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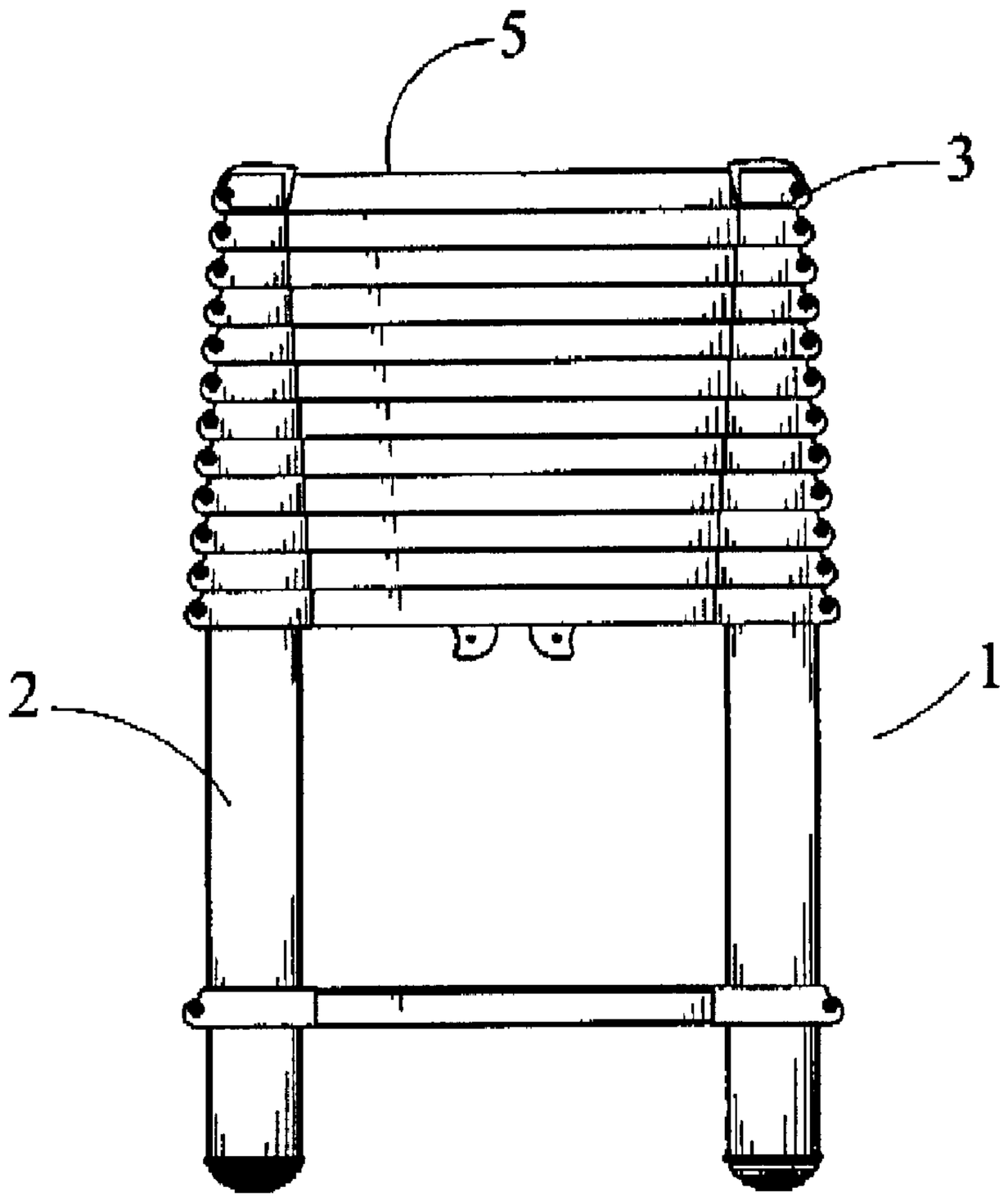
(54) Title: AN EXTENSION LADDER WITH IMPROVED MECHANISM



(57) Abrégé/Abstract:
An extension ladder with improved mechanism includes a plurality of ladder sections, connection kits, locking mechanism, and transverse step portions; wherein each ladder section is a hollow rung, and the caliber of the rung becomes smaller when it is in a

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(57) Abrégé(suite)/Abstract(continued):
higher location. The upper ladder section and lower ladder section can be interconnected and fit with each other, and said connection kits are horizontally provided in the upper end of said ladder section. The internal part of said connection kit is provided with a locking mechanism to snap-fit into a through hole of said ladder section to secure the extension between each ladder section, and the outside of said locking mechanism is covered by the transverse step portion. By the improved locking mechanism, the extension ladder can be assembled easily and firmly for providing superior safety to people, even when an external force is applied.

ABSTRACT OF THE DISCLOSURE

An extension ladder with improved mechanism includes a plurality of ladder sections, connection kits, locking mechanism, and transverse step portions; wherein each ladder section is a hollow rung, and the caliber of the rung becomes smaller when it is in a higher location. The upper ladder section and lower ladder section can be interconnected and fit with each other, and said connection kits are horizontally provided in the upper end of said ladder section. The internal part of said connection kit is provided with a locking mechanism to snap-fit into a through hole of said ladder section to secure the extension between each ladder section, and the outside of said locking mechanism is covered by the transverse step portion. By the improved locking mechanism, the extension ladder can be assembled easily and firmly for providing superior safety to people, even when an external force is applied.

AN EXTENSION LADDER WITH IMPROVED MECHANISM

BACKGROUND OF THE INVENTION

Field of the invention

The present invention relates to an extension ladder, and more particularly to an extension ladder, which can be assembled easily and firmly for providing superior safety to people.

Description of the Prior Art

It is noticed that stepladders have become a requisite tool for casual use. For example, climbing tools such as a ladder or scaffolding enable people to readily process construction or obtain objects at a high place.

A conventional stepladder 800, as shown in FIG. 1, is assembled by two ladder units having a pair of footpads respectively installed at the lower end of the ladder section 811 to prevent slippage, and is provided with parallel spaced step plates 821 therein. The stepladder appears as an A-frame ladder during usage.

