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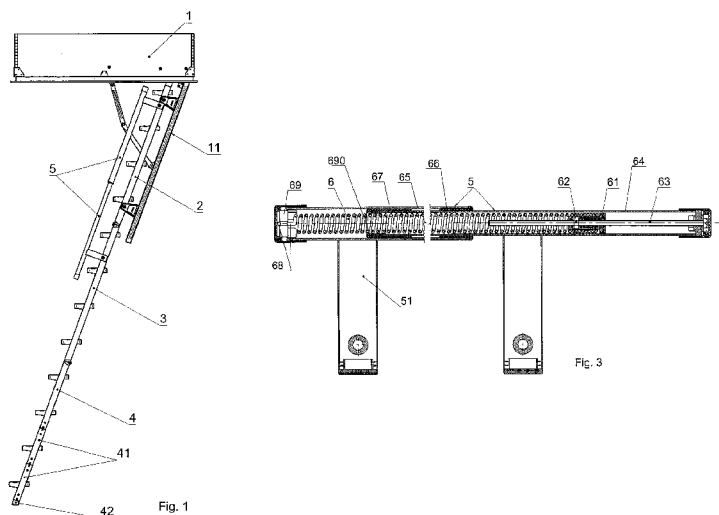
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(54) Title: FOLDABLE STAIRS, IN PARTICULAR METAL FOLDABLE LADDER-LIKE STAIRS



(57) Abstract: The invention relates to a foldable stairs, and in particular to a metal foldable ladder-like stairs, comprising stairs segments (2, 3, 4) moveable with relation to each other, wherein the uppermost segment (2) is rotationally connected with a frame (1) mounted in a ceiling and preferably the uppermost stairs segment (2) is attached to the cover (11) that adheres to said frame (1) in the stairs closed state and is connected with the frame (1) by means of a hinge mechanism and the stairs segments (2, 3, 4) are positioned within the frame (1) in the stairs closed state, where the stairs are preferably provided with a mechanism, preferably a spring mechanism, that supports lifting folded stairs up to the stairs closed state and at least partially counterbalances the weight of the stairs during opening thereof, and further the stairs are provided with at least one handrail arranged in the top part of the stairs flight. In order to facilitate folding and unfolding the stairs and to provide the stairs featuring adjustable length, the stairs comprise a spring (6) that supports lifting up of the stairs segments (3, 4, 7) other than the uppermost segment (2) during folding these segments (3, 4, 7) with the uppermost segment (2) and at least partially counterbalances the weight of these segments (3, 4, 7) during unfolding the stairs, wherein the spring (6) is arranged inside the handrail (5). The bottom segment (4) of the stairs is advantageously provided with means (41, 42) for regulating the length of the bottom segment (4).

FOLDABLE STAIRS, IN PARTICULAR METAL FOLDABLE LADDER-LIKE STAIRS

The present invention relates to foldable stairs, in particular metal foldable ladder-like stairs, embedded in a frame mounted in a ceiling and in a closed state placed in a frame, whereas transforming stairs into the opened state for use consists in
5 unfolding them downwards. Stairs of this kind are used mainly as attic entrances. They may also be used as a foldable ladder having a function similar to stairs but which is usually much steeper than typical stairs.

BACKGROUND OF THE INVENTION

The state of the art discloses foldable ladder-like stairs embedded in a frame
10 mounted in a ceiling. Such known stairs comprise three segments connected with each other by means of hinges. The uppermost segment is arranged on a cover closing a frame of stairs in the closed state. Folding stairs up consists in placing an intermediate segment and a bottom segment on the uppermost segment and lifting
15 up such a folded arrangement. Although these stairs are provided with springs that support lifting folded stairs as a whole along with the cover, they are not provided with an aid for folding the intermediate and the bottom segment in order to place them on the uppermost segment. The lack of this aid is of particular inconvenience in case of metal stairs which are substantially heavier than wooden ones.

SUMMARY OF THE INVENTION

20 The invention provides foldable stairs, in particular metal foldable ladder-like stairs, comprising stairs segments moveable with relation to each other, at least one handrail arranged in the top part of the stairs flight, and a spring that supports lifting the stairs segments other than the uppermost segment up during folding these segments on the uppermost segment and at least partially counterbalances the
25 weight of these segments during opening the stairs. Said spring is arranged inside the handrail. The handrail has preferably a telescopic construction and the posts thereof are connected preferably jointly connected, with two stairs segments. In a case of stairs having segments connected by hinges jointed connections between handrail posts and stairs segments are necessary.

