United States Patent	12385309
Kind Code	B2
Date of Patent	August 12, 2025
Inventor(s)	Salutzki; Thomas et al.

Linkage for a door actuator

Abstract

A linkage for force transmission between a driven axle of a door actuator and an assembly surface, includes a hinge, a fastening arrangement designed for fastening the hinge to the assembly surface, in particular a door, frame or wall, wherein an assembly axis is defined perpendicularly to the assembly surface, and a lever arrangement which is fastened to the hinge so as to be rotatable about a hinge axis perpendicular to the assembly axis and which is designed for rotationally-fixed connection to the driven axle of the door actuator. The linkage is designed to detach through the weight of the door actuator falling down in the event of a fire and/or wherein the linkage includes a thermally activatable trigger element that is designed to detach the linkage in the event of thermal activation triggered by a fire.

Inventors:	**Salutzki; Thomas (Ennepetal, DE), Wiemann; Sabine (Ennepetal, DE), Hellwig; Alexander (Ennepetal, DE)**
Applicant:	**dormakaba Deutschland GmbH** (Ennepetal, DE)

Family ID:	**1000008751573**
Assignee:	**DORMAKABA DEUTSCHLAND GMBH (Ennepetal, DE)**
Appl. No.:	**18/024427**
Filed (or PCT Filed):	**September 07, 2020**
PCT No.:	**PCT/EP2020/074972**
PCT Pub. No.:	**WO2022/048784**
PCT Pub. Date:	March 10, 2022

Prior Publication Data

Document Identifier	Publication Date
US 20240003174 A1	Jan. 04, 2024

Publication Classification

Int. Cl.: **E05F3/22** (20060101); **E05F15/00** (20150101)

U.S. Cl.:

CPC **E05F3/227** (20130101); **E05F15/00** (20130101); E05Y2201/214 (20130101); E05Y2201/626 (20130101); E05Y2600/63 (20130101); E05Y2900/132 (20130101)

Field of Classification Search

CPC: E05F (3/227); E05F (1/006); E05F (15/00); E05Y (2201/214); Y10S (16/43)

References Cited

U.S. PATENT DOCUMENTS

Patent No.	Issued Date	Patentee Name	U.S. Cl.	CPC
2035824	12/1935	Moore	N/A	N/A
4267619	12/1980	Suska	N/A	N/A
2014/0260929	12/2013	Leites et al.	N/A	N/A

FOREIGN PATENT DOCUMENTS

Patent No.	Application Date	Country	CPC
1508375	12/2003	CN	N/A
207144679	12/2017	CN	N/A
3638208	12/1987	DE	N/A
29880074	12/1999	DE	N/A
102012103709	12/2012	DE	B21K 1/76
102017006918	12/2018	DE	N/A
0802296	12/1996	EP	N/A
3425150	12/2018	EP	N/A
2320068	12/2008	ES	N/A
2378163	12/1977	FR	N/A
2378163	12/1977	FR	N/A
2013159859	12/2012	WO	N/A
2017020453	12/2016	WO	N/A

OTHER PUBLICATIONS

English translation of FR2378163A from WIPO (Year: 1978). cited by examiner
DE_102012103709 English translation from WIPO (Year: 2013). cited by examiner
International Search Report for International Application No. PCT/EP2020/074972, mailed Aug. 26, 2021, 9 pages. cited by applicant
United Kingdom Office Action for Application No. 2302549.7, dated Jan. 2, 2025, 5 pages. cited by applicant
United Kingdom Office Action for Application No. 2414145.9, dated Feb. 6, 2025, 7 pages. cited by applicant

Primary Examiner: Troy; Daniel J

Assistant Examiner: Heschel; Susan M.

Attorney, Agent or Firm: CANTOR COLBURN LLP

Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS

(1) This application is a 35 U.S.C. § 371 National Stage patent application of PCT/EP2020/074972 filed 7 Sep. 2020, the disclosure of which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

(2) The disclosure relates to a linkage for force transmission between a driven axle of a door actuator and an associated assembly surface. Furthermore, the disclosure shows an arrangement of the linkage with a door actuator.

BACKGROUND

(3) Door actuators are used to close and/or open doors. In particular, door closers and door drives are designated as door actuators. In the case of the door closer, a spring storage mechanism is generally loaded by the manual opening movement. The energy stored in this case is used to close the door. In the case of the door drive, the door can be opened and/or closed automatically for example by means of electromechanics or hydraulics. Door actuators are usually fastened on the door leaf or the frame or wall.

(4) Door actuators are commonly used in conjunction with a linkage. The linkage serves to transmit a force from the driven axle of the door actuator to the assembly surface of the linkage. The linkage is usually fastened to the door leaf or the frame or wall. If the door actuator is fastened to the door leaf, for example, the linkage is fastened to the frame or wall and vice versa.

(5) In particular in the case of fire protection doors, it must be noted that flammable fluids, in particular hydraulic oils, are often used in the door actuators. Suitable measures are used to as far as possible prevent the fluid in the door actuator from heating excessively and possibly igniting during a fire. For this purpose, it is provided, for example, that a door actuator is fastened to its assembly surface with fusible screws. If these fusible screws heat up in the event of a fire, the door actuator can fall off its assembly surface.

SUMMARY

(6) The present disclosure indicates a linkage for a door actuator, which enables a door to be used in an operationally-safe manner and at the same time meets all security-related requirements, in particular for the event of a fire.

(7) It has been recognized that it is not sufficient in all applications if only the door actuator detaches from its assembly surface in the event of a fire and it falls down. In general, the door actuator then continues to hang on its linkage and may therefore be too close to the door that is heating up.

(8) The linkage presented below provides a remedy here, as it allows the door actuator to fall down completely in the event of a fire.

(9) The linkage is provided for force transmission between a driven axle of the door actuator and the assembly surface of the linkage. The driven axle of the door actuator is in particular a rotatable shaft provided on or in the door actuator. The assembly surface is in particular a door leaf or a frame or wall. Perpendicular to this assembly surface, an assembly axis is defined. The assembly axis is usually horizontal and perpendicular to the frame or wall or perpendicular to the door leaf.