Stepladders are typically large and bulky; therefore, it is uneasy and inconvenient to carry them. Moreover, the storage of a folded stepladder may occupy a large space, which makes the use of a stepladder inflexible.

Accordingly, the present invention has been invented to solve the above-mentioned problems occurred in the prior art.

SUMMARY OF THE INVENTION

Therefore, an object of the present invention is to provide an extension

ladder with improved structure, which is composed of multi-segment ladder sections, connection kits, locking mechanisms, and transverse step portions, providing ease and convenience to fold and take along, store, or unfold and use.

According to one aspect of the invention there is provided an extension ladder with improved mechanism comprising: a plurality of ladder sections, connection kits, a locking mechanism, and transverse step beams, wherein each ladder section is a hollow rung having different caliber, which can be interconnected by fitting into each other and pulled and extended; its upper end is horizontally provided with a connection kit, while the inside of said connection kit is provided with a locking mechanism covered by said transverse step portion;

wherein said locking mechanism includes a locking bar which passes through said ladder section, on the locking bar, there are a pair of mounting grooves forming sectional shafts; one of said mounting grooves is mounted with a pair of separate arms of a turning key, the other one is mounted with a pair of separate feet of a passive key, while one end of said turning key and passive key has respectively a pair of locking pawls extruded outward on the side surfaces of said turning key and passive key, such that when said locking bar moves to and fro, said turning key and passive key rotate by using said locking pawl as an axial center, the one end of said passive key is installed with a pushing plate, and when said locking bar moves out of said ladder section, said pushing plate then extends outward to push said turning key inside an upper connection kit and then the locking mechanism becomes unlocked.

According to the extension ladder described in detail herein below, the locking mechanism has further improvements, such that after the extension ladder is extended for people's uses, the ladder would not become loose and cause danger. So as to confirm user's security, this is the second object of present invention.

In the extension ladder described in detail herein below, the connection kits and hollow rungs are locked in place, and then stuck and fastened. This prevents these components from becoming loose and becoming disattached, which serves as another object of the present invention.

According to the extension ladder described in detail herein below, the locking mechanism provided inside the connection kits are wrapped by transverse step beams, and can avoid the damage of rust, which serves as a further object of the present invention.

The detailed structure, application principle, function, and effects of the present invention will be more apparent from the following descriptions taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a three-dimensional view of a conventional extension ladder;

FIG. 2 is a front view showing the present invention before use;

FIG. 3 is a front view showing the present invention that has been extended for use;

FIG. 3A is a sectional view showing the magnified "A" portion of FIG. 3.

FIG. 4 is a three-dimensional exploded view showing the first ladder section and transverse step beam of the present invention;

FIG. 5 is a three-dimensional exploded view showing the ladder section and transverse step beam in the present invention except for the first ladder section;

FIG. 6 is a three-dimensional assembly view showing the assembly of the construction of the ladder section and the transverse step beam of the present invention;

FIG. 7 is a sectional view showing the assembly of the construction of the ladder section and the transverse step beam of the present invention; and

FIG. 8 is a sectional view showing the embodiment of present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The extension ladder with improved structure of the present invention, as shown in FIG. 2, wherein the extension ladder 1 is foldable, or unfoldable as shown in FIG. 3, includes a plurality of ladder sections, connection kits 3, and transverse step beams 5. The stepladder appears as a rising ladder when it is unfolded and used, and can be folded by fitting the ladder sections with different calibers one to another.

Referring to FIGs. 4, 5, and 6, such a ladder section 2 fits each other by providing a similar-shaped but smaller internal ladder section 2a. Said telescopic-shaped ladder section 2 is provided with a snap-fit hole 21 and an orientation hole 22 on its upper end, and is provided with a through hole 23 on its lower end. Also, an outward extruded blocking ring 25 is provided on

the upper end of said through hole 23 at a proper height, and on the surface of said ladder section 2, an inward protruding furrow ring 26 which is extruded inward to the interior of the ladder section 2, is formed at a position properly apart from said outward blocking ring 25. (Please refer to FIG. 3.).

The connection kit 3 has a ringlike covering part 31, and a pivotal joint 32. Said ringlike covering part 31 is horizontally provided on the upper end of the ladder section, and affixed to the ladder section by fastening a screw 33 therein. A plurality of orientation tenons 34 are provided on the inside of said connection kit for engaging with the snap-fit hole 21 of said ladder section, so that the connection kit can be assembled with the ladder section quickly. Also, the inside wall of said connection kit is provided with an adhesive channel 35, wherein the adhesive is infused into an adhesive-infusing hole 36 on its one end so that the connection kit can be firmly adhered to the ladder section 2. Moreover, a through hole 30 is provided in the connection kit for interconnection with the internal channel 37 of said pivotal joint 32.

Said pivotal joint 32 is integrally molded with the ringlike covering part 31, and comprises two vertical side plates 321, 322 having a channel 37 between them, so as to hold a locking mechanism . On the inner surface of the vertical side plates 321, 322, there are a pair of opposite vertical grooves 38 and two concavities 391, 392, wherein said vertical grooves 38 are formed at the position near the end of the side plates 321, 322; and one of said concavities 391 is formed on each of the upper edge of said side plates 321, 322, while the other concavity 392 is formed on each of the lower edges of said side plates 321, 322.

The locking mechanism comprises a base locking construction 4a and a

plurality of upper locking constructions 4b. As shown in FIG. 5, each of the upper locking constructions 4b includes a locking gate 41, a locking bar 42, a spring 43, a turning key 44 and a passive key 45; wherein, said locking gate 41 has a fixing plate 410 for inserting into the vertical grooves 38 formed in said plates 321, 322, and at the center of the fixing plate 410, there is a sleeve 413 having an open end facing said through hole 30.

Said locking bar 42 is a cylindric rod, its one end passes through said through hole 30 and said orientation hole 22 formed in said ladder section 2, while the other end can be inserted into said sleeve 413. The spring 43 is installed between said locking bar 42 and said sleeve 413, and said locking bar 42 returns to its original position by the force of spring 43. On the locking bar 42, there are two mounting grooves to form sectional shafts 421, 422 having radii smaller than that of locking bar 42.