The uppermost segment of the stairs is rotationally connected with a frame mounted in a ceiling. The uppermost segment is preferably attached to a cover that adheres to said frame in the stairs closed state and is connected with the frame by means of a hinge mechanism. The remaining stairs segments are positioned within said frame in the stairs closed state above the uppermost segment. In the opened state of the stairs unfolded for use, the uppermost and remaining segments are arranged in such a manner that their stringers (side beams) run slantwise downwardly wherein the top surfaces (treads) of stairs steps are oriented substantially horizontally. The foldable stairs according to the present invention are provided with a mechanism, advantageously a spring mechanism that supports lifting folded stairs up to the stairs closed state and at least partially counterbalances the weight of the stairs during opening thereof.

According to an embodiment of the present invention, segments of the foldable stairs are connected by means of hinges. The hinges are preferably situated alternately along successive connections on the top and the bottom surfaces of stringers of these segments. The stairs according to this embodiment are in general of a three-segment construction, wherein said telescopic handrail is jointedly connected to the uppermost segment and to the segment neighbouring the uppermost segment. Connections of the telescopic handrail with stairs segments are located in such a manner that in the stairs unfolded, opened state the axis of the hinge connecting the uppermost segment with its neighbouring segment is located above the straight-line between the axes of joints connecting said handrail with these segments. Owing to this in the opened stairs unfolded for use, the spring tightens the stringers of both segments to each other and thus stabilizes rectilinearity of their mutual positioning.

During folding the stairs up, after rotating the segment neighbouring the uppermost segment over the hinge connection by a small angle relative to this segment, the straight-line between the axes of joints connecting the handrail posts with stairs segments shall dislocate above the horizontal axis of the hinge connecting these segments. Consequently the tension of the spring shall act to support lifting up of all the stairs segments adjoining the uppermost segment. On the other hand during unfolding the stairs, the spring arranged in the telescopic handrail counterbalances at least partially the weight of the segments unfolded and when the line between the

axes of joints connecting the handrail with corresponding segments dislocates below the point crossed by the axis of the hinge between the uppermost and its neighbouring segment, the spring shall tighten the stringers of both these segments to each other.

- 5 According to another embodiment of the present invention, foldable stairs are provided with at least one slidable segment. In general such a slidable segment shall be a segment neighbouring the uppermost segment. Obviously further segments may also be slidable relative to neighbouring segments or alternatively they may be connected by means of hinges. Preferably a telescopic handrail with a spring
- 10 supporting lifting up the segments other than the uppermost one at one end should be connected with the uppermost segment and at the other end should be connected with a slidable segment neighbouring the uppermost segment or should be jointedly connected with a subsequent segment connected by hinges with this slidable segment. Obviously in a case where a handrail cooperates only with a slidable
- 15 segment jointed connections between the handrail and the stairs segments are not required.

Preferably according to the invention the spring arranged inside the telescopic handrail is provided with tension regulation, preferably by means of a regulating screw cooperating with a tensioning insert situated inside the coils of the spring. The

20 outer surface of the tensioning insert is advantageously provided with a spiral groove, the shape of which matches the shape of the internal side of coils of the spring. A nut cooperating with the tension regulating screw is arranged inside the tensioning insert.

Moreover the bottom segment of the stairs according to the invention is provided with

25 means for regulating the total length of the stairs in order to adjust the stairs to the height of the room inside of which they are to be installed and unfolded for use.

In one embodiment of such means the bottom segment of the stairs may be advantageously provided with supporting foots that can be slidably projected to extend the length of the bottom segment.

30 Additionally or alternatively the bottom segment may be provided with at least one demountable insert enabling adjustment of the length of this segment. Preferably the

bottom segment is provided with two demountable inserts connected in series. Depending on a desired length of this segment and the stairs as a whole, one or two inserts may be demounted from the segment bottom.

5 In yet another embodiment of such means the bottom segment of the stairs may be advantageously provided with supporting foots of regulated length that can be fixed directly to the bottom segment or to the bottom demountable insert of the bottom segment according to desired length of the bottom segment.

