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(54) Foldable stairs especially of 4 segments

(57) The stairs have a safety device (**3**) for protection against uncontrolled detachment of at least two last segments from the first segment (**11**) by rotation on the hinges (**21**), which mechanism is positioned near the top ends of the segments, beneficially overlaid on the extension hinge (**23**) that joins together segments 2 (**12**) and 3 (**13**). The safety device (**3**) is unlatched by the user lifting the bottom parts of segments 3 (**13**) and 4 (**14**). Also, the stairs have a bottom lock (**6**) installed on the hinge (**22**) that joins together segments 3 (**13**) and 4 (**14**).

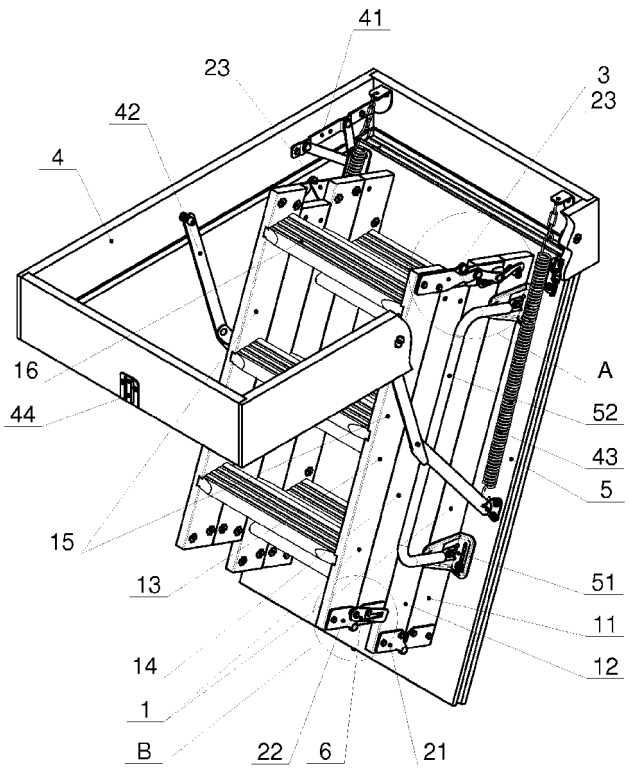

Fig. 1

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Description

[0001] The invention relates to the folded ladder stairs made from hinged segments (specifically 4 of them) attached to the ceiling and lowered by unfolding. The main application for the invention is an entrance to loft. The invention applies also to folded ladders that are different from ladder stairs because of their inclination angle.

[0002] **Technology status.** Segmented folded stairs, attached to the ceiling, opened downwards by unfolding, including 4-segment stairs, are a known design. The stairs have hinge connected segments, the first of which is mounted on the cover closing the stairs frame opening from the bottom. The existing stair designs have no safeguards against uncontrolled detachment of the second and the following segments from the first segment, which can happen in the case of hard opening of the stairs producing rebound and upward movement of the segments and, possibly, spontaneous uncontrolled unfolding of the stairs.

[0003] **The main idea of the solution.** The deliberated folded stairs designed for installing in the ceiling, opened downwards by unfolding, have a mechanism that prevents uncontrolled detachment of at least two last segments from the first segment, by rotation on the hinges, positioned, when the stairs are lowered and unfolded, at the bottom of the segments. The device has a hook that, together with the subassembly containing the first segment and, beneficially, the cover, joins together [the top segment] with one of the following segments. Also, the stairs have a frame installed in the ceiling, used for storing the stairs in folded and closed condition. Beneficially, the stairs have a bottom cover for closing the frame opening. The cover is opened and lowered together with the stair segments.

[0004] The first segment positioned, when the stairs are unfolded, at the top of all segments, is joined together with the frame with hinges, provided that the direct connection exists between the first segment and the frame or between the frame and the cover holding the first segment. For the purposes hereof, the term "subassembly containing the first segment and, beneficially, the cover" means, depending on stairs design either the first segment fastened to the cover that is joined with the frame using hinges or the first segment joined together with the frame using hinges with the cover attached to the bottom of the first segment or the first segment joined together with the frame using hinges but without the cover (which can be opened separately). The segment attached to the cover is fastened to the cover in such a way that during the operation of the stairs the segment remains fixed relative to the cover, which does not preclude existence of structural components enabling re-positioning the segment vs. the cover during assembly or repair. In "the cover hanged under the segment" design, the cover-to-segment connection can be fixed or hinged.

[0005] The subsequent ladder stair segments are joined together with the hinges positioned at segment interfaces at the top or bottom of the stringers (or side beams) of the segments. Segments 1 and 2 are joined together with hinges with the axis of rotation positioned near the top surfaces of the stringers of the two segments. When the stairs are unfolded, the facing surfaces of the stringers of the subsequent segments abut each other, while the positioning of the hinges, as to the principle, alternately on the top and bottom surfaces of the stringers ensures that the segments, when unfolded, lock one another to provide a straight-line and rigid flight of stairs.

[0006] The hook of the safety device is positioned, when the stairs are lowered and unfolded, near the top end of the first segment and while the stairs are unfolded the hook is unlatched by the user. Beneficially, the hook of the safety device is unlocked by lifting by the user of at least the terminal segment with simultaneous rotation of the segment on the hinges that are positioned at the top when the stairs are opened but unfolded. Alternatively, the safety device can have a pull rod for unlocking the hook, operated by the user independently of lifting the segments, beneficially using a lever positioned at the bottom ends of the segments when the stairs are opened but unfolded.

[0007] The invention consists mainly of the design containing 4 ladder stair segments, where the fourth segment starting from the top (when the stairs are unfolded) is joined together with the third segment with the hinges, the axis of rotation of which is positioned at the bottom of the stringers of the two segments, whereas segments 2 and 3 are joined together with hinges, the axis of rotation of which is offset from the bottom of the stringers of the two segments. The hinges with the offset axis of rotation, referred to in short as "extension hinges", the offset of the axis of rotation is at least one half of the height of the cross-section of the stringers of the two segments. Consequently, when the stairs are folded, the fourth segment is positioned between segments 3 and 2, the latter resting on the first segment. In this design of the invention, the hook of the safety device for protection against uncontrolled detachment of segment 2 and the following segments from the first segment by rotation on the hinges joining together segments 1 and 2 is positioned near the extension hinges. The hook of the safety device is unlatched by lifting coupled segments 3 and 4 by the user with simultaneous rotation of the two segments on the extension hinges and detachment of the hinges of segments 3 and 4 (positioned at the bottom) from segment 2.

[0008] In the first design of the invention, the hook of the safety device that operates in combination with the retainer as part of the subassembly containing the first segment and, beneficially, the cover, is hinged to segment 2 and it is unlocked by the unlatching pull rod hinged to the hook and one of the following segments, specifically the third segment. The retainer operating in combination with the hook of the safety device is positioned, beneficially, on segment 1. The retainer has the form of a pin protruding laterally from the segment's stringer. After lifting by the user the bottom of segment 3 and, pos-

sibly, the following segments, the unlatching pull rod joined with the third segment draws the hook away from the pin installed on segment 1 and unlocks the coupling of the segments. This enables rotating segments 2 and latter on the hinge joining together segments 1 and 2 and unfolding the stairs for walking.