Said turning key 44 is formed with a first panel 441 and a second panel 442 being connected in V shape. The upper end of the first panel 441 is formed with a pair of separate arms 443. The space between the separate arms 443 can be used for mounting with the sectional shaft 422 of said locking bar 42. The connection portion of said first panel 441 and second panel 442 is formed with a pair of locking pawls 444 extruded outward from side surfaces. By mounting the locking pawls 444 into said concavity 392 formed in the side plates 321, 322 of said ringlike covering part 31, then when the second panel 442 of said turning rod 44 is pushed upward from the lower position, the locking bar 42 can be moved to and fro by using the locking pawl 444 as an axis.

Said passive key 45 has a pushing plate 451 having locking pawls 452

extruded outward from its side ends. Similarly, the locking pawls 452 can be mounted into said concavities 391, 392 formed in the side plates 321, 322 of said ringlike covering part 31. In addition, the lower end of said pushing plate 451 is formed with a pair of separate feet 453. The space between the separate feet 453 can be used for mounting with the section shaft 421 of said locking bar 42. When the locking bar 42 is horizontally removed, the passive key 45 can swing to 90 degrees, such that the pushing plate 451 becomes perpendicular to the side plates 321, 322.

When the upper locking construction 4b is installed in the pivotal joint 32, the transverse step beam 5 is provided on the outside of said pivotal joint 32. On the lower face of said transverse step beam 5, there is a hole 51 formed at a position opposite to the second panel 442 of said turning key 44, while a second hole 52 is formed at a position opposite to the said passive key 45, so as to let said pushing plate 451 protrude upward.

Referring to FIG. 4, the base locking construction 4a has a spring 43, a turning key 44 and a passive key 45 which are identical in structure of the same elements of said upper locking construction 4b. The structures of the spring 43, the turning key 44 and the passive key 45 are not repeated herewith. The structural differences between the base locking construction 4a and the upper locking construction 4b are stated as follows.

As shown in FIG. 4 and FIG. 5, the locking bar 42 of the base locking construction 4a not only has a pair of section shafts 421, 422 for mounting the corresponding elements of said turning key 44 and passive key 45, but also has a narrow sleeve 423 formed at the section for the mounting spring 43 such that a C-shaped clamp 424 can be fixed inside the sleeve 423, and there is a

clamping part 425 formed at one end of the locking bar 42. At the position of the upper locking construction 4b for locating the locking gate 41, there is a vertical fixing plate 46 having a through hole 461 at its center part, to be inserted into the vertical grooves 38 formed in said plates 321, 322 of said pivotal joint 32.

In addition, there is installed a manual control button 47 and a connection rod 48. At the upper end of said manual control button 47, there is a guiding plate 471 having a horizontal groove 472 formed at its lower end, such that the guiding plate 471 can be pushed into a shifting hole 53 formed in the lower side of the transverse step beam 5, and the manual control button 47 can be mounted into the shifting hole 53 to move to and fro in the shifting hole 53.

Furthermore, the central part of manual control button 47 has a furrow 473, so as to connect the manual control button 47 with one end of said connection rod 48 by a pin 474. Said connection rod 48 has the front end penetrated through the through hole 461 of said fixing plate 46, and then connected to the clamping part 425 of the locking bar 42 by a pin 426. The other end of said connection rod 48 is bent downward, so as to penetrate the shifting hole 53 of said transverse step beam 5 and extend into the furrow 473 of said manual control button 47 to connect together with it.

In addition, the lower end of the ladder section 2a is provided with a conical sleeve-shaped buffering device 6. The upper end of said buffering device 6, by means of a hooked tip 61 provided thereon, is affixed to the opening 24 of said ladder section 2a. The lower-end outside of said buffering device 6 is provided with an elastic seal ring 62 to increase friction when it

contacts with the inside of said rung and reduce noise. When the ladder section 2a is pulled upward, the ladder can be pulled extensively, and when the ladder section 2a is pushed downward, the elastic seal ring 62 then shall generate a force against the ladder section 2 to slow down the downward movement of the ladder. Also, the internal part of said buffering device 6 can be provided with a mylar with its surface having a hole, which allows airs to enter the cavity of said mylar when the buffering device 6 moves upward and downward, and thus enhances the cushion effect.

When the assembling has been completed, as shown in the figures, the bottom of the ladder section 2 is provided with the buffering device 6 and the elastic seal ring 62 to increase the friction between the ladder section and the inside wall of the internal ladder section, so that the purpose of slowing down the descending can be achieved. Also, the connection kit and the upper end of said ladder section are provided with the adhesive channel 35 to infuse the adhesive therein, so that the connection kit and the ladder section can be adhered to each other. Accordingly, the present extension ladder is assembled integrally and securely. Moreover, the provided locking mechanism is fully covered by the connection kit 3 and the transverse step portion 5, which not only makes it easy and convenient to control the locking mechanism, but also prevents damage caused by any foreign object.

When the internal ladder section 2a and ladder section 2 are relatively extended, the blocking ring 25 having a larger caliber on the outside of said internal ladder section 2a is firmly against the inwardly protruding furrow ring 26 so as to be fixed at its position (as shown in FIG. 3A) in the external ladder section 2. Meanwhile, the through hole on the lower end of said

internal ladder section 2a is directly located in a route having the orientation hole 22 of said external ladder section, the through hole 30 of said connection kit, and the locking bar 42, which enables the locking bar 42 to be inserted in the fixed position smoothly when it is moved forward.

In using the present invention, as shown in FIG. 7 and FIG. 8, the manual control button 47 of said base locking construction 4a is moved to the central part of said transverse step beam 5. Then the connection rod 48 pulls the locking bar 42 out of the orientation hole 22 of said ladder section 2. When the locking bar 42 is moving, said turning key 44 is pushed to rotate in the clockwise direction and said passive key 45 is pushed to rotate in the counter-clockwise direction. Finally, the pushing plate 451 of said passive key 45 extends outward from the second through hole 52 of said transverse step beam 5.