10 Thanks to a spring assisting in lifting stairs segments other than the uppermost segment up, the foldable stairs according to the present invention are much more convenient since they require much less force to be applied while unfolding the stairs than stairs of a typical construction. Arranging the spring inside the handrail improves esthetical shape of the stairs. Providing the bottom segment of the stairs according to the present invention with functionality of adjusting its length enables convenient adjustment of the length of the stairs to the height of an accommodation in which the
15 stairs are to be installed.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is illustrated below with reference to the preferred embodiments thereof that should not be considered in any way as limitative and with reference to the attached drawings on which:

20 Fig. 1 shows a schematic side view of the first embodiment of foldable stairs according to the invention having three segments movable with regard to each other and connected by hinges in the opened state unfolded for use,

Fig. 2 shows a schematic side view of the stairs from Fig. 1 in an intermediate state of folding or unfolding,

25 Fig. 3 shows a schematic sectional side view of an embodiment of a telescopic handrail according to the present invention with a spring that supports folding up the stairs segments, and

Fig. 4 shows another embodiment of the stairs according to the invention having four segments disposed slidably with regard to each other and connected by hinges in
30 the opened state unfolded for use.

Another embodiment of foldable stairs according to the invention has not been depicted on the drawing but is thoroughly described with reference to the common and different features of the embodiments illustrated on drawings.

Embodiment 1

5 A three-segment foldable ladder-like stairs shown in Fig. 1 and 2 comprise a frame 1 embedded in a ceiling of a building. The frame 1 can be closed from the bottom by a cover 11 connected to the frame via a hinge mechanism and a tie rod arrangement that restricts the opening limits of the cover 11. The arrangement connecting the frame 1 with the cover 11 also comprises springs that support lifting the cover 11 up
10 along with folded stairs segments during closing the cover and counterbalance the weight of the cover 2 with the stairs during opening thereof. The uppermost segment 2 of the stairs is fixed on the cover 11 and the intermediate segment 3 of the stairs is connected to the uppermost segment 2 by means of hinges located at top surfaces of stringers (side beams) of these segments. The bottom segment 4 is
15 connected to the intermediate segment 3 by means of hinges located at the bottom surface of stringers of these segments. In the opened state of the stairs unfolded for use, the ends of the stringers of the neighbouring segments 2, 3, 4 adhere to each other preserving their straight-line alignment. During folding up the stairs, the intermediate segment 3 rotates at its hinges until it rests on the uppermost 2
20 segment whereas the bottom 4 segment rotates at its hinges until it rests on the intermediate segment 3. Subsequently the segments 2, 3, 4 are lifted up together along with the cover and hidden within the frame 1.

The stairs are provided with a telescopic handrail 5 which is connected by hinges to the uppermost segment 2 and to the intermediate segment 3 of the stairs by means
25 of its posts 51. The handrail is located on the external side of stringers of both these segments 2, 3 and is jointedly connected at the external surfaces of the stringers. The stairs may also have two such handrails mounted on both sides of the stairs segments.

The telescopic handrail comprises two concentric pipes 64, 65 of circular cross-section (cf. Fig. 3). In the area of relative displacement of the pipes with regard to
30 each other, the external pipe 65 is terminated with a sleeve 66 disposed inside the

external pipe and having an external flange, while the internal pipe 64 is terminated with a sleeve 67 having an internal flange. Position of the sleeve 67 relatively to the internal pipe 64 is defined by means of resilient pins projected radially to the interior of the sleeve 67 and inserted into openings formed in the wall of the internal pipe 64.

5 Both sleeves 66, 67 are preferably made of plastic.

In the interior of the telescopic handrail a pull spring 6 is arranged. The spring supports lifting up the intermediate segment 3 and the bottom segment 4 while they are folded together on the uppermost segment 2 and at least partially counterbalances the weight of these segments while unfolding the stairs. The spring is especially useful for metal stairs which are heavier than wooden ones. On one end, the spring 6 is provided with a lug 68 hooked on a transverse pin 69 fixed in the external pipe 65, whereas on the other end of the spring 6 a tensioning insert 61 is arranged internally between the spring coils. The outer surface of the tensioning insert 61 is provided with a spiral groove, the shape of which matches the shape of the internal side of the coils of the spring 6 in its untensioned state (thus also matches the pitch of the spring in its untensioned state), wherein a nut 62 cooperating with a tension regulating screw 63 is arranged inside the tensioning insert 61. A sleeve 67 mounted on the end of the internal pipe 64 has an internal collar 690 with an opening having a diameter slightly smaller than internal diameter of the pipe 64, so the collar 690 serves as an additional guiding element for the spring 6. The opening of the sleeve 67 at the frontal side of the collar 690 is cone-shaped what facilitates introducing spring coils therein.