[0009] When the stairs are folded and the hook of the safety device is locked, there is play between the retainer (pin) on segment 1 and the latching surface of the hook. This clearance eliminates friction between the components, which facilitates unlatching the hook. In addition, the unlatching arm of the hook has an oblique surface on the opposite of the latching surface, which operates in combination with the retainer as part of the subassembly containing the first segment and, beneficially, the cover, to facilitate the snapping of the hook in the latched position. The unlatching pull rod has a longitudinal opening on at least one of its ends to facilitate movement of the pin set in the component (preferably, the hook of the safety device) operating in combination with the pull rod. As a result, the lifting of the bottoms of the segments will first close the clearance in the longitudinal opening of the unlatching pull rod and then the pull rod will draw the hook away from the pin and unlock the coupling of the segments. Thus, the hook will be unlocked with a delay, as a result of deliberate action of the user, which eliminates the risk of uncontrolled unlocking in the case of hard opening the stairs and rebound of segment 2 and the following segments.

[0010] In 4-segment stairs with extension hinges between segments 2 and 3, the hook of the safety device is hinged to the base plate of the extension hinge, the base plate fastened to segment 2. The unlatching pull rod is hinged to the hook and the arm fastened to segment 3, overlaid on the extension hinge swivel plate fastened to segment 3. Beneficially, the arm is fastened using threaded connectors common for the arm and the swivel plate of the extension hinge.

[0011] In the second design of the invention, the hook of the safety device is fastened to the third or further segment, remaining fixed relative to the segment. The hook operates in combination with the retainer as part of the subassembly containing the first segment and, possibly, the cover, provided that, beneficially, the retainer (a pin protruding laterally from the segment's stringer) is positioned on segment 1. This monolithic hook has a mounting plate, connector and a latching arm. In folded stairs the latching arm points towards the end of the first segment that is the top of the segment when the stairs are open and extends beyond the retainer installed in this segment.

[0012] After rotating by the user, while unfolding the bottom parts of segments 3 and, possibly, the following segments, the hook of the safety device swivels, together with the segments, around the axis of the hinge joining together segments 2 and 3, which hinge, when the stairs are lowered and unfolded, is positioned on the top of the segments. As a result of the rotation, the connector and the latching arm of the hook move below the pin, thus unlocking the swivelling movement of the segments and enabling complete unfolding the stairs. When the stairs are folded and the hook holds the segments together, there is play between the retainer (pin) and the latching surface of the hook. This clearance eliminates friction between the components. The hook of the safety device is installed, beneficially, on segment 3. Thus, when the stairs are unfolded, the hook protrudes obliquely towards the bottom from this segment, without disturbing the walking.

[0013] In the third design of the invention, the hook of the safety device, identical as in the first design, is operated by the control lever independently of the operation of the third and, possibly, fourth segment. The lever has a swivel connection with segment 3 or 2, installed near the bottom, when the stairs are lowered and unfolded, end of the segment. The control lever is coupled with the hook with a pull rod running along the same segment.

[0014] 4-segment stairs with extension hinges between segments 2 and 3, i.e., stairs in which the fourth segment is positioned, when the stairs are folded, between segments 2 and 3, have a bottom lock in the coupling of segments 3 and 4. The lock prevents segments 3 and 4 from uncontrolled separation. The bottom lock consists of a flat connector hinged to segment 3 or 4 and a pin installed in segment 2. The connector has a longitudinal opening terminated with a recess across the opening with a bearing surface. The recess is located on the side of the hinge coupling the connector with the segment. The pin, installed in segment 2, operates in combination with the longitudinal opening and its lateral recess. Also, the bottom lock has spring that forces the resetting of the connector to the position in which the pin enters the lateral recess of the longitudinal opening and, by engaging the bearing surface of the recess, holds segments 4 and 3 together. While the stairs unfold, the connector of the lock moves, after overcoming resistance from the spring, to the position in which the pin leaves the lateral recess and can move along the whole length of the longitudinal opening.

[0015] **Benefits of the invention.** Ceiling-mounted folded stairs furnished with a safety mechanism for protection against detachment of at least two last segments from the first segment are safer than the hitherto known designs. The safety device is particularly important for 4-segment stairs with elevated centre of gravity of the folded segments. In the case of designs featuring the safety device controlled by the movement of unfolded segments, the added benefit consists of elimination of additional control components.

[0016] **Real-life examples of the invention.** The folded stairs representing the invention are illustrated in the following figures:

Fig. 1: 4-segment stairs with the hook of the safety device engaged on the extension hinge; the stairs open and folded; axonometric view

Fig. 2: The safety device of the stairs shown in Fig. 1 (detail "A"); the stairs open and folded; side view

Fig. 3: The safety device of the stairs shown in Fig. 1 (detail "A"); while unfolding, with segments 3 and 4 lifted; side view

Fig. 4: The bottom lock of the stairs shown in Fig. 1 (detail "B"); the stairs folded; axonometric view

Fig. 5: 4-segment stairs shown in Fig. 1; the stairs unfolded; axonometric view

Fig. 6: The safety device of the stairs; the stairs unfolded (detail "C" from Fig. 5); axonometric view

Fig. 7: The bottom lock of the stairs; the stairs unfolded (detail "D" from Fig. 5); axonometric view

Fig. 8: 4-segment stairs with the hook of the safety device fastened in fixed position relative to segment 3; the stairs open and folded; axonometric view

Fig. 9: The safety device of the stairs shown in Fig. 8; the stairs open and folded; side view.

Fig. 10: The safety device of the stairs shown in Fig. 8 while unfolding, with segments 3 and 4 lifted; side view.

[0017] The stairs representing the invention are also shown in other real-life examples (not included in the foregoing drawings but described by indicating similarities to and differences from the foregoing examples).

[0018] **Example1.** Folded stairs installed in the ceiling have a ladder stairs unit (1) consisting of 4 segments. When unfolded (Fig. 5), the first segment **(11)** is located on the top and segments 2 **(12),** 3 **(13)** and 4 **(14)** descend towards the floor, with the fourth segment **(14)** footed on the floor. Each segment has two stringers **(15),** i.e. lateral beams joined together with steps **(16).** When the stairs are unfolded, the surface of each step is horizontal. Each pair of segments is joined together with hinges installed on the extremes of the segments. The hinges, coming in pairs (left and right), are attached to the outer surfaces of segment stringers **(15).**

[0019] The first **(11)** and second **(12)** segments are joined together with upper hinges **(21).** The pins **(2)** of the hinges providing the axis of rotation for segment 2 **(12)** and the following two segments are placed near the tops (when the stairs are unfolded; Fig. 5) of the stringers **(15)** of the first and second segments. When the stairs are folded (Fig. 1) segments 1 **(11)** and 2 **(12)** touch each other with these stringer surfaces. Segments 3 (13) and 4 **(14)** are jointed together with lower hinges **(22).** The pins **(2)** of the hinges, providing the axis of rotation for the fourth segment, are placed near the bottoms (when the stairs are unfolded) of the stringers **(15)** of the two segments. When the stairs are folded, segments 3 **(13)** and 4 **(14),** touch each other with these stringer surfaces.

[0020] Segments 2 **(12)** and 3 **(13)** are joined together with extension hinges **(23).** The pins **(2)** of the hinges, providing the axis of rotation for segments 3 **(13)** and 4 **(14)** are placed near the bottoms (when the stairs are unfolded; Fig. 5) of the stringers **(15)** of segments 2 and 3. Each extension hinge has a base plate **(24)** fixed to segment 2 **(12)** and a swivel plate **(26)** fixed to segment 3 **(13).** The distance from the axis of pins **(2)** extension hinges **(23)** to the bottom (when the stairs are unfolded) surfaces of stringers (15) of segments 2 **(12)** and 3 **(13)** is slightly larger than one half of the height of the cross-section of stringers **(15)** in segment 4 **(14).** Because of this design of the extension hinges **(23),** using lower hinges 22 between segments 3 **(13)** and 4 **(14),** segment 4 **(14)** is positioned between segments 2 **(12)** and 3 **(13)** when the stairs are folded (Fig. 1).