Then, the pushing plate 451 of said passive key 45 passes through the through hole 51a of the second transverse step beam 5a, and pushes the second panel 442a of the turning key 44a inside the second transverse step beam 5a. Then the turning key 44a rotates clockwisely. At the same time, the turning key 44a pushes the locking bar 42a inside the second transverse step beam 5a and moves it out of the orientation hole 22a of said second ladder section 2. The ladder becomes unlocked and the second ladder 2a then can be pulled upward until the passing hole 23a of said second ladder section 2a is opposite to the through hole 30 of said base ladder section 2a. Then the locking bar 42a will be inserted into said passing hole 23a by the action of the spring 43a, and the second ladder section 2a therefore obtains an extended condition. In addition, when the locking bar 42a moves out of the orientation

hole 22a of said second ladder section 2a, the passive key 45a installed on the second transverse step beam 5a then rotates counter-clockwisely, so that its pushing plate 451a then extends outward and continuously pushes the turning key inside the third transverse step beam, such that the locking constructions of other levels are unlocked.

When the locking bar 42 returns to the locking position, and the pushing plate 451 of the passive key 45 does not completely return to the horizontal locking position, if the transverse step beam 5 is mistakenly stepped or pressed downward, the locking bar 42 will be pushed into the ladder section and rigidly lock the construction. Therefore, the present invention has very good functions of security.

Accordingly, the extension ladder with improved structure in the present invention are integrally assembled securely by providing a snap-fit hole 21, orientation tenon 34, and blocking ring 25 between the connection kit 3 and ladder section 2 for quick and correct orientation. Also, the ladder assembly can be secured by providing the adhesive channel 35. Furthermore, the locking mechanism is provided on the connection kit 3 for making the assembling more convenient, the control of the ladder easier, and prolonging ladder life.

As described above, the extension ladder apparatus in the present invention certainly enhances appliance safety, and makes folding and using quick and convenient, which can improve the deficiencies of conventional ladders. Also, since the present invention has not yet been opened to the public, it complies with the conditions of allowable patents.

Although the above-mentioned embodiments of the present invention

have been described for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

WHAT IS CLAIMED IS:

1. An extension ladder with improved mechanism comprising: a plurality of ladder sections, connection kits, a locking mechanism, and transverse step beams, wherein each ladder section is a hollow rung having different caliber, which can be interconnected by fitting into each other and pulled and extended; its upper end is horizontally provided with a connection kit, while the inside of said connection kit is provided with a locking mechanism covered by said transverse step portion;

wherein said locking mechanism includes a locking bar which passes through said ladder section, on the locking bar, there are a pair of mounting grooves forming sectional shafts; one of said mounting grooves is mounted with a pair of separate arms of a turning key, the other one is mounted with a pair of separate feet of a passive key, while one end of said turning key and passive key has respectively a pair of locking pawls extruded outward on the side surfaces of said turning key and passive key, such that when said locking bar moves to and fro, said turning key and passive key rotate by using said locking pawl as an axial center, the one end of said passive key is installed with a pushing plate, and when said locking bar moves out of said ladder section, said pushing plate then extends outward to push said turning key inside an upper connection kit and then the locking mechanism becomes unlocked.

2. The extension ladder with improved mechanism as claimed in claim 1, wherein said locking mechanism installed inside the connection kit of a base level has one end of the locking bar connected to a transversely

movable manual control button.

3. The extension ladder with improved mechanism as claimed in claim 2, wherein the upper end of said manual control button has a guiding plate having horizontal grooves formed at its lower end, such that said guiding plate can be pushed into a shifting hole formed on the lower side of said transverse step beam, and the manual control button can move at the lower end of said transverse step beam.

4. The extension ladder with improved mechanism as claimed in claim 2, wherein the locking bar has a narrow sleeve formed at the end where said locking bar and connecting rod is connected, such that a C-shaped clamp can be mounted inside said narrow sleeve, and there is also a spring mounted onto the end portion of said locking bar, and the another end of said spring then pushes against a vertical fixing plate inserted into a connection kit, thereby the locking bar can return to its locking position by the force of the spring after it is moved to unlock the mechanism.

5. The extension ladder with improved mechanism as claimed in claim 1, wherein said locking mechanism installed inside the connection kit of an upper level has a locking gate to be inserted inside said connection kit, and said locking gate has a fixing plate having a sleeve installed at its central part, and the open end of said sleeve is installed with a spring and said locking bar.

6. The extension ladder with improved mechanism as claimed in claim 1, wherein said ladder section and connection kit are adhered to each other by engaging the orientation hole on the ladder section with the orientation tenon of said connection kit, and then infusing an adhesive into an

adhesive channel on the inside of said connection kit.

7. The extension ladder with improved mechanism as claimed in claim 1, wherein the joint part of said ladder section and connection kit is provided with an orientation hole to interconnect with a through hole of said connection kit, so that the locking bar of the locking mechanism in the internal part of said connection kit can be moved forward and backward to a predetermined position through the joint part.

8. The extension ladder with improved mechanism as claimed in claim 3, wherein said connection kit is connected with the ladder section by means of a ringlike covering part, and a pivotal joint on the connection kit is provided with the locking mechanism.

9. The extension ladder with improved mechanism as claimed in claim 8, wherein said pivotal joint of the connection kit is integrated with said ringlike covering part, and comprises two vertical side plates.

10. The extension ladder with improved mechanism as claimed in claim 9, wherein said vertical side plates have a channel between them, and on the inner surface of said vertical side plates, there are a pair of opposite vertical grooves and two concavities, wherein said vertical grooves are formed at a position near the end of said vertical side plates, and one of said concavities is formed in each of the upper edges of said vertical side plates, while the other concavity is formed in each of the lower edges of said vertical side plates.

11. The extension ladder with improved mechanism as claimed in claim 1, wherein the lower end of said ladder section is provided with a sleeve-shaped buffering device, and an elastic seal ring is provided on a

bottom outer rim of said buffering device to maintain friction when it contacts with the inside of said rung, and to reduce noise and slow down the folding.