(10) The linkage comprises a hinge and a fastening arrangement. The fastening arrangement is designed to fasten the hinge to the assembly surface. In a simple configuration, the fastening arrangement comprises one or a plurality of screws that run parallel to the assembly axis in order to

screw the hinge to the assembly surface.
(11) The hinge preferably comprises at least one hinge base plate which is aligned substantially perpendicular to the assembly axis and bears against the assembly surface directly or with corresponding intermediate elements. At least one hinge leg preferably extends from this hinge base plate. Two parallel hinge legs spaced apart from one another are particularly preferably provided. The at least one hinge leg preferably holds a hinge pin. The hinge pin preferably extends vertically and defines a hinge axis.
(12) Furthermore, a lever arrangement is provided in the linkage. The lever arrangement is fastened to the hinge, in particular to the hinge pin, so as to be rotatable about the hinge axis perpendicular to the assembly axis. Furthermore, the lever arrangement is designed for rotationally-fixed connection to the driven axle of the door actuator.
(13) The lever arrangement is preferably a scissor linkage. This scissor linkage comprises a first lever which is connected directly or indirectly to the hinge and a second lever which, in particular via a lever eye, is connected in a rotationally fixed manner to the driven axle of the door actuator. The two levers are connected to one another via a joint, in particular via a ball joint.
(14) Particularly preferably, the first lever comprises two elements whose length can be adjusted one into the other, for example designated as a tensioning screw and a tensioning nut. The tensioning screw comprises in particular a threaded rod. The tensioning nut is preferably an elongated lever-like element with an internal thread on one side for screwing in the tensioning nut.
(15) Furthermore, it is preferably provided that the lever arrangement comprises a connecting element. The connecting element is preferably connected to the first lever, in particular the tensioning screw, via a swivel joint. The swivel joint preferably has a swivel joint pin defining a swivel joint axis. The swivel joint pin can also be formed by two coaxial pin elements. The swivel joint axis is preferably horizontal and/or perpendicular to the hinge axis. The connecting element is preferably rotatably connected to the hinge. In particular, the hinge pin runs through the connecting element.
(16) It is preferably provided that the linkage is designed to detach through the weight of the door actuator falling down in the event of a fire. As described, the linkage is used in conjunction with a door actuator. The door actuator is preferably fastened to its assembly surface in such manner that it falls off in the event of a fire. This is possible, for example, by the door actuator being fastened with fusible screws; but other variants are also possible, in which, for example, the door actuator is pushed away from its assembly surface by thermally intumescent material, in order to detach the door actuator at the corresponding temperature. The linkage is preferably designed such that the weight of the door actuator is sufficient to detach the linkage. Detaching the linkage is understood as the linkage detaching at some point, for example at a swivel joint, at the hinge or at the fastening arrangement such that the door actuator can fall down completely. The weight of conventional door closers is in the range of 1 kg to 5 kg and is sufficient, taking into account the corresponding lever force, to detach the linkage as desired. Door drives usually weigh considerably more, around 10 kg to 30 kg.
(17) Additionally or alternatively to detaching the linkage through the weight of the door actuator falling down in the event of a fire, it is preferably provided that the linkage comprises at least one thermally activatable trigger element. This thermally activatable trigger element is designed to detach the linkage in the event of thermal activation triggered by a fire. In this variant, not only is the door actuator detached from its assembly surface via a thermally activatable element, for example the fusible screws, but at the same time the region of the linkage, in particular in the region of the fastening arrangement or the hinge, is heated and thus the trigger element is thermally activated. Variants and configurations for the trigger element will be described in detail later.
(18) It is also provided to combine the two variants in a linkage such that the linkage is simultaneously designed to detach through the weight of the falling door actuator and also comprises a thermally activatable trigger element for detaching the linkage.

(19) It is preferably provided that a securing element is provided on the swivel joint or the hinge. The securing element is designed and arranged such that it holds the swivel joint or hinge together. The securing element is designed in particular as a securing sleeve, securing tab, securing splint or securing screw. As a result of the first lever being lowered, the securing element can be moved into a position which no longer holds the swivel joint or hinge together. This movement, i.e. the lowering of the first lever, takes place when the door actuator detaches from its assembly surface and pulls the lever arrangement downwards through its weight. This movement with the first lever being lowered is used to move the securing element into its position which does not hold the swivel joint or hinge together.
(20) The securing element as a securing sleeve is placed in particular on the swivel joint and encloses the swivel joint, wherein the swivel joint detaches by removing the securing sleeve.
(21) The securing element as a securing tab is placed in particular on or at the hinge pin or swivel joint pin. In particular, the securing tab has a U-shaped receptacle which is placed onto a groove of the corresponding pin. The securing tab thus acts on the outside of the pin and prevents it from detaching from the hinge or swivel joint.
(22) A similar function is fulfilled by the securing splint, which does not act on the outside of the pin, but is inserted through a hole in the pin.
(23) When the securing element is configured as a securing screw, an element of the hinge or swivel joint, in particular the pin, is held in its position by means of the securing screw, wherein it is provided in particular that the securing screw is destroyed in order to detach the hinge or swivel joint. The securing screw itself can be destroyed or torn out of its thread.
(24) As already described, it is preferably provided that the lever is connected to the connecting element via the swivel joint axis. The essential part of the first lever extends from this axis of rotation to the ball joint and thus to the connection with the second lever. However, it is preferably provided that a small part of the first lever protrudes beyond the swivel joint axis in the direction of the hinge. This protruding portion is referred to as the actuating section. When the lever arrangement is lowered, in particular when the second lever of the ball joint and the first lever are lowered, the first lever rotates about the swivel joint axis. As a result, the actuating section rises. The actuating section and the securing element are preferably arranged and designed such that the securing element is moved into the position which does not hold the hinge or swivel joint together by the actuating section moving upwards.
(25) As mentioned, it is preferably provided that the securing element is designed as a securing sleeve which sits on the swivel joint. It is preferably provided that the swivel joint comprises a U-shaped, downwardly open first pin receptacle. This first pin receptacle is formed on the connecting element and/or on the first lever. The swivel joint pin inserts in this first pin receptacle during normal use of the linkage. The securing sleeve has a second pin receptacle. The second pin receptacle of the securing sleeve is also U-shaped and open at the side such that the securing sleeve placed onto the swivel joint and thus also the swivel joint pin holds the swivel joint pin in its desired position, namely in the first pin receptacle. As soon as the securing sleeve is removed, in particular pushed off, from the swivel joint, in particular by the actuating section of the first lever being raised, the swivel joint detaches since the swivel joint pin can be moved downwards out of the first pin receptacle.
(26) Preferably, a fixing element is provided on the securing sleeve to prevent accidental removal of the securing sleeve during normal use of the linkage. The fixing element is, for example, a plastic screw with which the securing tab is screwed to the connecting element or to the first lever. This plastic screw tears off when the securing tab is removed through the actuating section. It is also possible for at least one projection to extend horizontally from the first lever as a fixing element. This fixing element, designed as a projection, prevents a movement of the securing tab as long as the first lever is in its normal horizontal position. When the first lever is lowered, the fixing element then also moves downwards and frees the movement path for the securing tab.