[0021] The 4-segment folded stairs have a safety device **(3)** for protection against uncontrolled detachment of segments 2 **(12),** 3 **(13)** and 4 **(14)** from the first segment **(11).** The mechanism is mounted on the extension hinge **(23)** which means that when the stairs are lowered and unfolded the mechanism is positioned near the top end of segment 1 **(11).** The key component of the safety device is the hook **(31)** hinged on the pin **(25)** that is fixed to the extension hinge base plate (24) fixed to segment 2 (12). The pin **(25)** is a bolt driven into the stringer of segment 2 **(12).** There is a bush inserted on the bolt, which acts in two ways: the outer cylindrical surface of the bush provides the axis for the hook **(31)** of the safety device whereas the bush faces transfer the pressure force from the bolt fixing the extension hinge base plate **(24)** to segment 2 (12). The latching surface **(32)** the hook **(31)** operates in combination with the retaining pin **(17)** protruding laterally from the outer surface of the stringer of segment 1 **(11).** When the stairs are folded, there is play between pin **(17)** and the latching surface of the hook **(32)** that facilitates unlatching the hook **(31)** by the user and decelerates uncontrolled movement of segment 2 and the following segments in the event of hard opening the cover with the stairs. On the opposite side of the latching surface **(32),** the hook has an oblique surface **(33)** that facilitates automatic snapping one of the hook **(31)** to the latched position while the segments are folded. Also, the safety device has a spring **(34)** wound onto the pin **(25),** the force of which moves the hook **(31)** to the latched position. In the upper part of the hook **(31)** there is a stop **(35)** that in the extreme position of the hook leans against the head of the bolt **(26)** (invisible in Fig. 2 and 3, visible under the stop in Fig. 6) that fixes the extension hinge base plate **(24)** to segment 2 **(12).**

[0022] The operation of the hook **(31)** is controlled by the unlatching pull rod **(36)** hinged to the hook **(31)** and to the arm **(37)** overlaid on the swivel plate **(27)** of the

extension hinge fixed to segment 3 **(13).** The arm **(37)** and the swivel plate **(27)** are fastened using threaded connectors: bolts **(28)** common for the arm and swivel plate. The unlatching pull rod **(36)** has a longitudinal opening **(38)** for the setting of the headed pin **(39)** in the lateral surface of the hook **(31),** which provides the swivel and sliding joint, whereas the connection between the unlatching pull rod **(36)** and the arm **(37)** is a swivel-only joint based on the pin placed in the round openings of the unlatching pull rod and the arm.

[0023] The whole ladder stairs unit **(1)** is installed in the ceiling, in the frame (4), together with the bottom cover **(5).** The first segment **(11)** is fastened to the cover **(5)** with angular retainers **(51).** A handrail **(52)** is fastened to the cover next to the segment to facilitate walking and improve safety. The cover (5) is coupled with the frame **(4)** with the hinges **(41)** and connectors **(42)** that restrict the cover opening angle. Springs **(43)** installed between the frame **(4)** and the cover **(5)** make it easier to lift the cover **(5)** together with the stairs (1) while storing them in the frame and, on the other hand, reduce the cover and stairs lowering speed. Also, the frame contains a seat **(44)** for the lock keeping the cover **(5)** closed.

[0024] The ladder stairs unit **(1)** has a bottom lock **(6)** for protection against uncontrolled unfolding of segments 3 **(13)** and 4 **(14)** installed on the lower hinge **(22)** coupling the two segments. The bottom lock **(6)** consists of a flat connector **(61)** and two pins **(62),** each installed in one of the lower hinge **(22)** plates. The pins are bolts driven into the stringers of segments 3 **(13)** and 4 **(14).** The pins have outer bushes performing two roles: the outer cylindrical surface of the bush operates in combination with the connector **(61)** of the bottom lock and the facing surfaces of the bushes transfer the pressure force from bolts that fasten the lower hinges **(22)** to the segments. The connector **(61)** has a round opening for mounting on one of the pins **(62)** and a longitudinal opening **(63)** terminated with a lateral recess **(64)** housing the other pin **(62).** The lateral recess has a bearing surface matching the pin. In the example of the bottom lock shown in Figs. 4 and 7, the connector **(61)** has a swivel connection with the pin **(62)** installed in segment 3 **(13)** and the pin **(62)** operating in combination with the longitudinal opening **(63)** is installed in segment 4 **(14).** However, the connector can be installed in the reversed position without affecting the functionality of the lock. The bottom lock has a spring **(65)** wound onto the pin **(62)** with which the connector **(61)** has swivel connection. The spring forces automatic repositioning of the connector to the latched position.

[0025] The stairs shown in Fig. 1 are open and folded, ready for storing in the frame or unfolding for walking. When the stairs are closed, the ladder stairs unit **(1)** is stored within the frame **(4)** and the cover **(5)** closes the bottom opening of the frame. The process of unfolding starts from opening and lowering the cover **(5)** together with the ladder stairs unit **(1).** In the event of hard opening and, consequently, rapid stopping of the cover with the stairs at the position forced by the connectors **(42),** segments 2 **(12),** 3 **(13)** and 4 **(14)** can rebound from the opening stops and rotate on the hinges coupling segments 1 and 2. In such case, the safety device allows slight movement of the second and next segments depending on the play between the latching surface **(32)** the hook **(31)** and the retainer/pin **(17)** protruding laterally from the outer surface of the stringer of segment 1 **(11).** Then, segments 2 **(12),** 3 **(13)** and 4 **(14)** will fall on the first segment (11) under their own weight.

[0026] Also in the case of uncontrolled rebound of segments 3 **(13)** and 4 **(14)** with simultaneous rotation of the segments on the connecting segments 2 and 3, the movement of segments 3 and 4 will be limited to the play longitudinal opening **(38)** of the unlatching pull rod **(36),** without unlocking the hook **(31).** Then, segments 3 and 4 will fall on segment 2 under their own weight.

[0027] To unfold the stairs, the user lifts the bottoms of segments 3 **(13)** and 4 **(14)** while swivelling the segments on the extension hinges **(23).** This will first close the clearance in the longitudinal opening **(38)** of the unlatching pull rod **(36).** Then, if the user continues to lift the two segments, the unlatching pull rod **(36)** will raise the hook **(31),** the latching surface **(32)** of which will be drawn away from the pin **(17)** protruding laterally from segment 1 **(11).** This will unlock and enable the unfolding of the stairs, provided that segments 3 **(13)** and 4 **(14)** held together by the bottom lock **(6)** are moved in such a way that the segments abut one another. In the final unfolding phase the connector **(61)** rotates in the bottom lock **(6)** so that the pin **(62)** operating in combination with the longitudinal opening **(63)** of the connector could exit the lateral recess **(64).** Then the user can unfold segments 3 **(13)** and 4 **(14),** provided that, during the unfolding, pin **(62)** moves in the longitudinal opening (63) of the connector **(61)** of the bottom lock. In folded stairs (Fig. 5) the components of the safety device and the bottom lock are positioned as shown in Figs. 6 and 7, respectively.