Connection of the telescopic handrail 5 with the uppermost segment 2 and the intermediate segment 3 is envisaged in such a manner that in the opened stairs the axis of the hinge connecting these two segments is located above the straight-line running through the axes of joints connecting the handrail with these segments. Owing to this in unfolded stairs, the spring 6 tightens stringers of these segments to each other stabilizing their position.

The bottom segment 4 of the stairs is terminated with two demountable inserts 41 connected in series, wherein the bottom insert is provided with supporting feet 42 provided with means for regulating the length of their projection from this segment. The regulation range amounts approximately the length of the insert 41. Such a

construction enables for adjusting the length of the stairs according to the height of the room they are installed. Regulation is realized by projecting the supporting foot 42 for a desired length and if necessary also by demounting one or two inserts 41 and connecting the supporting foot 42 directly with the remaining part of the stairs.

5 Embodiment 2

A four-segment foldable ladder-like stairs shown in Fig. 4 comprise a frame 1 embedded in a ceiling of a building. From the bottom the frame 1 can be closed by a cover 11 connected to the frame via a hinge mechanism and a tie rod arrangement—similarly to that of Embodiment 1. The uppermost segment 2a of the stairs is fixed on
10 the cover 11. An intermediate segment 7 is slidably connected to the segment 2a, while the intermediate segment 7 and subsequent segments: an intermediate segment 8 and a bottom segment 4a are connected with each other by means of hinges.

An intermediate segment 8 is connected to the slidable segment 7 by means of
15 hinges located at the top surface of the stringers of these segments 7, 8, and the bottom segment 4a is connected to the intermediate segment 7 by means of hinges located at the bottom surface of stringers of these segments 4a, 7. In the opened stairs unfolded for use, the ends of the stringers of the neighbouring intermediate segments 7, 8 and 4a, adhere to each other preserving their straight-line alignment.

20 The stairs are also provided with a telescopic handrail 5 connecting the uppermost segment 2a with the slidably disposed intermediate segment 7. The handrail 5 is arranged on the outer side of the stringers of these two segments of the stairs and is fixed to the outer surface of the stringers by means of two handrail posts. The stairs may obviously have two or more of such handrails on both sides thereof and/or
25 handrails fixed to other segments (for example to the uppermost segment 2a and to the intermediate segment 8). In the interior of the handrail a spring, similar to the spring of the Embodiment 1, is arranged and provided with tension regulation functionality.

When the stairs are folded one should displace the slidable segment 7 upwards
30 along the length of the uppermost segment 2a, which action is supported by the pull spring arranged inside of the telescopic handrail 5. Then one should rotate the

intermediate segment 8 on its hinges until it settles down on the slidable segment 7 and at the same time one should rotate the bottom segment 4a on its hinges until it settles down on the intermediate segment 8. Subsequently one should lift all the segments up along with the cover 11 in order to hide the stairs inside the frame 1.

5 Embodiment 3

Similarly as in the Embodiment 1 foldable ladder-like stairs comprise a frame embedded in a ceiling of a building, which can be closed by a cover connected to the frame via a hinge mechanism and a tie rod arrangement with springs. A set of ladder-like segments, a system of hinge connections between the segments and a
10 method of unfolding and folding the segments remain the same as in the Embodiment 1.

In this embodiment a telescopic handrail has a slightly different construction and comprises two C-shaped profiles, where the internal profile is slidably disposed in the external profile in a manner that enables for telescopic projecting the internal profile
15 out from the external profile. The flanges (end parts of arms) of the external profile are bent enabling for safely guiding the internal profile.