(27) In an alternative configuration, it is provided that a securing element on the hinge, in particular a hinge pin, is detached by the first lever being lowered and the actuating section thereby moving upwards.
(28) As mentioned at the outset, the hinge has one or two hinge legs which extend from the hinge base plate and in which the hinge pin is received. In order to allow easy detachment of the hinge, for example detachment of the connecting element from the hinge pin or the hinge pin falling out, it is preferably provided that only one hinge leg is used instead of the two hinge legs spaced apart from one another. This one hinge leg is located either on the upper side, i.e. above the connecting element, or on the underside, i.e. below the connecting element.
(29) The securing element, in particular as a securing tab or securing splint, is preferably arranged and designed such that it can be pulled off the hinge pin by the actuating section. In particular, this means that the hinge pin, which is only secured by the securing element, falls out of the hinge downwards, as a result of which the connecting element and thus the entire lever arrangement detaches from the hinge. Alternatively, the connecting element can also detach from the hinge pin.
(30) Furthermore, it is provided that when a hinge leg is arranged above the connecting element, the hinge pin is fastened to the hinge leg from above with a locking screw that is set coaxially in the hinge pin. The actuating section is arranged and designed such that it deforms the hinge leg upwards, as a result of which the securing screw tears off or is torn out of its thread. This also makes it possible for the securing pin to detach from the hinge. It goes without saying that the securing screw is selected corresponding to material and strength such that it detaches under the usual weight of the falling door actuator.
(31) Additionally or alternatively to detaching the linkage on the swivel joint or on the hinge, it is preferably provided that the ball joint, which connects the two levers to one another, is designed to detach through the weight of the falling door actuator. In particular, the first lever and the second lever each have an overhang with which the respective lever protrudes beyond the ball joint. When the door actuator falls down, the second lever with the door actuator first lowers, causing the two levers to rotate relative to one another on the ball joint and causing the two overhangs to come into contact. The ball joint is preferably designed to be so unstable that it detaches through the forces that occur, for example the ball element slides out of its associated socket. A vertical adjusting screw can preferably be provided in the first or second lever in the region of the two overhangs, which predefines the distance between the two overhangs.
(32) As described above, the linkage can comprise at least one thermally activatable trigger element. This is preferably provided in the region of the fastening arrangement such that when thermally activated, the fastening arrangement detaches and the hinge therefore detaches from its assembly surface. In particular in the region of the fastening arrangement, the thermally activatable trigger element can be positioned as close as possible to the assembly surface, preferably directly in contact with the assembly surface such that this trigger element heats up quickly in the event of a fire.
(33) Of course, it must always be assumed that the linkage and the door actuator are on the side of the door away from the fire. The fire first heats up the frame and the door leaf and, as a result, the assembly surface of the linkage and door actuator facing away from the fire.
(34) The trigger element can be thermally activated; in particular in a temperature range from 90° C. to 200° C. “Activating the trigger element” is equivalent to “triggering the trigger element”. For example, the trigger element is an ampoule, in particular a glass ampoule filled with fluid, as is known, for example, from sprinkler systems. The trigger element is designed such that it triggers at the corresponding temperature that is appropriate to avoid ignition of the fluid in the door actuator.
(35) Furthermore, the trigger element can be designed as a fusible element. The fusible element is in particular made of plastic. The fusible element is also designed such that it preferably “triggers” at the temperature described above and is therefore plastically deformed.
(36) Furthermore, the trigger element can be made of thermally intumescent material, which

preferably undergoes an increase in volume at the temperature described above.
(37) Furthermore, it is provided that the trigger element is made of a shape-memory material, for example a shape-memory spring, wherein the trigger element preferably changes its shape, for example contracting, expanding or bending, as a result of the temperature described above.
(38) In principle, it is therefore provided that the trigger element can be destroyed and/or deformed and/or melted upon thermal loading or thermal activation.
(39) It is preferably provided that the fastening arrangement comprises a hinge support. This hinge support is fastened to the assembly surface, for example with corresponding screws. When the linkage is detached, in particular when the fastening arrangement is detached, the hinge falls off the hinge support.
(40) At least one blocking element is preferably provided, which can be moved from a retaining position into a release position. The blocking element is preferably movably fastened to the hinge support or the hinge bracket, i.e. either to the hinge base plate or to the hinge leg.
(41) In its retaining position, the blocking element is designed to hold the hinge on the hinge support. In its release position, the blocking element releases the hinge such that it can detach from the hinge support. When it is thermally activated, the trigger element can directly generate a movement of the blocking element into the release position. This is possible, for example, if the trigger element is designed as a thermally intumescent material that can exert a force on the blocking element due to its increase in volume. Alternatively, it is also provided that the trigger element releases or allows a movement of the blocking element into its release position when it is thermally activated. The force required for the movement is then applied in some other way, for example by a pretensioned spring or by the weight of the linkage or door actuator.
(42) It is preferably provided that the hinge, in particular with its hinge base plate, is inserted on one side under a holder of the hinge support. On the opposing side, the hinge is fixed by the blocking element. When the blocking element is moved into the release position, there is thus no need for fixing on one side, as a result of which the hinge folds away from the hinge support and is also detached from the holder.
(43) In particular, it is provided for this purpose that the blocking element is designed as a rotatably mounted swivel bolt. The swivel bolt is in particular rotatably mounted about a swivel bolt axis of rotation. In particular, the swivel bolt is rotatably mounted on the hinge support. The swivel bolt axis of rotation is preferably parallel to the hinge axis.
(44) The swivel bolt preferably comprises two legs. The swivel bolt axis of rotation is preferably arranged between the two legs. One leg holds the hinge and the trigger element acts directly or indirectly on the other leg in order to block the rotary movement of the swivel bolt. So as long as the trigger element does not trigger, the rotary movement of the swivel bolt is blocked and the swivel bolt is in the retaining position.
(45) The trigger element is arranged in particular such that it is exposed on the rear side of the hinge support facing the assembly surface such that it is in direct contact with the assembly surface. For this purpose, the trigger element is preferably fixed to the hinge support by means of a latch connection such that it cannot fall out on the rear side of the hinge support before assembly.
(46) In particular, when using the swivel bolt, it is provided that the trigger element is designed as a fusible element. As soon as the fusible element is deformed by the thermal activation, a swivel movement of the swivel bolt is possible: The weight acting on the hinge (due to the weight of the linkage and/or door actuator) creates a force on the first leg of the swivel bolt and thus a torque about the swivel bolt axis of rotation, wherein the movement of the second leg is no longer blocked by the deforming fusible element. This moves the swivel bolt to the release position.
(47) Alternatively, it is also possible to use at least one ampoule as the trigger element, which, like the fusible element, acts directly or indirectly on the second leg and thereby prevents a rotary movement of the swivel bolt. Thermal activation and thus destruction of the at least one ampoule eliminates this blocking of the rotary movement of the swivel bolt.