[0028] To fold the stairs, the user lifts the bottom section consisting of segments 2 **(12),** 3 **(13)** and 4 **(14),** swivelling them on the extension hinges **(23).** Then, segment 4 **(14)** rotates on the lower hinges **(22),** and folds under segment 3 **(13).** In the final phase of rotation of segment 4 **(14),** the spring-loaded connector (61) of the bottom lock automatically guides the lateral recess **(64)** of its longitudinal opening **(63)** onto the pin **(62)** that, operating in combination with the bearing surface of the recess, binds segments 3 and 4 together. As the folding continues, segment 2 **(12)** rotates on the upper hinges **(21)** and rests on the surface of segment 1 **(11)** and segments 3 **(13)** and 4 **(14)** rotate on the extension hinges **(23),** laying segment 4 on the top of segment 2. In the final phase of folding the segments, the hook **(31)** of the safety device abuts with its oblique surface **(33)** the pin **(17)** protruding laterally from segment 1 **(11)** and then, after overcoming resistance from the spring **(35),** raises on the pin and automatically snaps in with its latching surface **(32)** behind the pin **(17),** thus binding segments

2, 3 and 4 with segment 1. Then, the ladder stairs unit **(1)** retracted to the cover **(5)** is lifted together with the cover on the hinges **(41),** with assistance from the springs **(43),** and stored in the frame **(4).** Then the cover closes the bottom opening of the frame.

[0029] **Example 2.** Ceiling-mounted folded stairs have a ladder stairs unit **(1)** consisting of 4 segments, as in the first real-life example, each segment consisting of two stringers (side beams) and steps. The unit consists of segments 1 **(11),** 2 **(12),** 3 **(13)** and 4 **(14),** shown unfolded and ready for use in Fig. 5. Like in the first real-life example, segments 1 **(11)** and 2 **(12)** are coupled with the upper hinges **(21),** segments 3 **(13)** and 4 **(14)** are coupled with the lower hinges **(22),** and segments 2 **(12)** and 3 **(13)** are joined together with the extension hinges **(23).** When the stairs are folded (Fig. 5), segment 4 **(14)** is positioned between segments 2 **(12)** and 3 **(13).**

[0030] The 4-segment folded stairs have a safety device **(7)** for protection against uncontrolled detachment of segments 2 **(12),** 3 **(13)** and 4 **(14)** from the first segment **(11).** The safety device is installed slightly below the extension hinge **(23),** so, when the stairs are lowered and unfolded, it is positioned near the top end of segment 1 **(11).** The safety device consists of a hook **(71)** fastened to segment 3 **(13),** remaining fixed relative to the segment, and a retainer operating in combination with the hook. The hook has the form of a pin **(17)** protruding laterally from the outer surface of the stringer of segment 1 **(11).** The monolithic hook has a mounting plate **(72)** fastened to segment 3 **(13)** with bolts **(73).** Also, the hook **(71)** has a latching arm **(74)** pointing upwards, parallel to the stringers, that, when the stairs are lowered and unfolded, extends from the bottom beyond the retainer/pin **(17)** protruding laterally from segment 1 **(11).**

[0031] As in the first real-life example, the whole ladder stairs unit **(1)** is installed in the ceiling using the frame **(4)** with the bottom cover **(5).** The first segment **(11)** is fastened to the cover **(5)** with angular retainers (51). The handrail **(52)** is installed next to the segment. The cover **(5)** is coupled with the frame **(4)** with the hinges **(41)** and connectors **(42)** for opening angle restriction and the springs **(43).** The ladder stairs unit **(1)** has a bottom lock **(6)** for protection against uncontrolled separation of segments 3 **(13)** and 4 **(14)** with design and operation identical as in the first real-life example invention.

[0032] The stairs shown in Fig. 8 are open and folded, ready for storing in the frame or unfolding for walking. In the event of hard opening and, consequently, rapid stopping of the cover with the stairs at the position forced by the connectors **(42)** and uncontrolled rebound of segments 2 **(12),** 3 **(13)** and 4 **(14)** with simultaneous rotation on the hinges **(21)** coupling segments 1 and 2, the latching arm **(74)** of the hook will be held by the pin **(17)** protruding laterally from the outer surface segment 1 **(11).** Then, segments 2 **(12)** and the following will fall on segment 1 under their own weight.

[0033] To unfold the stairs, the user needs to lift the bottom section of segments 3 **(13)** and 4 **(14)** while rotating them on the extension hinges **(23).** Then the hook **(71)** will slightly rotate downwards and the latching arm of the hook will dive below the retainer/pin **(17)** in segment 1 **(11).** This enables rotating segment 2 **(12)** on the upper hinges **(21)** and draw the upper part of the segment away from segment 1 **(11).** The further process of unfolding and releasing the bottom lock **(6)** are the same as in the first real-life example.

[0034] The user needs to reverse the foregoing procedure to fold the stairs, only in the final folding phase, just before laying segment 2 **(12)** on the top of segment 1 **(11),** the user needs to lift the bottom end of segments 3 **(13)** and 4 **(14)** so that the latching arm **(74)** of the hook **(71)** passes by the pin **(17)** protruding from segment 1. After resting segments 2 **(12),** 3 **(13)** and 4 **(14)** on segment 1 **(11),** the latching arm **(74)** of the hook **(71)** engages with the pin (17) and performs its safeguarding role.

[0035] **Example 3.** The third real-life example of design are 3-segment stairs. The first segment, cover, frame, segment-cover and cover-frame joints, and segment 2 are identical as in the two foregoing examples. Segments 2 and 3 are joined together with lower hinges: the ones that were used to connect segments 3 and 4 in the foregoing examples.

[0036] The safety device, the same as in the first real-life example, is installed on the lower hinge, also as in the first example, on the coupling of segments 2 and 3. When the stairs are lowered and unfolded, the safety device is positioned near the top end of segment 1. Since there is no segment 4, the stairs have no bottom lock.

[0037] The hook of the safety device is released, while the stairs unfold, by lifting the bottom end of segment 3.

[0038] **Example 4.** The fourth design are 4-segment stairs with most components - specifically the segments, frame, cover, joints and bottom lock - identical as in the first real-life example. The safety device mounted on the extension hinge that couples segments 2 and 3 has a hook that operates in combination with the retainer/pin on segment 1 as in the first real-life example.

[0039] The control of the hook of the safety device is different because this design has a manual control lever hinged to the bottom section of the stringer of segment 3. The control lever is coupled with the hook of the safety device using a pull rod running along the segment. To unfold the stairs, the user places the control level in the "hook released" position. Then, the user unfolds segments by following the same steps as for the stairs deliberated in the first example.

Claims

1. Folded, specifically 4-segmented, stairs, designed for installing in the ceiling, opened downwards, specifically together with the bottom cover of the frame installed in the ceiling, unfolded to the room underneath the ceiling, joined with the frame with a hinged

mechanism and via the cover; containing ladder stair segments joined with hinges installed at the interfaces of subsequent segments at the top or bottom of the stringers of the segments; the first segment positioned, when the stairs are unfolded, at the top of all segments is joined with the second segment with hinges featuring their rotation axis directly near the top surface of the stringers of the two segments, **characterised in that** the hinges have a safety device **(3, 7)** for protection against uncontrolled detachment of at least two last segments from the first segment **(11)** by rotation on the hinges **(21)** positioned, when the stairs are lowered and unfolded, at the bottom of the segments, provided that the safety device has a hook **(31, 71)** that, together with the subassembly containing the first segment **(11)** and, especially, the cover **(5),** joins together the top segment with one of the following segments, provided that the hook is positioned, when the stairs are lowered and unfolded, near the top end of the first segment **(11),** and the hook is unlatched by the user.

2. The stairs according to claim 1, **characterised in that** the hook **(31, 71)** of the safety device **(3, 7)** is unlatched by lifting at least the last segment of the stairs accompanied by it swivel movement on the hinges **(23)** positioned at the top when the stairs are lowered and unfolded.