Each profile is provided at its end cooperating with the other profile with a plastic material welt, which facilitates mutual sliding of the profiles with regard to each other. Moreover both profiles are oriented with their central web sections at the top. Inside
20 the profiles accessible from below a tensioning spring is arranged. Similarly as in previous Embodiments 1 and 2 the spring supports lifting up all the intermediate segments and the bottom segment of the stairs while they are folded on the uppermost segment, and at least partially counterbalances the weight of these segments while unfolding the segments.

At both its ends the spring is terminated with lugs and is mounted in the interior of
25 the handrail by means of transverse pins. The handrail is provided with several sockets for these pins enabling for regulation of the spring tension, wherein distribution of these sockets is different for each end of the spring (and the handrail), thus increasing capabilities for choosing regulation distances. Each profile is
30 provided with a post fixedly connected to the profile and jointedly connected to the

corresponding segment of the stairs, wherein obviously each profile is connected with a different segment.

Patent claims

1. Foldable stairs, in particular metal foldable ladder-like stairs, comprising stairs segments moveable with relation to each other, wherein the uppermost segment is rotationally connected with a frame mounted in a ceiling and preferably the uppermost stairs segment is attached to the cover that adheres to said frame in the stairs closed state and is connected with the frame by means of a hinge mechanism and the stairs segments are positioned within said frame in the stairs closed state, where the stairs are preferably provided with a mechanism, preferably a spring mechanism, that supports lifting folded stairs up to the stairs closed state and at least partially counterbalances the weight of the stairs during opening thereof, and further the stairs are provided with at least one handrail arranged in the top part of the stairs flight, characterized in that, the stairs comprise a spring (6) that supports lifting up of the stairs segments (3, 4, 7, 8) other than the uppermost segment (2) during folding these segments (3, 4, 7, 8) with the uppermost segment (2) and at least partially counterbalances the weight of these segments (3, 4, 7, 8) during unfolding the stairs, wherein the spring (6) is arranged inside the handrail (5).
2. The foldable stairs according to claim 1, characterized in that said handrail (5) has a telescopic construction and the posts (51) thereof are connected, preferably jointly connected, with two stairs segments (2, 3; 2, 7).
3. The foldable stairs according to claim 1 or 2, characterized in that stairs segments (2, 3, 4; 7, 8, 4a) are connected by means of hinges, preferably situated alternately along successive connections on the top and the bottom surfaces of stringers of these segments, wherein said telescopic handrail (5) is jointly connected to the uppermost segment (2) and to the segment (3, 7) neighbouring the uppermost segment (2).
4. The foldable stairs according to claim 3, characterized in that in the stairs unfolded, opened state the axis of the hinge connecting the uppermost segment with its neighbouring segment is located above the straight-line between the axes of joints connecting said handrail with these segments.

5. The foldable stairs according to claim 1 or 2, characterized in that the stairs are provided with at least one slidable segment (7) and preferably the segment (7) neighbouring the uppermost segment (2a) is disposed slidably with regard to the uppermost segment (2a).
- 5 6. The foldable stairs according to any one of claims 1-5, characterized in that said spring (6) is provided with tension regulation, preferably by means of a regulating screw (63) cooperating with a tensioning insert (61) situated inside the coils of the spring (6).
- 10 7. The foldable stairs according to claim 6, characterized in that the outer surface of the tensioning insert (61) is provided with a spiral groove, the shape of which matches the shape of the internal side of coils of the spring (6), wherein a nut (62) cooperating with the tension regulating screw (63) is arranged inside the tensioning insert (61).
- 15 8. The foldable stairs according to any one of claims 1-7, characterized in that the bottom stairs segment (4) of the stairs is provided with supporting feet (42) that can be slidably projected to extend the length of the bottom segment (4).
- 20 9. The foldable stairs according to any one of claims 1-8, characterized in that the bottom stairs segment (4) is provided with at least one demountable insert (41) enabling adjustment of the length of this segment (4), and preferably the bottom segment (4) is provided with two demountable inserts (41) connected in inserts.
- 25 10. The foldable stairs according to claim 1-9, characterized in that the bottom stairs segment (4) is provided with supporting feet of regulated length that can be fixed directly to the bottom segment (4) or to the bottom demountable insert (41) of the bottom segment (4) according to desired length of the bottom segment.