(48) Alternatively to the swivel bolt, the blocking element is designed as a linearly displaceable bolt. In particular, the linearly displaceable bolt is displaced in a plane perpendicular to the assembly axis, for example perpendicular to the swivel axis. When thermally activated, the trigger element can move the bolt into the release position, i.e., for example, push or pull it, or release a spring-loaded bolt to move into the release position. For example, with thermally intumescent material, it is possible to press the bolt into its release position. For example, by means of a fusible element or an ampoule, it is possible to release a pretensioned spring in order to thereby move the bolt by means of the spring force.
(49) Also when using the displaceable bolt, it is preferably provided that the hinge is inserted under the holder of the hinge support on one side and is held on the opposing side by means of the bolt.
(50) In further variants, it is also possible for a plurality of blocking elements to be provided, which fasten the hinge at a plurality of points with respect to the hinge support. By detaching this plurality of blocking elements or by moving this plurality of blocking elements into the release positions, it is possible to detach the hinge from the hinge support.
(51) In particular, the individual blocking elements are designed as pin elements. These pin members extend through the hinge and hinge support, thus holding the hinge and hinge support together. For example, the hinge support is U-shaped with two opposing legs. The hinge, in particular the hinge bracket, is inserted between these two opposing legs. The connection between the hinge support and the hinge is made by vertical pin elements. In particular, the blocking elements designed as pin elements can be moved parallel to the hinge axis into their release position.
(52) In further variants, it is provided that the fastening arrangement comprises one or a plurality of screws with which the hinge is fastened to the assembly surface, wherein the screw head contact or the recesses, in particular holes, are variable in size such that, when thermally activated, the screw heads can fit through their recesses and the hinge can thus detach from the screws of the fastening arrangement.
(53) To detach the hinge from the fastening screws, it is preferably provided that the trigger element is designed as a fusible element. The fusible element has a first recess for the fastening element, in particular the screw. The hinge, in particular the hinge base plate of the hinge bracket, has a second recess for the same screw. The two recesses are aligned. In the normal fastened state, the screw extends through both recesses. The screw head rests against the fusible element. In this case, the fusible element can extend through the second recess such that it is in direct contact with the assembly surface. The second recess has a larger diameter than the first recess. In particular, the diameter of the second recess is larger than the diameter of the screw head. After melting or deforming of the fusible element, the head is no longer held by the fusible element such that the head moves through the second recess.
(54) Alternatively to the fusible element, a trigger element with thermally intumescent material can also be used here in combination with a retaining element. The thermally intumescent material is arranged to displace the retaining element when thermally activated. The retaining element has the first recess for the screw. In the fastened state, the screw head is thus in contact with the retaining element. The hinge, in particular the hinge base plate, has the second recess, which is aligned with the first recess. The diameter of the second recess is in turn larger than that of the first recess and in particular larger than the screw head. Thermal activation and the resulting displacement of the retaining element causes the retaining element or the first recess to be pushed or pulled out from under the screw head such that the screw head can move through the second recess, causing the hinge to detach from the at least one screw.
(55) In particular, the retaining element is an angled element. The at least one first recess is provided on a leg of the retaining element. The intumescent material acts on the other leg of the retaining element and is thus supported in particular against the second leg and the hinge. When thermally activated, the thermally intumescent material pushes the retaining element away from the

hinge, in particular from one of the two hinge legs.
(56) In combination with the retaining element, it is preferably provided that at least one fusible element, for example as an intermediate plate, is arranged between the hinge and the assembly surface. This intermediate plate deforms when heated and thus reduces the pretension of the screws, which allows easy movement of the retaining element.
(57) A further variant for detaching the fastening arrangement provides that the trigger element is positioned as a thermally intumescent material for arrangement between the hinge and the assembly surface. For this purpose, the trigger element or the plurality of trigger elements can be positioned on the rear side of the hinge base plate. Furthermore, it is also possible to use an assembly bracket between the hinge and the assembly surface, in which the thermally intumescent material is arranged. When thermally activated, the thermally intumescent material expands and thus pushes the hinge away from the assembly surface, which destroys a fastening, for example a screw connection, and thus detaches the hinge from the assembly surface. When using the assembly bracket, all or part of the assembly bracket may detach from the assembly surface together with the hinge. Alternatively, the assembly bracket can also be designed such that the assembly bracket remains completely on the assembly surface and the thermally intumescent material pushes the hinge away from the assembly bracket.
(58) Additionally or alternatively to detaching the fastening arrangement with a thermally activatable trigger element and/or additionally or alternatively to detaching the linkage through the weight of the door actuator, it is preferably provided that the hinge, i.e. the connection between the hinge bracket and the connecting element, can be detached by a thermally activatable trigger element.
(59) In particular, it is provided here that a securing element is provided on the hinge. In this variant, this securing element is designed in particular as a securing tab or securing splint. In particular, the securing element ensures that the connecting element is detached from the hinge pin in the event of a falling lever arrangement. Accordingly, it is preferably provided that the hinge has a hinge leg only on the upper side of the connecting element such that the connecting element can slide downwards off the hinge pin. During normal use, the connecting element is secured against falling by the securing element. Regardless of whether one or two hinge legs are used, the hinge pin can be secured against falling out with the securing element. In both variants, the hinge can be detached by removing the securing element; either by the connecting element falling off the hinge pin or by detaching the hinge pin from at least one hinge leg.
(60) The thermally activatable trigger element is designed to pull off the securing element itself upon thermal activation or to release a spring force for removing the securing element. For example, the trigger element, as an ampoule, can block a pretensioned tension or compression spring, wherein the spring pulls off the securing element after the ampoule has been destroyed.
(61) Furthermore, it is preferably provided that the trigger element consists of shape-memory material, for example designed as a shape-memory spring. This shape-memory spring can contract when thermally activated and thereby pull the securing element.
(62) The disclosure also comprises an arrangement. The arrangement comprises the linkage described and a door actuator. The door actuator is in particular a door closer or door drive. The linkage is connected in particular to the driven axle of the door actuator. The door actuator or an assembly bracket on the door actuator are designed to detach the door actuator from its assembly surface in the event of thermal activation triggered in the event of a fire. For this purpose, for example, the fusible screws described above can be used for fastening the door actuator. However, the assembly bracket described with thermally intumescent material can also be used in the region of the door actuator in order to push the door actuator away from its assembly surface in the event of a fire and thus detach it. The door actuator weighs in particular from 1 kg to 30 kg and can therefore, as described above, detach the linkage with its weight.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