3. The stairs according claim 1 or 2, **characterised in that** they contain four ladder stair segments, where the fourth segment **(14),** starting from the top, in unfolded stairs, is joined together with the third segment **(13)** with the hinges **(21)** the axis of rotation **(2)** of which is situated at the bottom of the stringers of the two segments and segments 2 **(12)** and 3 **(13)** are joined together with the hinges **(23),** the axis of rotation **(2)** of which is offset from the bottom of the stringers of the two segments by at least one half of the height of the cross-section of the stringers **(15)** of the two segments, referred to in short as "extension hinges", so that when the stairs are folded, the fourth segment **(14)** is positioned between segments 3 **(13)** and 2 **(12),** the latter resting on the first segment **(11),** and the hook (31) of the safety device **(3)** for protection against uncontrolled detachment of the remaining segments from the first segment **(11),** by rotation on the hinges **(21)** joining together segments 1 and 2, is positioned near the extension hinges **(23).**

4. The stairs according to claim 3, **characterised in that** the hook **(31)** of the safety device **(3)** is unlatched by lifting coupled segments 3 **(13)** and 4 **(14)** with a swivelling movement of the two segments on the extension hinges **(23)** and detachment of the hinges **(22)** of segments 3 and 4 from segment 2 **(12).**

5. The stairs according to claims 1, 2, 3 or 4, **characterised in that** the hook **(31)** of the safety device **(3)** is joined together with the second segment with hinges and it is unlocked by the unlatching pull rod **(36)** that is hinged to the hook and one of the following segments, provided that the hook **(31),** beneficially, has oblique surface **(33)** on the opposite of the latching surface **(32)** which facilitates automatic snapping of the hook in the latched position.

6. The stairs according to claims 3 or 4, **characterised in that** the hook **(31)** of the safety device **(3)** is hinged to the base plate **(24)** of the extension hinge **(23),** the base plate fastened to the second segment (12), and unlatched by the pull rod (36) hinged to the hook and to the arm **(37)** fastened to the third segment **(13).**

7. The stairs according to claim 6, **characterised in that** the arm **(37)** connected to the unlatching pull rod **(36),** overlaid on the swivel plate **(27)** of the extension hinge **(23)** fastened to the third segment **(13),** beneficially, using threaded connectors **(28)** common for the arm **(36)** and the swivel plate **(27)** of the extension hinge.

8. The stairs according to claims 5, 6 or 7, **characterised in that** unlatching pull rod **(36)** has a longitudinal opening **(38)** enabling movement of the pin **(39)** set in the component operating in combination with the pull rod, beneficially, on the hook **(31)** of the safety device.

9. The stairs according to claims 1, 2, 3 or 4, **characterised in that** the hook **(71)** of the safety device (7) is fastened to the third (13), beneficially, or a latter segment, remaining fixed relative to the segment.

10. The stairs according to any predicted claims, **characterised in that** retainer in the subassembly containing the first segment **(11)** and, beneficially, the cover **(5),** operating in combination with the hook **(31)** of the safety device **(3)** has the form of a pin **(17)** protruding laterally from the stringer of the first segment **(11),** provided that, beneficially, when the stairs are folded, there should be play between the pin **(17)** and the latching surface **(32)** of the hook.

11. The stairs according to claims 3, 4, 5, 6, 7, 8, 9 or 10, featuring 4 segments, **characterised in that** the interfaces of segments 3 **(13)** and 4 **(14)** have bottom locks (6) that prevent the two segments against uncontrolled spreading apart, each consisting of a flat connector **(61)** hinged to one of the segments and a pin **(62)** set in the other segment, and the connector **(61)** has a longitudinal opening **(63)** terminated with a recess across the opening **(64)** operating in combination with the pin **(62).**

12. The stairs according to claim 11, **characterised in that** the connector **(61)** of the bottom lock abuts the hinge **(22)** joining together segments 3 **(13)** and 4 **(14).**

