configured as oblong holes for allowing for the deformation. The form closure assembly 41 is formed between the two mounting elements 3, 4 so that the deformation of the first mounting element 3 loosens the form closure assembly 41.

Figure 30 shows an eighth exemplary embodiment of the backplate 1, wherein herein only a detail is shown. Again the two mounting elements 3, 4 are connected to each other via the form closure assembly 41. For promoting loosening of said form closure assembly 41, a rolling body 16 is inserted at the form closure assembly 41 between the two mounting elements 3, 4.

In the eighth exemplary embodiment, additionally or as an alternative, the deformation of the first mounting element 3 is achieved by means of the shape memory assembly 20 with a swell pad 42. Said swell pad 42 is positioned between first mounting element 3 and mounting surface 101 and is made from thermally intumescent material, which expands at corresponding temperature and thus deforms the first mounting element 3.

Figures 31 and 32 show details, which can be realized in all exemplary embodiments. According to these two Figures, a detaching element 43 is used, which charges the door actuator 102 and/or the second mounting element 4 so as to
5 move the door actuator 102 away from the mounting surface 101.

According to the Figures 31, 32, the detaching element 43 is formed as a spring. Figure 31 shows a plate-shaped spring, which is inserted between mounting surface 101 and
10 backplate 1 and thereby acts on the second mounting element 4.

Figure 32 shows that the detaching element 43, as an integral spring, is bent out of the base plate 8. Said spring, incorporated into the base plate 8, directly acts onto the door
15 actuator 102.

Additionally or as an alternative to the shown elastic detaching elements 43, also thermally intumescent material can be employed, which, upon thermal activation, expands and thereby pushes away the second mounting element 4
20 and/or the door actuator 102.

List of references signs

	1	backplate
	2	mounting axis
	3	first mounting element
5	4	second mounting element
	5	connecting assembly
	6	backside
	7	front side
	8	base plate
10	9	fastening holes
	10	longitudinal axis
	11	vertical axis
	12	receiving recess
	13	bar element
15	14	guide
	15	guide extension
	16	rolling member
	17	shoulder
	20	shape memory assembly
20	21	shape memory element
	22	end piece
	23	receiving groove
	24	receiving fork
	25	base plate recess
25	30	bridge
	31	play compensating spring
	32	bushing

	33	swivel bar
	34	swivel bar axis of rotation
	35	transverse element
	36	inclined plane
5	37	transmission rod
	38	bar axis of rotation
	39	conical cam
	40	blocking element
	41	form closure assembly
10	42	swell pad
	43	detaching element
	44	thickness
	100	assembly
	101	mounting surface
15	102	door actuator
	103	output axis

Patent claims

1. A backplate (1) for a door actuator (102), comprising
 - at least one first mounting element (3) and a second mounting element (4), wherein one of the two mounting elements (3) is formed for fastening to a mounting surface (101), in particular door, casing or wall, and the other mounting element (4) is formed for accommodating the door actuator (102),
 - at least one connecting assembly (5), which, in a retaining position, keeps the two mounting elements (3, 4) together, and, in a release position, does not keep the two mounting elements (3, 4) together,
 - and at least one shape memory assembly (20) with at least one shape memory element (21) made from shape memory material, wherein, upon thermal activation, the shape memory assembly (20) moves the connecting assembly (5) to the release position.
2. The backplate according to claim 1, wherein the shape memory element (21) is a wire or a rod or a spring, wherein, upon thermal activation, the shape memory element changes the length thereof, in particular shortens.
3. The backplate according to claim 1 or 2, wherein the shape memory element (21), at least partially, extends

- 5 4. The backplate according to any of the preceding
claims,
- wherein the connecting assembly (5) comprises at least one bar element (13), which is mobile disposed at the first mounting element (3) and is
10 movable from the retaining position thereof to the release position,
 - and wherein, upon thermal activation, the shape memory assembly (20) moves the bar element (13) to the release position.
- 15 5. The backplate according to claim 4, wherein at least two counter-directional bar elements (13) are disposed, wherein the two ends of the at least one shape memory assembly are connected to the counter-directional bar elements (13) so that, upon
20 thermal activation, the at least one shape memory assembly (20) simultaneously moves the two bar elements (13).
6. The backplate according to claim 4, wherein at least two bar elements (13) are disposed, wherein at least
25 one proper shape memory assembly (20) is provided per bar element (13), wherein one end of the shape

memory assembly (20) is connected to the respective bar element (13) and the other end of the shape memory assembly (20) to the first mounting element (3).

- 5 7. The backplate according to claim 4, wherein at least two counter-directional bar elements (13) are disposed and at least one shape memory assembly (20) is disposed for transferring force onto both bar elements (13) so that, upon thermal activation, the at least one
10 shape memory assembly (20) simultaneously moves the two bar elements (13).
8. The backplate according to any of the claims 4 to 7, wherein at least one rolling body (16) is disposed, preferably just inserted, between bar element (13) and
15 first mounting element (3) and/or between bar element (13) and second mounting element (4).
9. The backplate according to any of the claims 4 to 8, wherein the bar element (13) is supported linearly mobile at the first mounting element (3).
- 20 10. The backplate according to claim 9, wherein the bar element (13) has at least one guide (14), in particular oblong guide hole or guide groove, wherein a guide extension (15), in particular a screw, which is integrally shaped at the first mounting element (3), protrudes
25 into the guide (14).

11. The backplate according to claim 9 or 10, wherein a swivel bar (33) is disposed between bar element (13) and second mounting element (4).
12. The backplate according to any of the claims 4 to 8,
5 wherein the bar element (13) is supported rotationally mobile at the first mounting element (2).
13. The backplate according to any of the claims 4 to 8,
10 wherein the at least one shape memory assembly (20) is disposed for deforming the at least one bar element (13).
14. The backplate according to any of the claims 4 to 13,
15 wherein, when moving to the release position, the bar element (13) is movable over an inclined plane (36), so that the bar element (13) moves away for pushing away the door actuator (102) from the mounting surface (101).
15. The backplate according to any of the claims 1 to 3,
20 wherein the connecting assembly (5) comprises at least one form closure assembly (41) between the two mounting elements (3, 4), wherein, upon thermal activation for releasing the form closure assembly (41), the shape memory assembly (20):
- displaces the second mounting element (4) in relation to the first mounting element (3) to the
25 release position,

- or deforms one of the two mounting elements (3, 4) to the release position.
16. The backplate according to any of the preceding claims, comprising a detaching element (43), in particular with thermally intumescent material and/or a spring, which is disposed for pushing away the door actuator (102) from the mounting surface (101).
17. The backplate according to any of the preceding claims, wherein the first mounting element (3) comprises a base plate (8) .
18. The backplate according to any of the preceding claims, wherein the second mounting element (4) is formed as a plate; preferably with a receiving recess (12) for disposing the first mounting element (3) in the second mounting element (4).
19. The backplate according to any of the preceding claims, wherein the backplate (1) has a thickness (44) of maximum 6 mm, preferably of maximum 4 mm.
20. An assembly (100) comprising a backplate (1) according to any of the preceding claims and a door actuator (102), which is fastened to the backplate (1).