(1) The disclosure will now be described further on the basis of exemplary embodiments, in which is shown:

(2) FIG. **1** an arrangement according to the disclosure with linkage and door actuator according to the disclosure for all exemplary embodiments,

(3) FIGS. **2** to **6** a linkage according to the disclosure in accordance with a first exemplary embodiment,

(4) FIGS. **7** to **9** the linkage according to the disclosure in accordance with a second exemplary embodiment,

(5) FIG. **10** the linkage according to the disclosure in accordance with a third exemplary embodiment,

(6) FIGS. **11** to **13** the linkage according to the disclosure in accordance with a fourth exemplary embodiment,

(7) FIG. **14** the linkage according to the disclosure in accordance with a fifth exemplary embodiment,

(8) FIGS. **15** to **16** the linkage according to the disclosure in accordance with a sixth exemplary embodiment,

(9) FIGS. **17** to **18** the linkage according to the disclosure in accordance with a seventh exemplary embodiment,

(10) FIGS. **19** to **20** the linkage according to the disclosure in accordance with an eighth exemplary embodiment,

(11) FIGS. **21** to **23** the linkage according to the disclosure in accordance with a ninth exemplary embodiment,

(12) FIG. **24** the linkage according to the disclosure in accordance with a tenth exemplary embodiment,

(13) FIGS. **25** to **26** the linkage according to the disclosure in accordance with an eleventh exemplary embodiment,

(14) FIG. **27** the linkage according to the disclosure in accordance with a twelfth exemplary embodiment,

(15) FIG. **28** the linkage according to the disclosure in accordance with a thirteenth exemplary embodiment,

(16) FIGS. **29** to **30** the linkage according to the disclosure in accordance with a fourteenth exemplary embodiment,

(17) FIG. **31** the linkage according to the disclosure in accordance with a fifteenth exemplary embodiment,

(18) FIG. **32** the linkage according to the disclosure in accordance with a sixteenth exemplary embodiment, and

(19) FIGS. **33** to **34** the linkage according to the disclosure in accordance with a seventeenth exemplary embodiment.

DETAILED DESCRIPTION OF THE DRAWINGS

(20) A plurality of exemplary embodiments of a linkage **1** for force transmission between a driven axle **102** of a door actuator **101** and an assembly surface **105** are described in detail below. Identical or functionally identical parts are provided with the same reference numerals.

(21) The exemplary embodiments 1 to 3 with FIGS. **2** to **10** show variants for detaching the linkage **1** through the weight of a falling door actuator **101**. The exemplary embodiments 4 to 15 with FIGS. **11** to **31** show variants for detaching the linkage with a thermally activatable trigger element **32** in the region of a fastening arrangement **8**. The exemplary embodiments 16 and 17 with FIGS.

32 to **34** show variants for detaching the linkage with a thermally intumescent trigger element **32** on a hinge **2**.
(22) FIG. **1** shows an arrangement **100** with the door actuator **101** and the linkage **1** for all exemplary embodiments. FIG. **1** also shows a door leaf **103** to which the door actuator **101** is fastened. The door leaf **103** is rotatably mounted in a door frame **104**. On the door frame **104**, which forms the assembly surface **105**, the linkage **1** is mounted with its hinge **2** via the fastening arrangement **8**. Perpendicular to this assembly surface **105**, an assembly axis **106** is defined.
(23) As shown in FIG. **1** and the figures for the individual exemplary embodiments, the linkage **1** is designed as follows:
(24) The linkage **1** comprises the hinge **2**. The hinge **2** in turn has a hinge bracket **3**. The hinge bracket **3** has a hinge base plate **4**. The hinge base plate **4** is in particular perpendicular to the assembly axis **106**. Furthermore, the hinge bracket **3** can have one or two hinge legs **5** which extend perpendicularly from the hinge base plate **4**. A hinge pin **7**, which defines a hinge axis **6**, is received on the at least one hinge leg **5**. The hinge axis **6** is vertical and perpendicular to the assembly axis **106**.
(25) The fastening arrangement **8** is provided for connecting the hinge **2**, in particular the hinge bracket **3**, to the assembly surface **105**. In a simple configuration, the fastening arrangement **8** comprises at least one screw **9** which is firmly screwed into the assembly surface **5**.
(26) Furthermore, the linkage **1** comprises a lever arrangement **10**. The linkage **1** is designed here as a scissor linkage such that the lever arrangement **10** comprises a first lever **15** and a second lever **19**. The two levers **15**, **19** are rotatably connected to one another via a ball joint **18**.
(27) The first lever is connected to a connecting element **11** of the lever arrangement **10** via a swivel joint **12**. The swivel joint **12** comprises one or a plurality of coaxial swivel joint pins **14** defining a swivel joint axis **13**. The swivel joint axis **13** is in particular horizontal and thus perpendicular and offset to the hinge axis **6**.
(28) In particular, the connecting element **12** has two parallel tabs, between which the first lever **15** is arranged. The one or plurality of swivel joint pins **14** extend through the two tabs and the first lever **15**.
(29) The first lever **15** preferably comprises a tensioning screw **16** in a tensioning nut **17**. By screwing the tensioning screw **16** into the tensioning nut **17**, the length of the first lever **15** can be adjusted.
(30) The second lever **19** is connected to the driven axle **102** or the associated shaft of the door actuator **101**, for example via the lever eye **20** shown, in a rotationally-fixed manner.
(31) In FIG. **1**, the door actuator **101** is located on the door leaf **103** and the hinge **2** accordingly on the door frame **104**. The reverse arrangement is also possible, where the door actuator **101** is fastened to the door frame **104** and the hinge **2** is fastened to the door leaf **103**.
(32) The door actuator **101** is designed and arranged on its assembly surface such that it can be detached from its assembly surface, in the example shown the door leaf **103**, in the event of a fire and the associated heating. For example, the door actuator **101** is pushed away from its assembly surface by thermally intumescent material and thereby detaches. This causes the door actuator **101** to fall down.
(33) First exemplary embodiment with FIGS. **2** to **6**: The linkage **1** comprises a securing element **21**, designed as a securing sleeve **26**. The securing sleeve **26** is placed on the swivel joint **12**.
(34) As the exploded illustration in FIG. **4** shows in particular, the connecting element **11** has a first pin receptacle **22**. The first pin receptacle **22** is U-shaped and open at the bottom.
(35) The securing sleeve **26** has a second pin receptacle **23**. The second pin receptacle is U-shaped and open at the side.
(36) In the assembled state, the first lever **25** is inserted with the swivel joint pin **14** in the first pin receptacle **22**. The swivel joint pin **14** is prevented from falling out downwards due to the placement of the securing sleeve **26**.