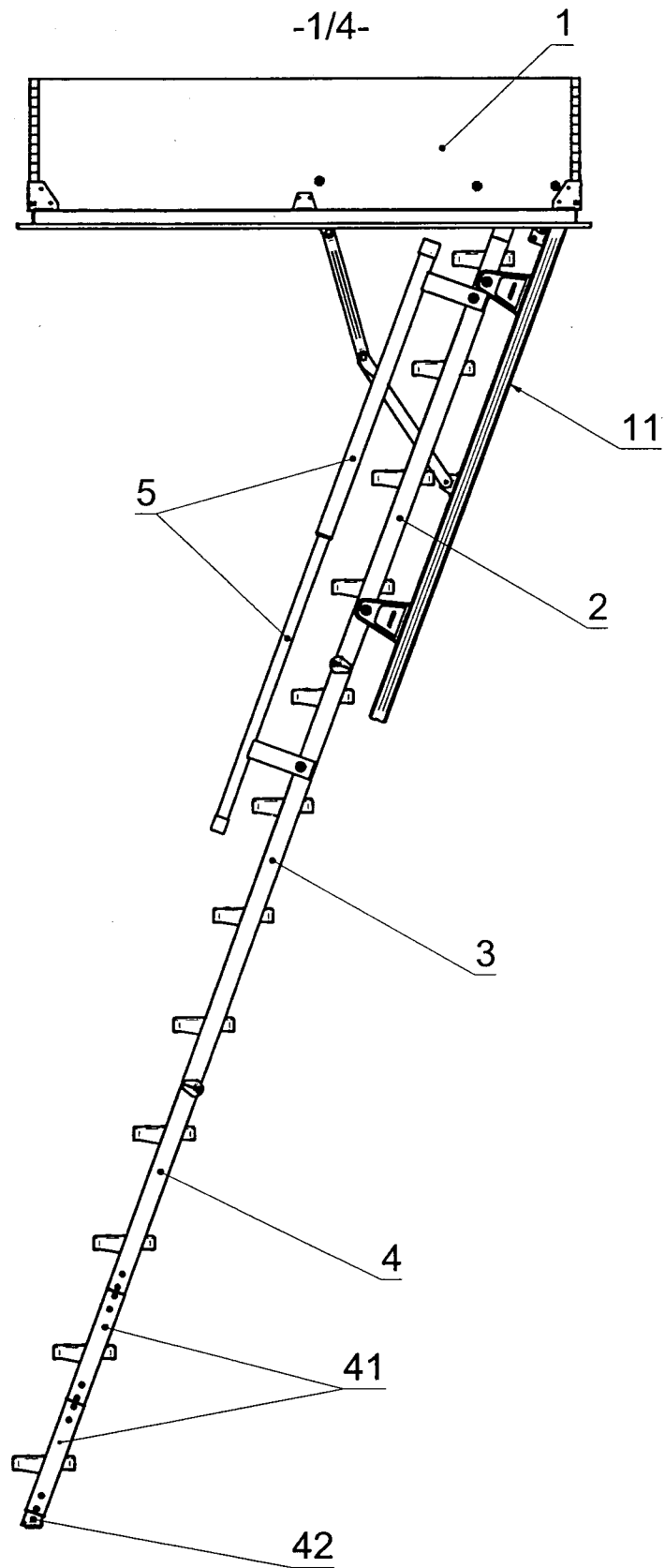


Fig. 1

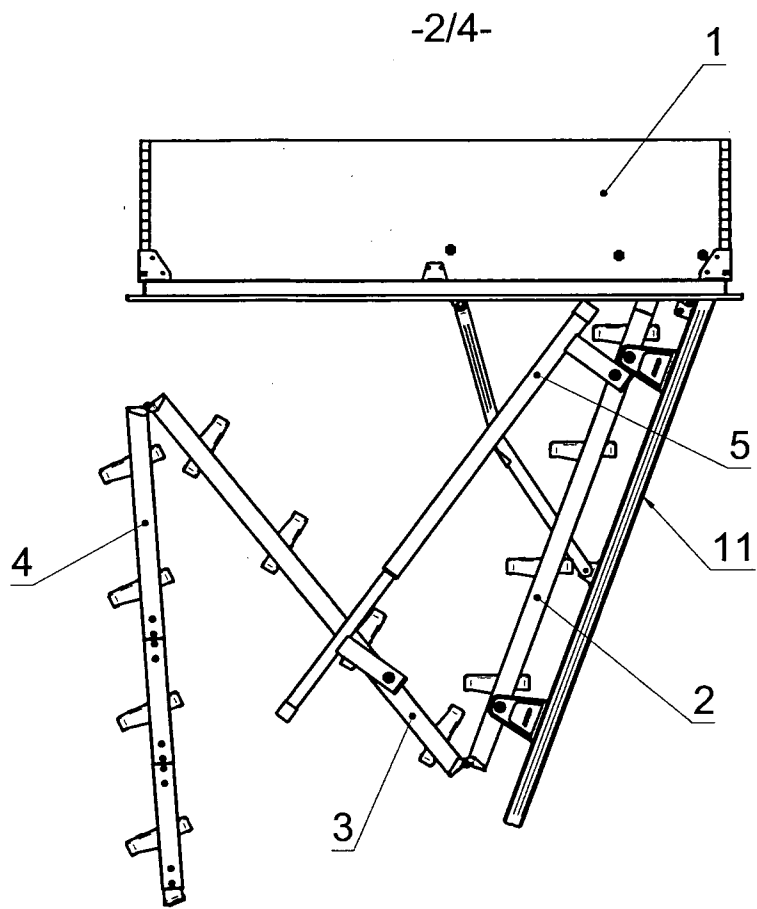


Fig. 2