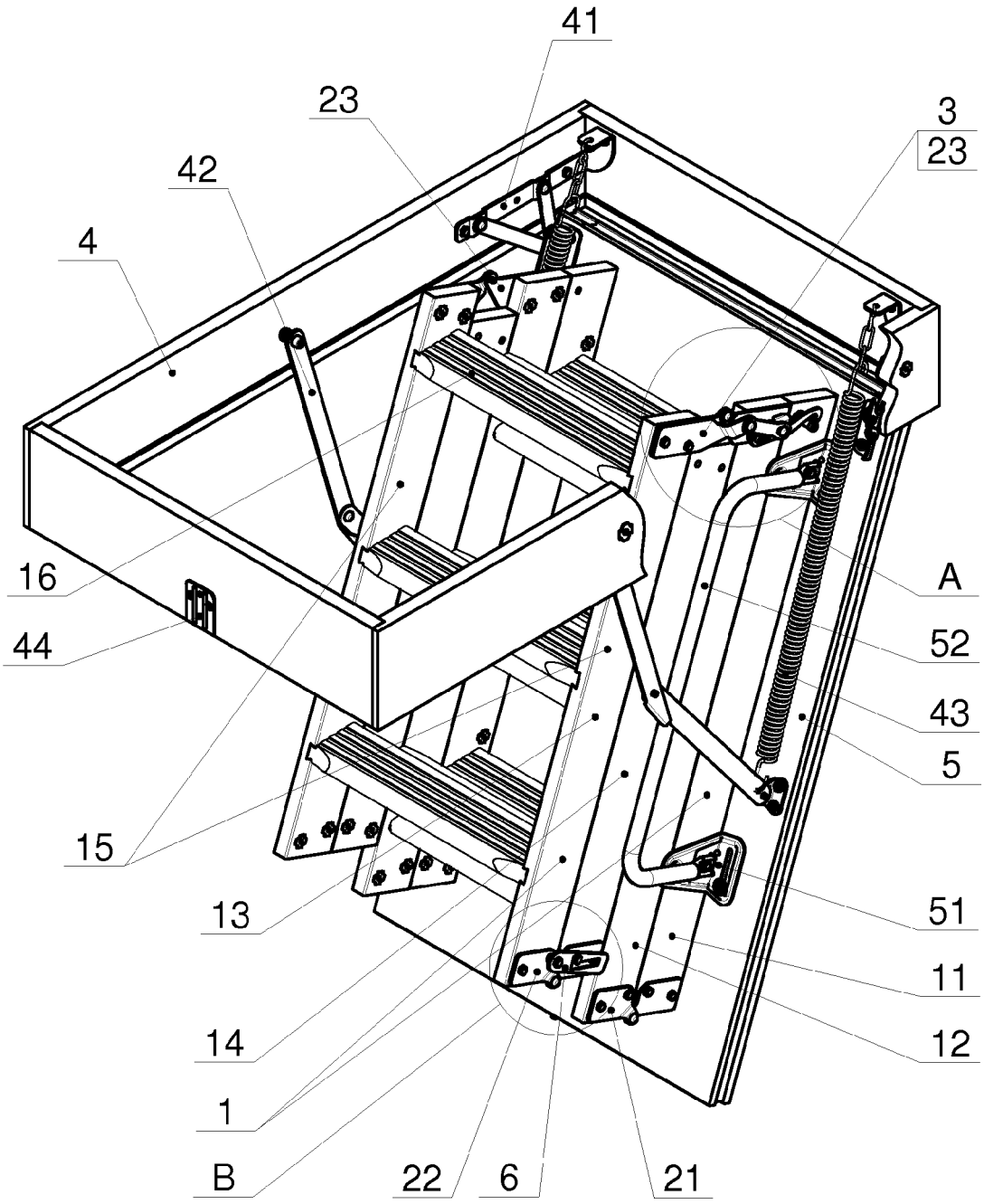

Fig. 1

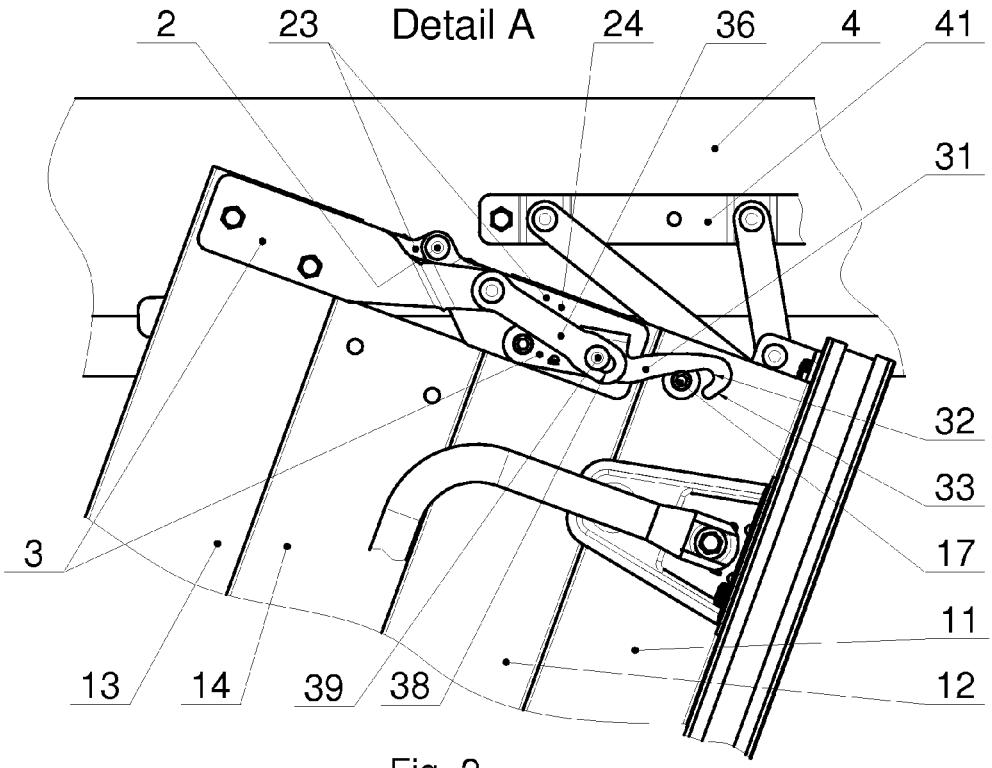
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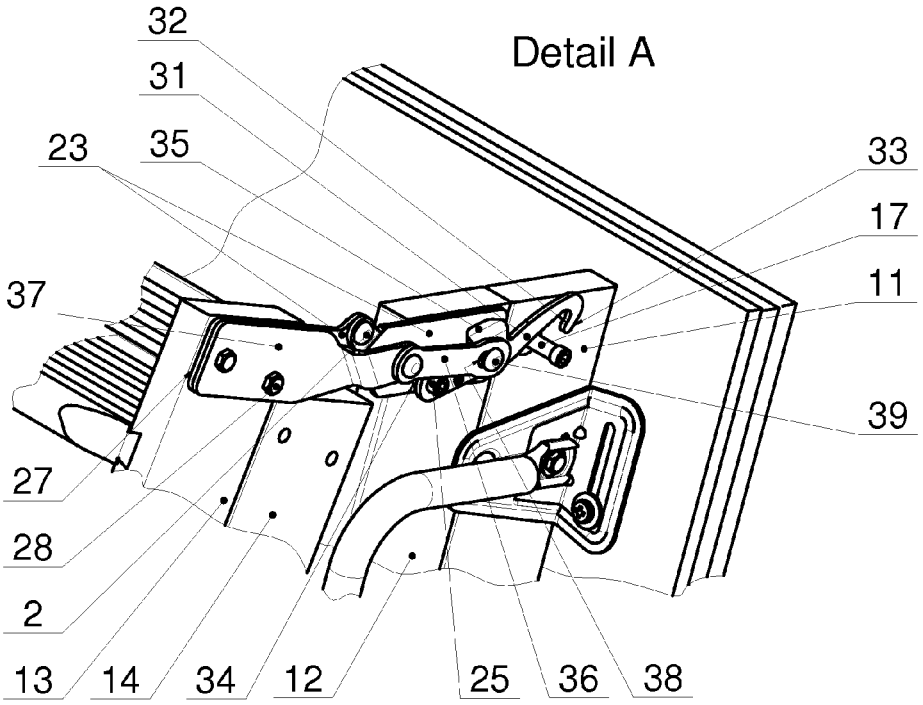
Fig. 2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Detail A
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Fig. 3