12. The extension ladder with improved mechanism as claimed in claim 11, wherein the inside of said buffering device is provided with a mylar, in which a hole is formed to enhance the cushion effect by allowing airs to enter into the cavity of said mylar via the hole when the buffering device moves upward and downward.

13. The extension ladder with improved mechanism as claimed in claim 1, wherein the lower section of said internal ladder section is provided with an outward extruded blocking ring, and an inward protruding furrow ring extruded inward to the interior of the ladder section is provided at the upper section of said ladder section, such that when the internal ladder section and the external ladder section are pulled in opposite directions, said outward extruded blocking ring of said internal ladder section shall move to a position against said inward protruding furrow ring to define the length of the extended ladder.

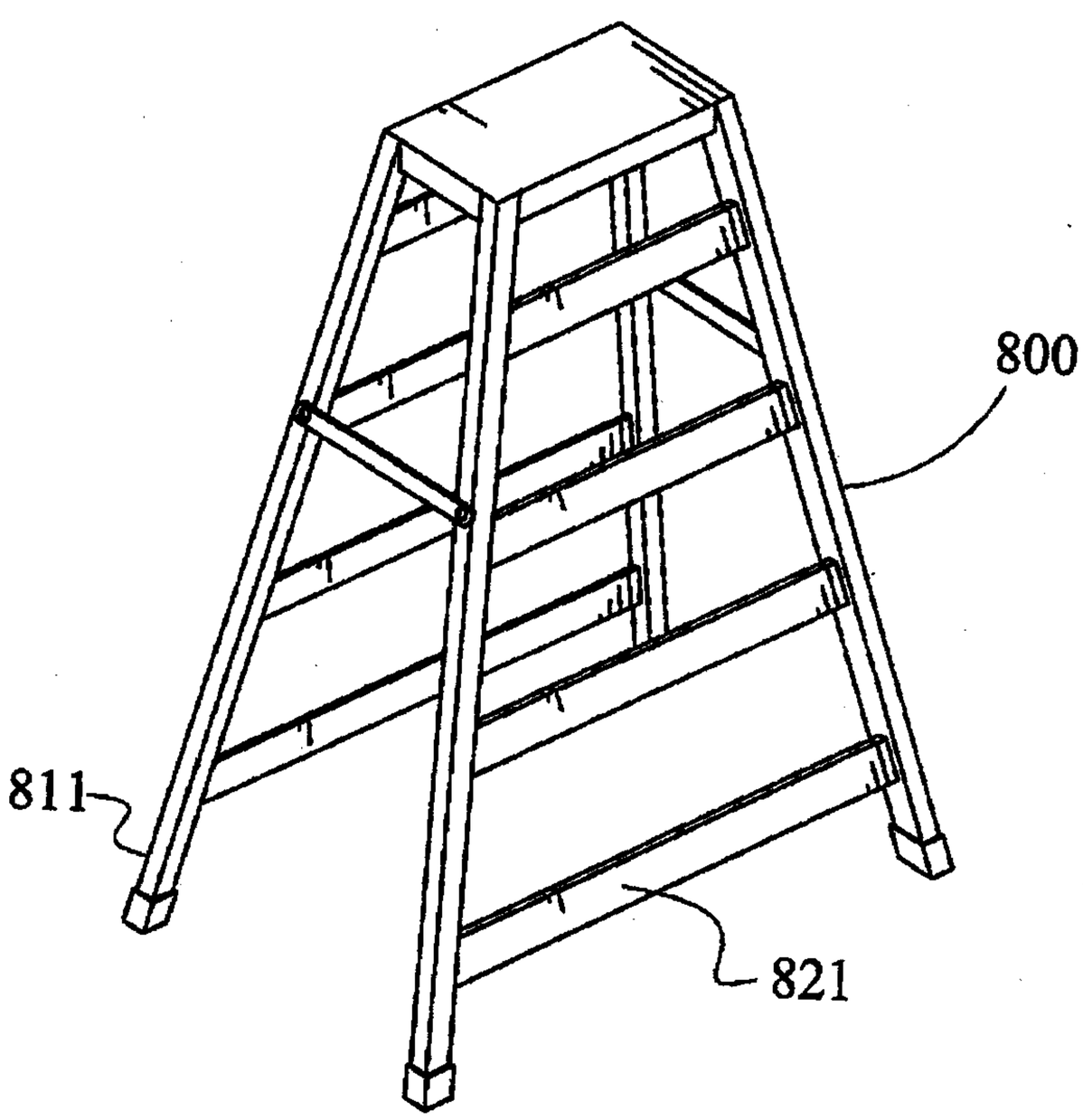

FIG.1
Prior art