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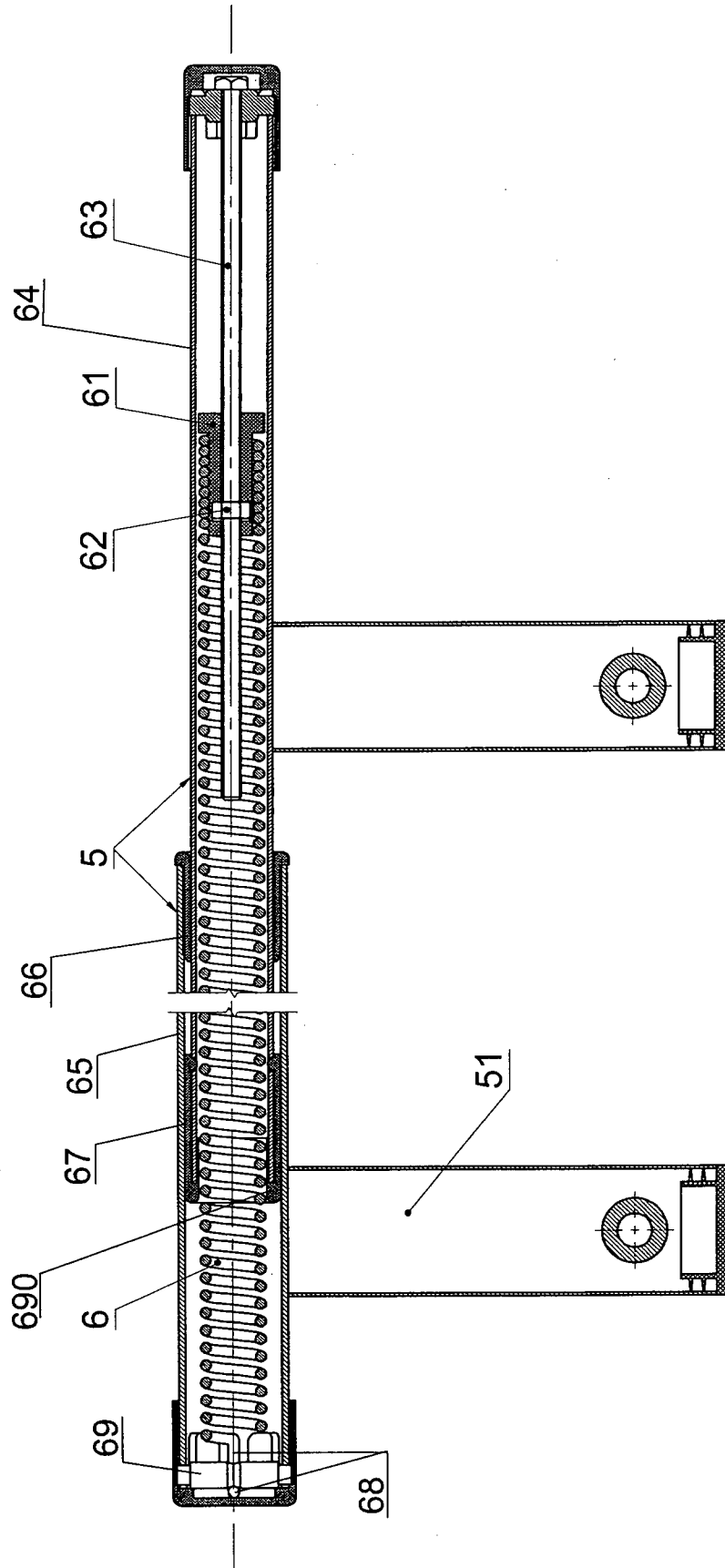