Detail B

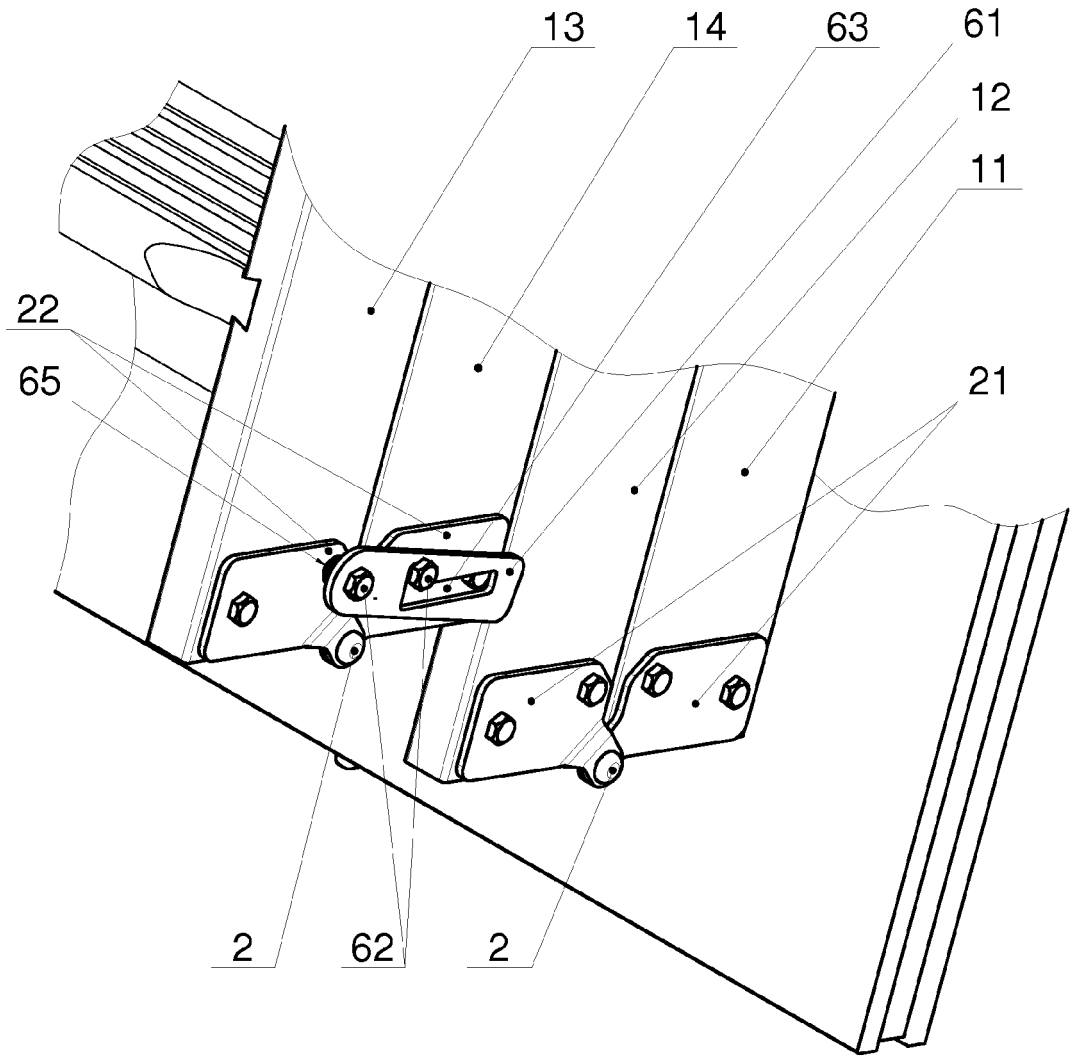

Fig. 4

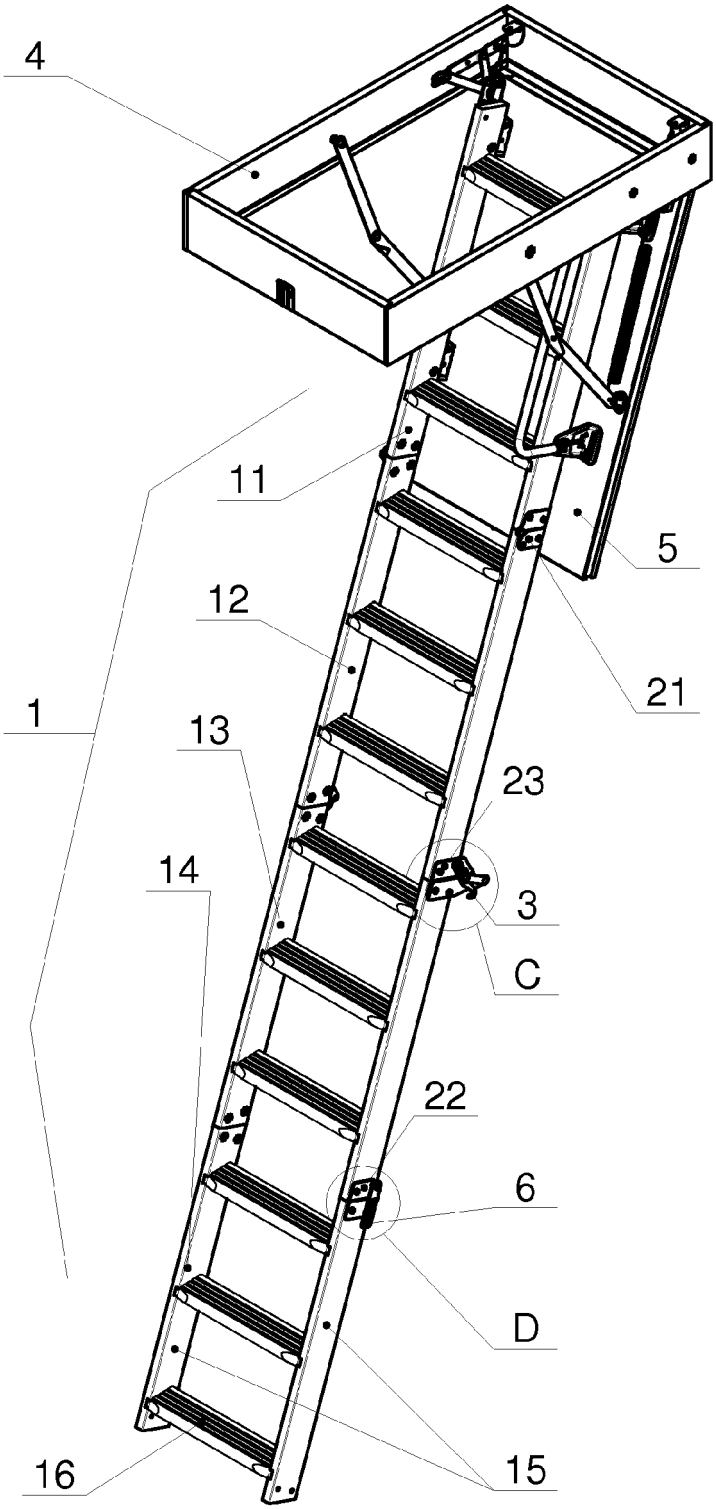

Fig. 5

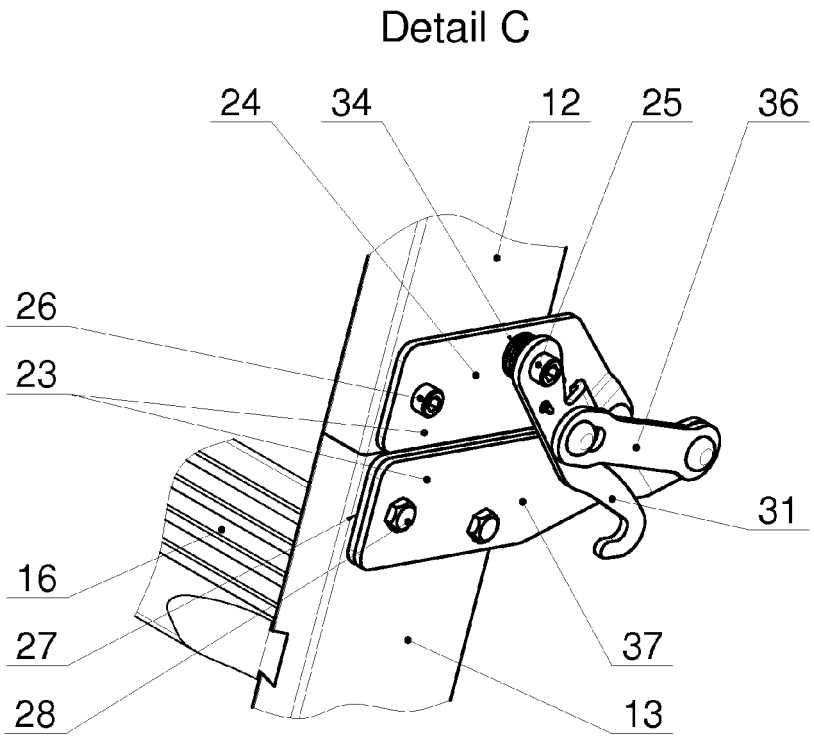
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Fig. 6

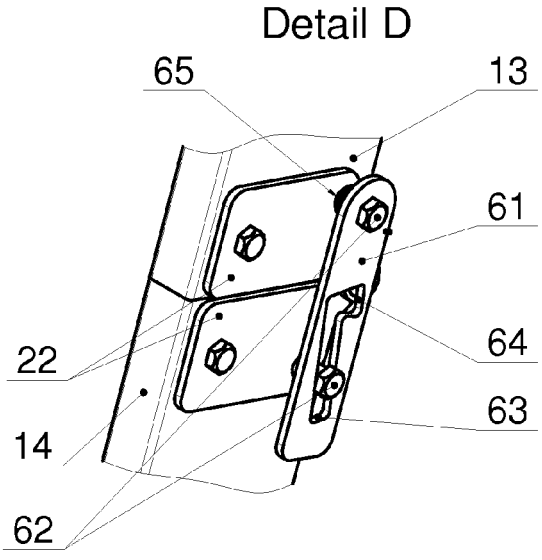
Detail D
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Fig. 7