(37) FIG. **5** illustrates for the first and second exemplary embodiment that the first lever **15** comprises an actuating section **24** which protrudes beyond the swivel joint axis **13**. When the first lever **15** is lowered by the falling door actuator **101**, the actuating section **24** rises.
(38) In the first exemplary embodiment, the securing sleeve **26** is pushed off by the rising actuating section **24** such that the second pin receptacle **23** detaches from the swivel joint pin **14**.
(39) FIGS. **4** and **5** show a fixing element **25**, designed as a projection, which extends horizontally from the first lever **15**. In the normal horizontal position of the first lever **15**, this fixing element **15** prevents a movement of the securing sleeve **26**. Only after lowering the first lever **15** according to FIG. **5** is a movement of the securing sleeve **26** released.
(40) FIG. **6** illustrates that the fixing element **25** can also be designed as a plastic screw, for example, which connects the securing sleeve **26** to the connecting element **11**, for example. The screw is designed to be so unstable that it is destroyed when the securing sleeve **26** is displaced by the actuating section **24**.
(41) Second exemplary embodiment with FIGS. **7** to **9**: In the second exemplary embodiment, the hinge **2** is detached, i.e. in particular the connecting element **11** is detached from the hinge bracket **3**. In FIGS. **7** and **8**, the securing element is designed as a securing tab **27** for this purpose. The U-shaped recess of the securing tab **27** is inserted in a corresponding groove of the hinge pin **7**. In the variant shown in FIGS. **7** and **8**, the securing tab **27** holds the hinge pin **7**. When the securing tab **27** is pulled off by the actuating section **24**, the securing tab **27** detaches from the hinge pin **7** such that the hinge pin **7** together with the connecting element **11** can fall downwards. For this purpose, it is in particular provided that the hinge bracket **3** has a hinge leg **5** only on the upper side.
(42) The securing tab **27** preferably has a tab recess **28** into which the actuating section **24** can dip.
(43) Alternatively to the securing tab **27**, a securing splint can also be used here, which is correspondingly configured such that it can be pulled by the actuating section **24**.
(44) FIG. **9** shows a variant of the second exemplary embodiment, in which the securing element **21** is designed as a securing screw **29**. The securing screw **29** is screwed into the hinge pin **7** coaxially to the hinge axis **6** from above and holds the hinge pin **7** with its head, optionally with a washer, with respect to the upper hinge leg **5**. A hinge leg **5** is preferably not provided on the underside here too. The securing screw **29** is correspondingly unstable, for example made of plastic such that the actuating section **24** can lift the hinge leg **5** when the first lever **15** is lowered and can thereby destroy the securing screw **29**, for example by tearing off the head of the securing screw **29** or by tearing the securing screw **29** out of its thread. This eliminates the securing of the hinge pin **7** in the hinge bracket **3** and thus the connecting element **11** can fall down together with the hinge pin **7**.
(45) Third exemplary embodiment with FIG. **10**: FIG. **10** shows the ball joint **18** for connecting the two levers **15**, **19** in a sectioned detail illustration. This ball joint **18** is configured to be unstable in such manner that the ball joint **18** and thus the two levers **15**, **19** detach from one another through the weight of the falling door actuator **101**. In particular, it is provided that the two levers **15**, **19** each have an overhang **30** that protrudes beyond the ball joint **18**. The two overhangs **30**, possibly with a vertical adjusting screw **31**, touch when lowering the door actuator **101** and thus facilitate the detachment of the ball joint **18**.
(46) Fourth exemplary embodiment with FIGS. **11** to **13**: In the fourth and a plurality of the following exemplary embodiments, the linkage **1** comprises a hinge support **34** as part of the fastening arrangement **8**. The hinge support **34** is firmly connected to the assembly surface **105**, for example with the screws **9**. The hinge **2**, in particular the hinge bracket **3**, can be detached from the hinge support **34** using at least one thermally activatable trigger element **32**.
(47) According to FIGS. **11** to **13**, a blocking element **35** is provided, which is designed as a swivel bolt **36** here. The swivel bolt **36** is fastened to the hinge support **34** so as to be rotatable about a swivel bolt axis of rotation **37**. The swivel bolt axis of rotation **37** is parallel and offset to the hinge axis **6**.