Fig. 3

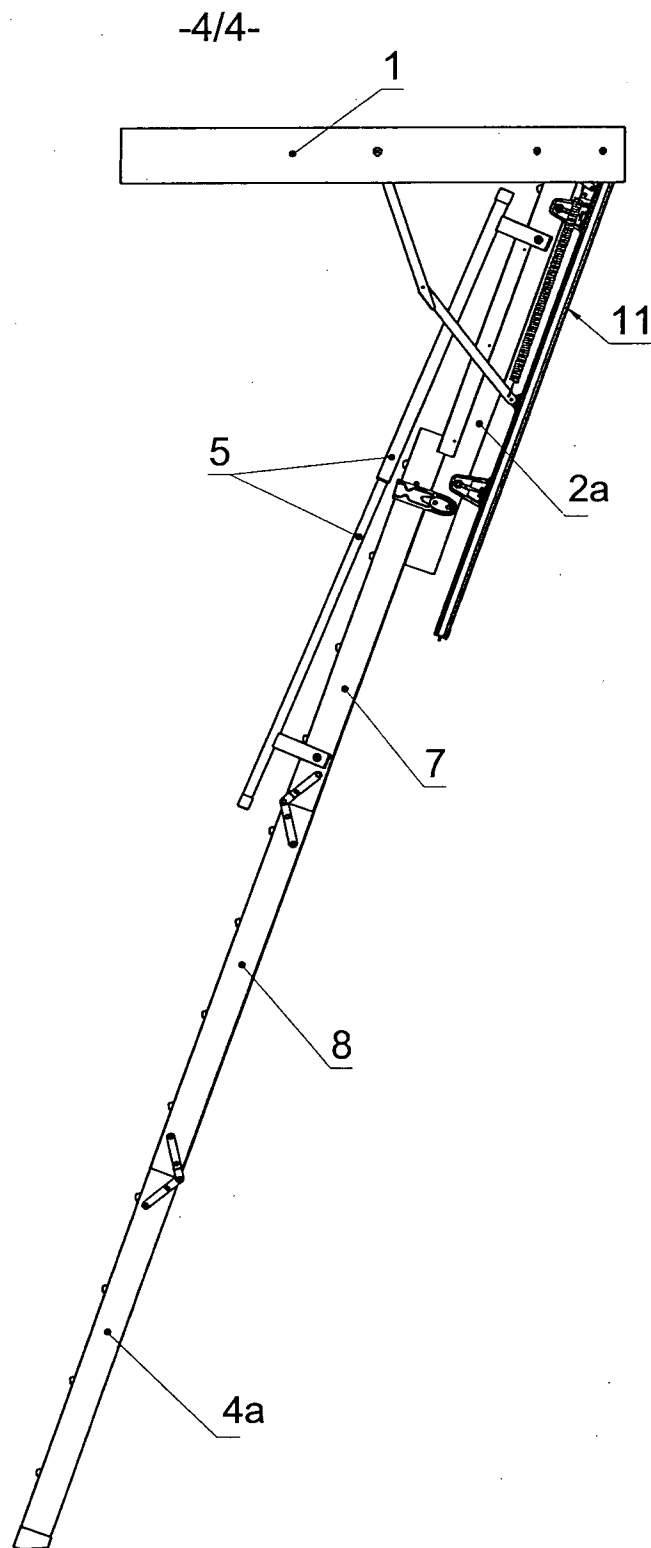


Fig. 4