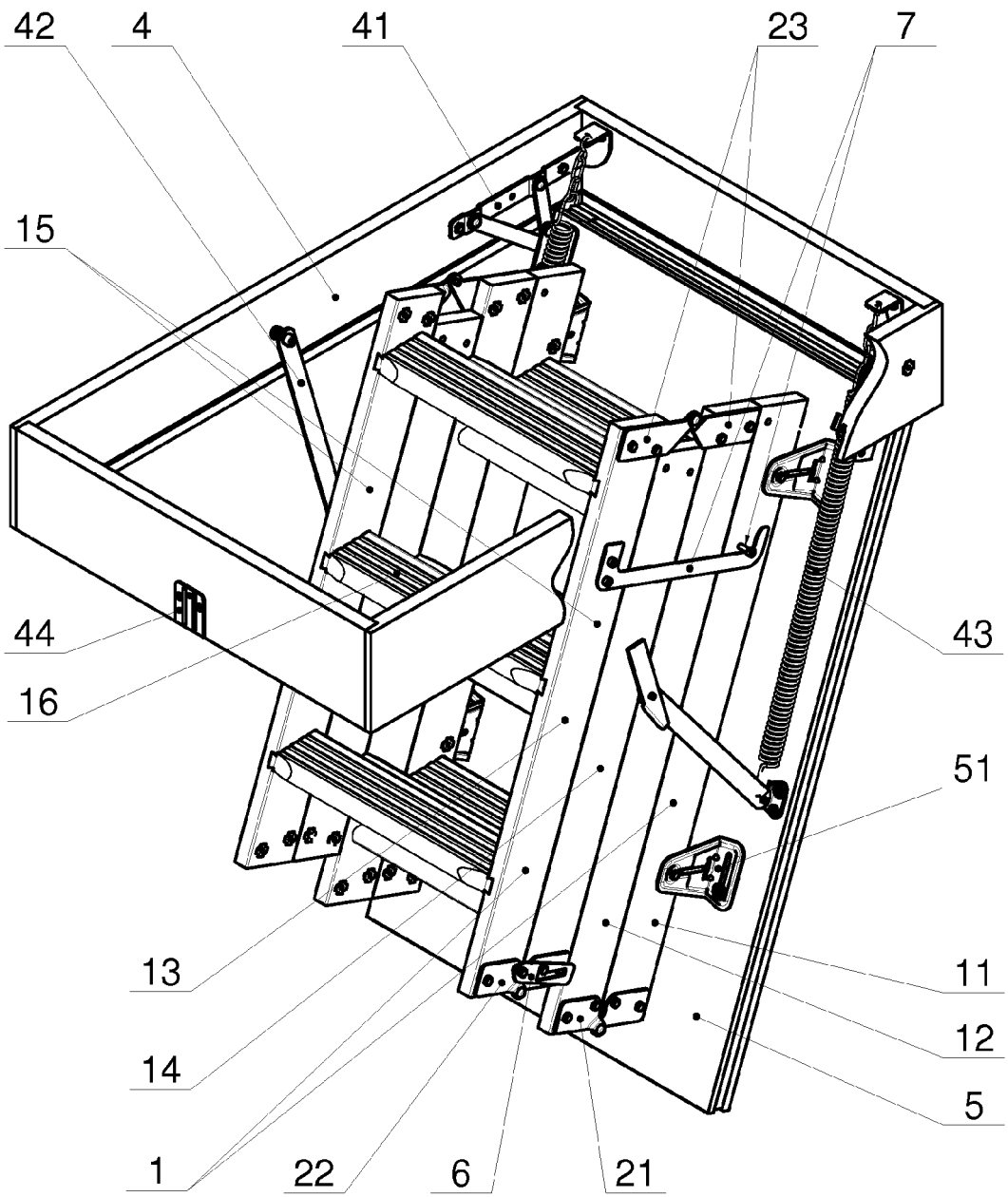

Fig. 8

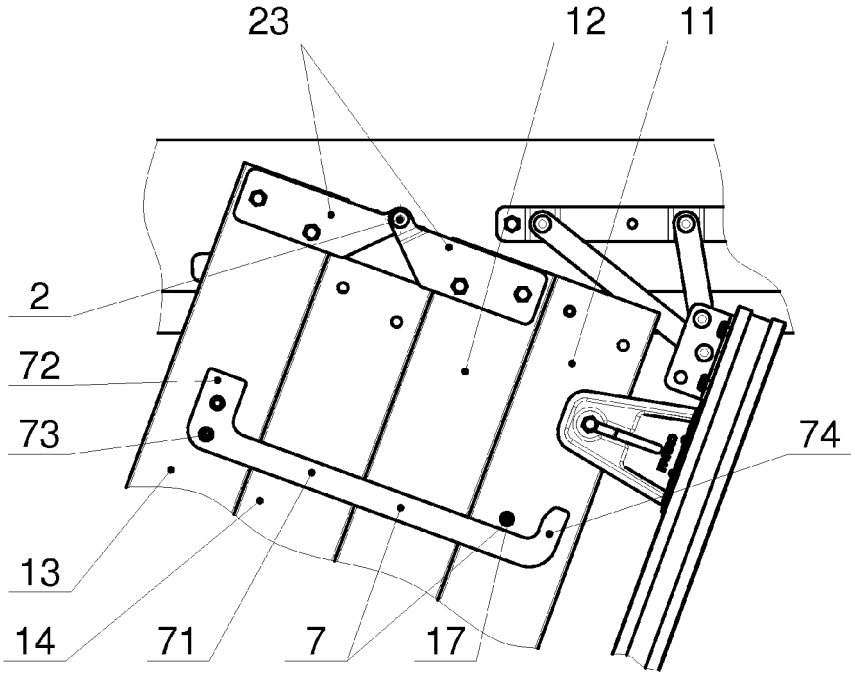

Fig. 9

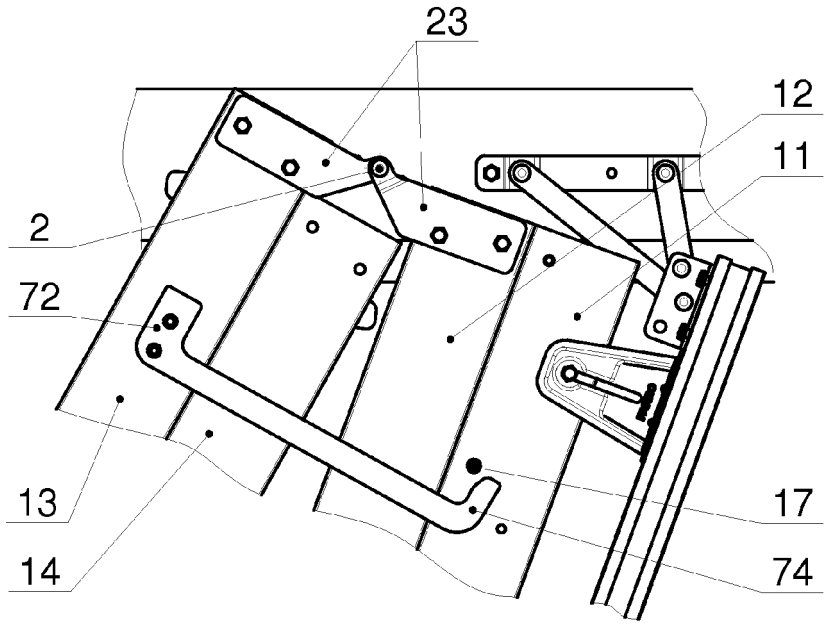

Fig. 10