(48) The swivel bolt **36** has a first leg **38** and a second leg **39**. The swivel bolt axis of rotation **37** is located between the two legs **38**, **39**.
(49) The hinge bracket **3**, in particular the hinge base plate **4**, is pushed under a holder **40** of the hinge support **35** on one side. On the opposing side, the first leg **38** holds the hinge **2** on the hinge support **34**.
(50) The swivel bolt **36** is prevented from rotating by the trigger element **32**, designed here as a fusible element **33**. This fusible element **33** is exposed in particular on the rear side of the hinge support **34** and is therefore in direct contact with the assembly surface **105**. As a result, the fusible element **33** is clamped between the assembly surface **105** and the second leg **39** in the assembled state. In order to prevent the fusible element **33** from falling out before assembly, a latch connection **41** is preferably provided between the fusible element **33** and the hinge support **34** according to FIG. **13**.
(51) Fifth exemplary embodiment with FIG. **14**: According to FIG. **14**, the blocking element **35** is also designed as a swivel bolt **36**. Here, however, the two legs **38**, **39** are arranged such that between the legs **38**, **39** there is a deflection of 270°. An intermediate piece **42** is located between the fusible element **33** and the second leg **39**. Here, too, after the fusible element **33** has melted, the swivel bolt **36** can be rotated, as a result of which the hinge **2** detaches from the hinge support **34**.
(52) Sixth exemplary embodiment with FIGS. **15** and **16**: In the illustration according to FIGS. **15** and **16**, the hinge support **34** is hidden for the sake of clarity. Two trigger elements **32** designed as ampoules **43** are located in the hinge support **34**. The ampoules **43** are supported against the second lever **39** of the swivel bolt **36** via corresponding intermediate elements **42**. In the event of thermal activation and thus destruction of the ampoules **43**, the swivel bolt **36** can be rotated. Corresponding tensioning screws **44** are screwed into the hinge support **34** in order to tension the two ampoules **43** in the hidden hinge support **34**.
(53) Seventh exemplary embodiment with FIGS. **17** and **18**: In the seventh and the following eighth exemplary embodiment, the blocking element **35** is designed as a linearly displaceable bolt **45**. In these variants, too, the hinge bracket **3** is pushed under the holder **40** on one side and is held on the opposing side by the blocking element **35**, here as a bolt **45**.
(54) In FIGS. **17** and **18**, the trigger element **32** is designed as a thermally intumescent element **46**. When thermally activated, the volume of the thermally intumescent element **46** increases. The element **46** bears on the one hand against the hinge support **34** and on the other hand against the bolt **45** such that the bolt **45** is linearly displaceable into its release position.
(55) Eighth exemplary embodiment with FIGS. **19** and **20**: At least one compression spring **47** is provided here, which is supported against the hinge support **34** and the bolt **45**. In the normal state, the bolt **45** is loaded in its retaining position by the pretensioned compression spring **47**. However, the trigger element **32**, designed as an ampoule **43**, holds the bolt **45** in the retaining position against the force of the compression spring **47**. After the ampoule **43** has been destroyed, the force of the at least one compression spring **47** can move the bolt into the release position.
(56) In the following exemplary embodiments with FIGS. **21** to **27**, different variants are shown in which a plurality of blocking elements **35** are used to connect the hinge **2** and the hinge support **34**. In particular, here the hinge support **34** is U-shaped and comprises two parallel legs between which the hinge bracket **3** is inserted.
(57) Ninth exemplary embodiment with FIGS. **21** to **23**: Here two blocking elements **35** are provided, each of which is designed as follows; the blocking element **35** comprises a pin element **48**. The pin element **48** consists here of two nested hollow elements, which are kept at a distance by the internal ampoule **43**. The hinge bracket **3** is pressed against the hinge support **34** via a tensioning element **49** which is inserted into tensioning element grooves **50** of the hinge support **34**. The pin element **48** with ampoule **32** keeps the tensioning element **49** tensioned. After the ampoule **43** has been destroyed, this pretensioning ceases such that the tensioning element **49** can be pushed out of the tensioning element grooves **50** by a compression spring **47**, as a result of

which the hinge bracket **3** detaches from the hinge support **34**.
(58) FIG. **22** shows the design with hidden blocking element **35**. FIG. **23** shows a sectional view through the blocking element **35**.
(59) Tenth exemplary embodiment with FIG. **24**: A blocking element **35** is shown, which is used in a plurality of positions for the connection between the hinge bracket **3** and the hinge support **34**. The single blocking element **35** comprises the pin element **48** with two nested elements which are held at a distance by an internal ampoule **43**. Two opposing ends of the pin element **48** are each inserted in associated recesses in the hinge support **34** and the hinge bracket **3**. The pin element **48** and associated ampoule **43** extend vertically. By destroying the ampoule **43**, the two parts of the pin element **48** can be moved towards one another or the upper element falls down. This causes the hinge **2** to detach from the hinge support **34**.
(60) Eleventh exemplary embodiment with FIGS. **25** and **26**: Here, in the hinge bracket **3**, in particular between the two hinge legs **5**, there is an arrangement of two scissor arms **51**. The two scissor arms **51** are connected to one another at a scissor axis **52**. In particular, the scissor axis **52** is fastened to the hinge base plate **4**. FIG. **26** shows the arrangement with the two scissor arms **51** on their own.
(61) The blocking elements **35** designed as pin elements **48** are located on the scissor arms **51** and are inserted into corresponding holes of the hinge support **34** and the hinge bracket **3**.
(62) Compression springs **47** are provided which are pretensioned and preload the scissor arms **51** into rotational movement about the scissor axis **52** in such manner that the scissor arms **51** pull the pin elements **58** out of their holes. However, this movement is blocked by the ampoule **43** such that before the ampoule **43** is destroyed, the movement of the scissor arms **51** is blocked.
(63) Twelfth exemplary embodiment with FIG. **27**: A plurality of blocking elements **35** each with a pin element **48** are provided here. The pin element **48** is in turn inserted into corresponding holes in the hinge bracket **3** and hinge support **34**. A thermally intumescent element **46** is provided as a trigger element **32** between the respective pin element **48** and the hinge bracket **3**. When thermally activated, this thermally intumescent element **46** pushes the pin element **48** out of the corresponding holes.
(64) Compression springs **47** are preferably provided here for holding the pin elements **48** in the retaining position, wherein the thermally intumescent element **46** moves the pin element **48** against the force of these compression springs **47** into the release position.
(65) As FIG. **27** shows in the sectional illustration, two opposing blocking elements **35** can also be braced against one another with a common compression spring **47**.
(66) Thirteenth exemplary embodiment with FIG. **28**: FIG. **28** shows a trigger element **32**, which is designed as a fusible element **33**, in a sectional view. This fusible element **33** has a first recess **53**. In the hinge bracket **3**, in particular the hinge base plate **4**, a second recess **54** is provided. The two recesses **53**, **54** are aligned and the screw **9** of the fastening arrangement **8** extends through both recesses **53**, **54**.
(67) The diameter of the first recess **53** is so small that the screw head rests on the fusible element **33**. The second recess **54** is selected to be large enough such that the screw head fits through the second recess **54** after deformation of the fusible element **33**. As a result, the hinge **3** can detach from the screws **9** after the deformation of the fusible element **33**.
(68) As the illustration in FIG. **28** shows, the material of the fusible element **33** preferably extends through the second recess **54** such that direct contact between the fusible element **33** and the assembly surface **105** is possible for the transfer of heat.
(69) Fourteenth exemplary embodiment with FIGS. **29** and **30**: An angled retaining element **55** is provided. The retaining element **55** has the smaller first recess **53**. The larger second recess **54** is again provided in the hinge bracket **3**. In the normal state, the screw head of the screw **9** rests against the retaining element **55**. Only after the retaining element **55** has been displaced, here perpendicularly to the assembly axis **106**, is the retaining element **55** pulled out from under the

screw head such that the hinge **3** can be detached from the screw **9** again.
(70) As shown in FIGS. **29** and **30**, the retaining element **55** is angled such that one leg extends parallel to one of the hinge legs **5**. The trigger element **32** is arranged as a thermally intumescent element **46** between the hinge leg **5** and the angled leg of the retaining element **55**. When thermally activated, the retaining element **55** is displaced perpendicular to the assembly axis **106**.
(71) An intermediate plate **56** made of fusible material can be arranged between the hinge base plate **4** and the assembly surface **105** such that this intermediate plate **56** is deformed during the thermal activation and the pretensioning of the screws **9** is thus reduced.
(72) Fifteenth exemplary embodiment with FIG. **31**: FIG. **31** shows an exploded illustration with a plurality of trigger elements **32** as thermally intumescent elements **46** in plate form. These elements **46** are arranged between the hinge **3** and the assembly surface **105** and can push the hinge **3** away from the assembly surface **105** when thermally activated. In the specific configuration, an assembly bracket **57** is provided for this purpose. This assembly bracket **57** comprises a first assembly plate **58** and a second assembly plate **59**. The two assembly plates **58**, **59** are screwed onto one another with predetermined break elements **60**, for example screws. The first assembly plate **58** is to be firmly connected to the assembly surface **105** with the screws **9**. The hinge **3** is firmly fastened to the second assembly plate **59** with corresponding screws.
(73) The recesses for receiving the trigger elements **32** are located in the first assembly plate **58**. When the thermally intumescent elements **46** expand, they push the second assembly plate **59** away from the assembly surface **105** or from the first assembly plate **58** such that the predetermined break elements **60** are destroyed or torn from their threads.
(74) Such an assembly bracket or a similar assembly bracket can also be used to connect the door actuator **101** to its assembly surface in order to detach the door actuator **101** in the event of a fire and the associated heating.
(75) Sixteenth exemplary embodiment with FIG. **32**: The hinge **3** is shown with only one upper hinge leg **5**. The connecting element **11** is placed on the hinge pin **7**. The connecting element **11** is secured against falling with a disc **61** and the securing element **21** designed as a securing splint **62**. The securing splint **62** inserts in the hinge pin **7**.
(76) The trigger element **32**, here as a shape-memory element **63**, is tensioned in the form of a spring between the securing splint **32** and the hinge support **34**. When the shape-memory element **63** heats up thermally, it contracts and thereby pulls the securing splint **62**, as a result of which the connecting element **11** can fall downwards.
(77) Seventeenth exemplary embodiment with FIGS. **33** and **34**: Here, as in FIG. **32**, the securing splint **62** is provided on the hinge pin **7**. By pulling the securing splint **62**, the connecting element **11** can be detached downwards.
(78) The securing splint **62** can be pulled via a pretensioned tension spring **64**. However, a contraction of the tension spring **64** is blocked by the trigger element **32** in the form of an ampoule **43**. Only after the ampoule **43** has been destroyed can the tension spring **64** contract.
(79) FIG. **34** shows a variant of FIG. **33**, with which the securing splint **62** can also be pulled with a compression spring **47**. The compression spring **47** is pretensioned here, and the release of its tension is blocked by the ampoule **43**. The ampoule **43** is supported against the compression spring **47** and the hinge support **34**.

Claims

1. A linkage for force transmission between a driven axle of a door actuator and an assembly surface, comprising: a hinge; a fastening arrangement designed to fasten the hinge to the assembly surface, wherein an assembly axis is defined perpendicularly to the assembly surface; a lever arrangement which is fastened to the hinge so as to be rotatable about a hinge axis perpendicular to the assembly axis and which is designed for rotationally-fixed connection to the driven axle of the

door actuator, wherein the linkage is designed to detach through the weight of the door actuator falling down in the event of a fire and/or wherein the linkage comprises a thermally activatable trigger element that is designed to detach the linkage in the event of thermal activation triggered by a fire; and a securing element is arranged on a hinge joint or the hinge and is configured for holding together the hinge joint or the hinge, wherein the lever arrangement comprises a first lever, the hinge joint, and a connecting element, wherein the connecting element is fastened to the hinge so as to be rotatable, and the first lever is rotatably connected to the connecting element via the hinge joint, wherein a hinge joint axis is perpendicular to the hinge axis.

2. The linkage according to claim 1, wherein the hinge or a joint in the lever arrangement is designed to detach through the weight of the falling door actuator.

3. The linkage according to claim 1, wherein the securing element, by the first lever being lowered, is configured to be moved into a non-constrained position which does not hold the hinge joint or hinge together.

4. The linkage according to claim 3, wherein the first lever comprises an actuating section which protrudes beyond the hinge joint axis in the direction of the hinge and which moves upwards when the first lever is lowered and thereby moves the securing element to the non-constrained position.

5. The linkage according to claim 4, wherein the hinge comprises a hinge pin, wherein the hinge pin is secured against falling out with the securing element, configured as a securing tab, securing splint or securing screw.

6. The linkage according to claim 5, wherein the hinge comprises a hinge leg only on the upper side of the connecting element, in which the hinge pin is received.

7. The linkage according to claim 5, wherein the securing element, configured as a securing tab or a securing splint, is configured to be pulled off the hinge pin.

8. The linkage according to claim 5, wherein the securing element, configured as a securing screw, is configured to be destroyed by the movement of the actuating section.

9. The linkage according to claim 3, wherein the securing element is a securing sleeve which sits on the hinge joint.

10. The linkage according to claim 9, wherein the hinge joint has a hinge joint pin and a U-shaped, downwardly open first pin receptacle on the connecting element and/or on the first lever, wherein the securing sleeve with a U-shaped, laterally open second pin receptacle holds the hinge joint pin in the first pin receptacle, and wherein the securing sleeve is configured to be removed from the hinge joint pin to detach the hinge joint.

11. The linkage according to claim 2, wherein the lever arrangement comprises the first lever and a second lever, wherein the two levers are connected to one another with a ball joint, and wherein the ball joint is designed to detach through the weight of the falling door actuator.