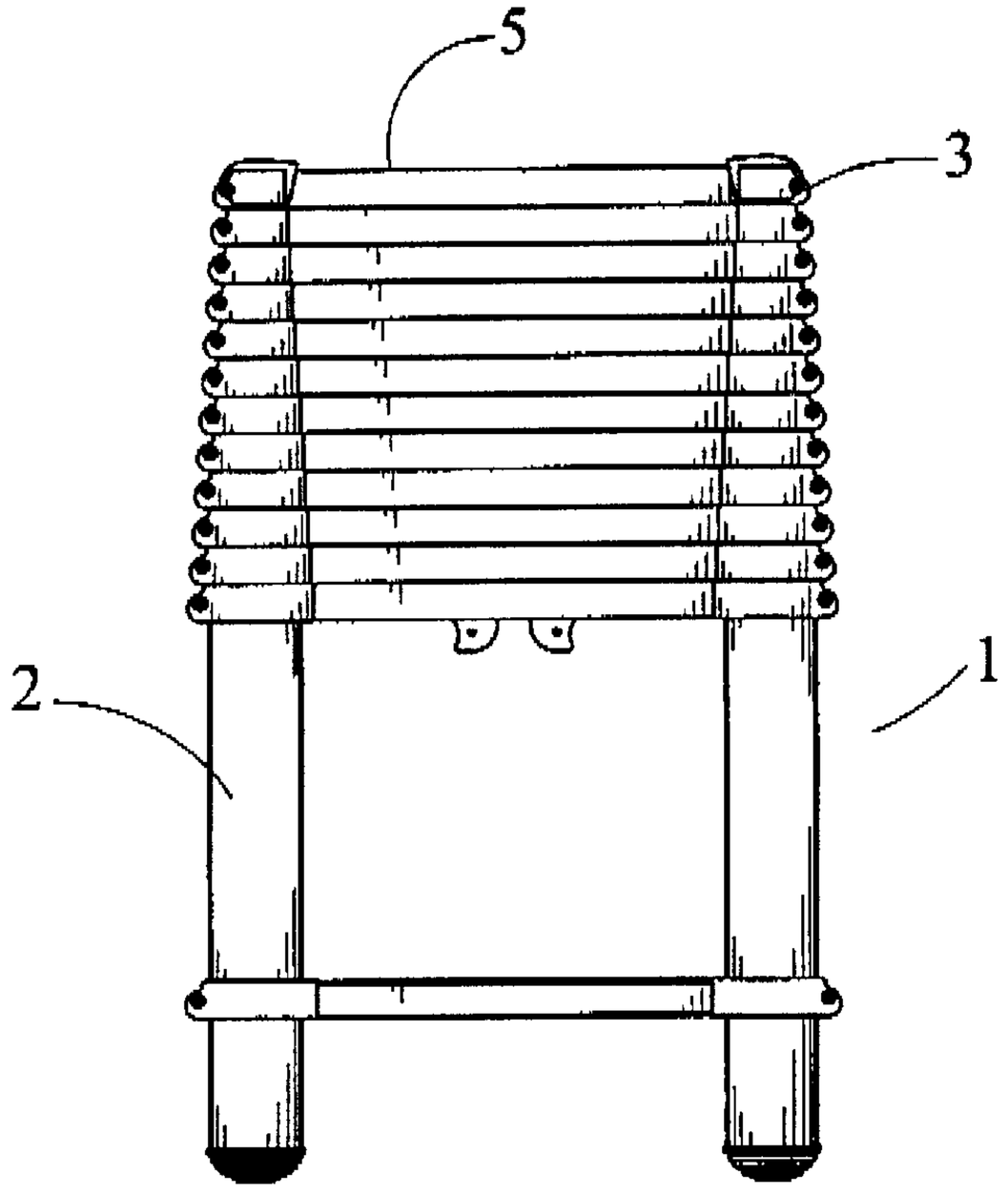

FIG.2

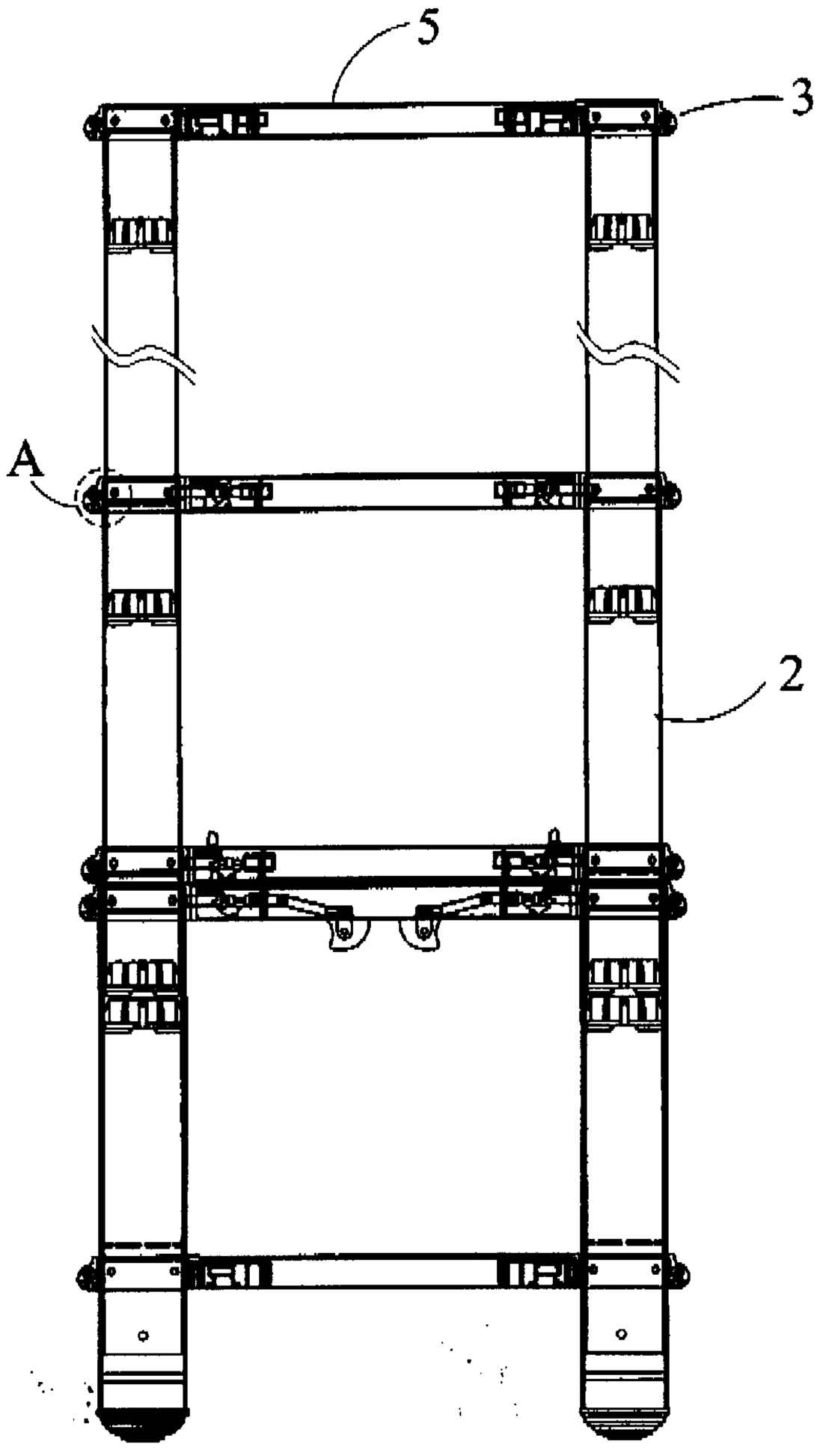

FIG.3

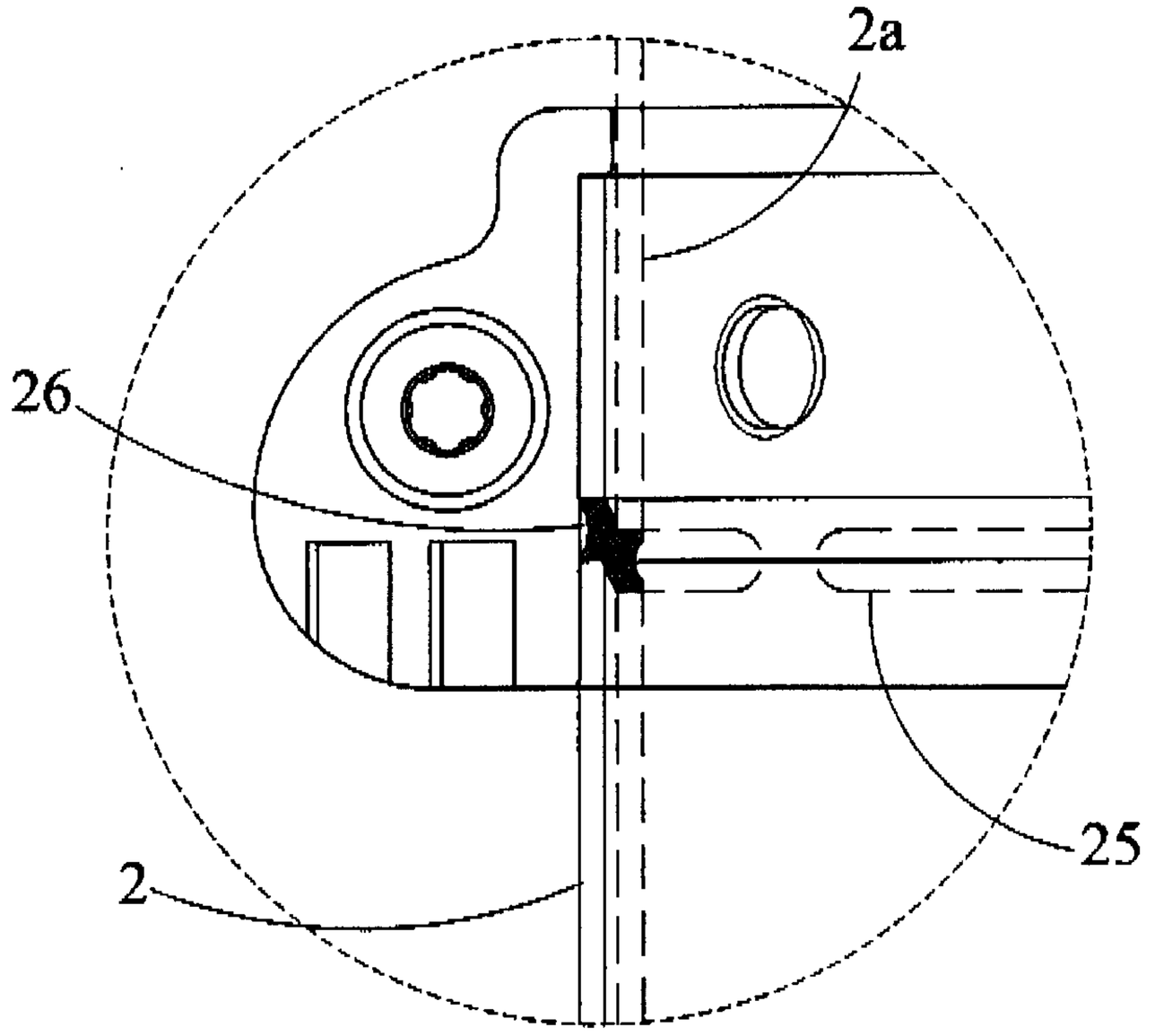

FIG.3A

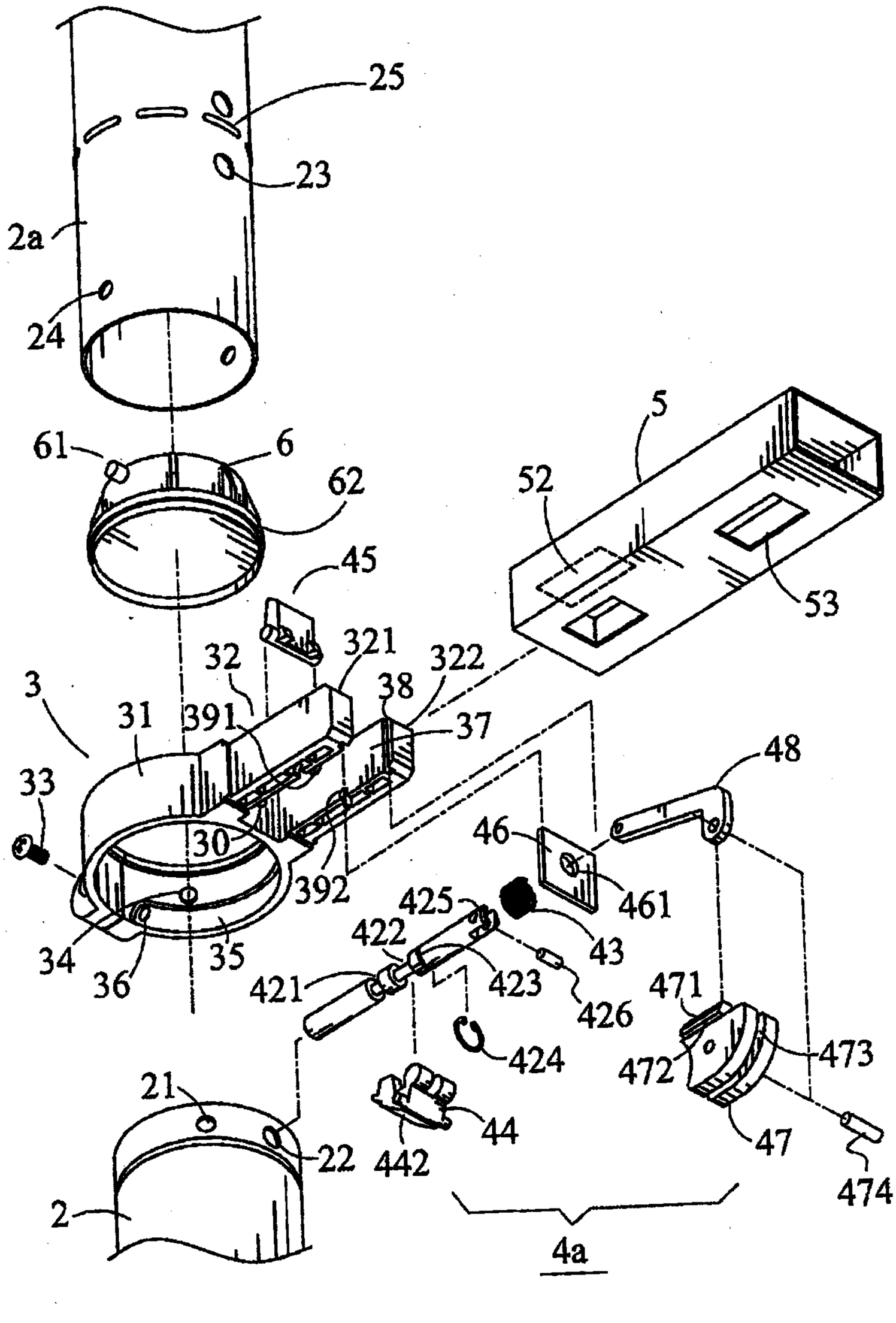
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FIG.4

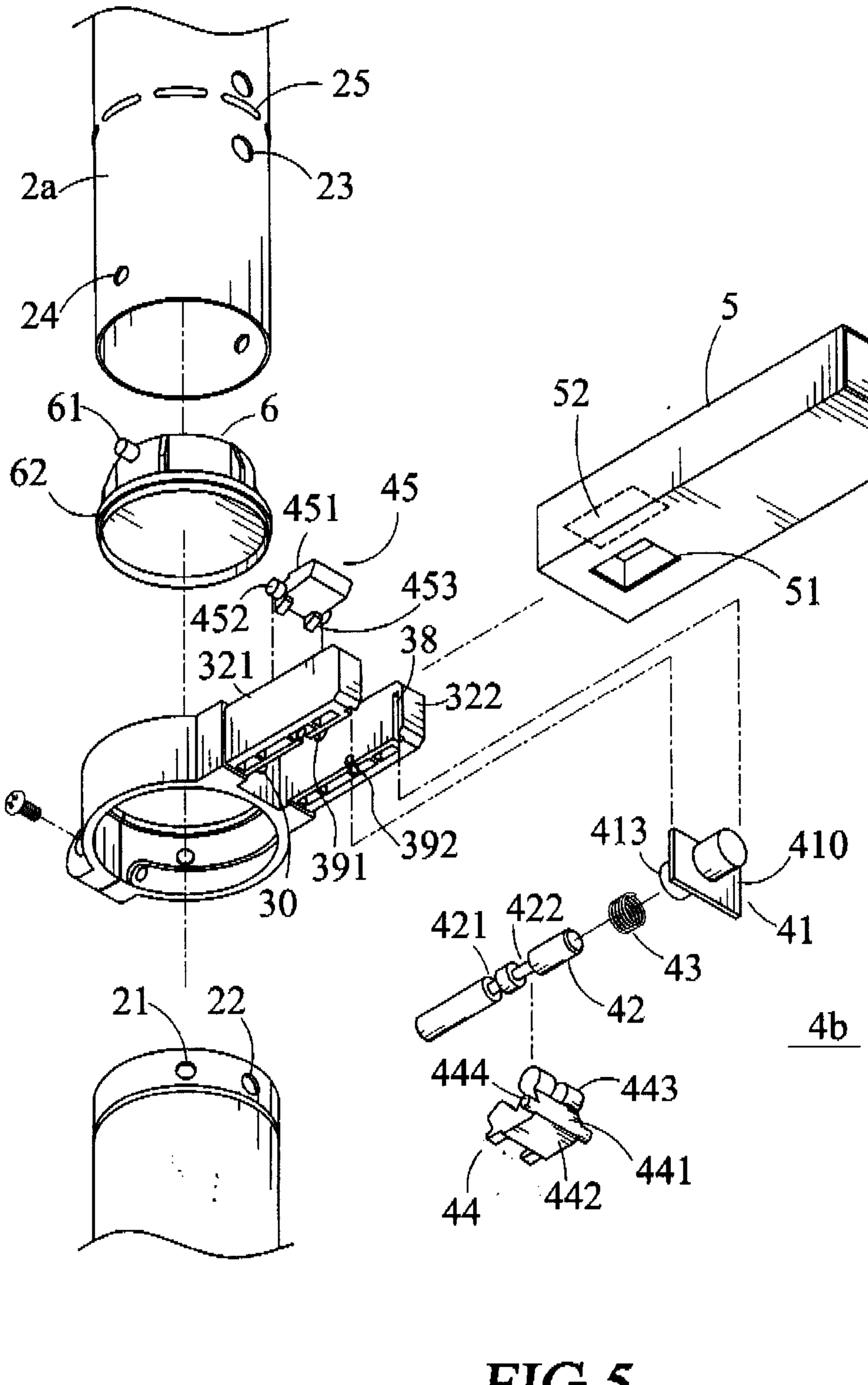
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FIG.5

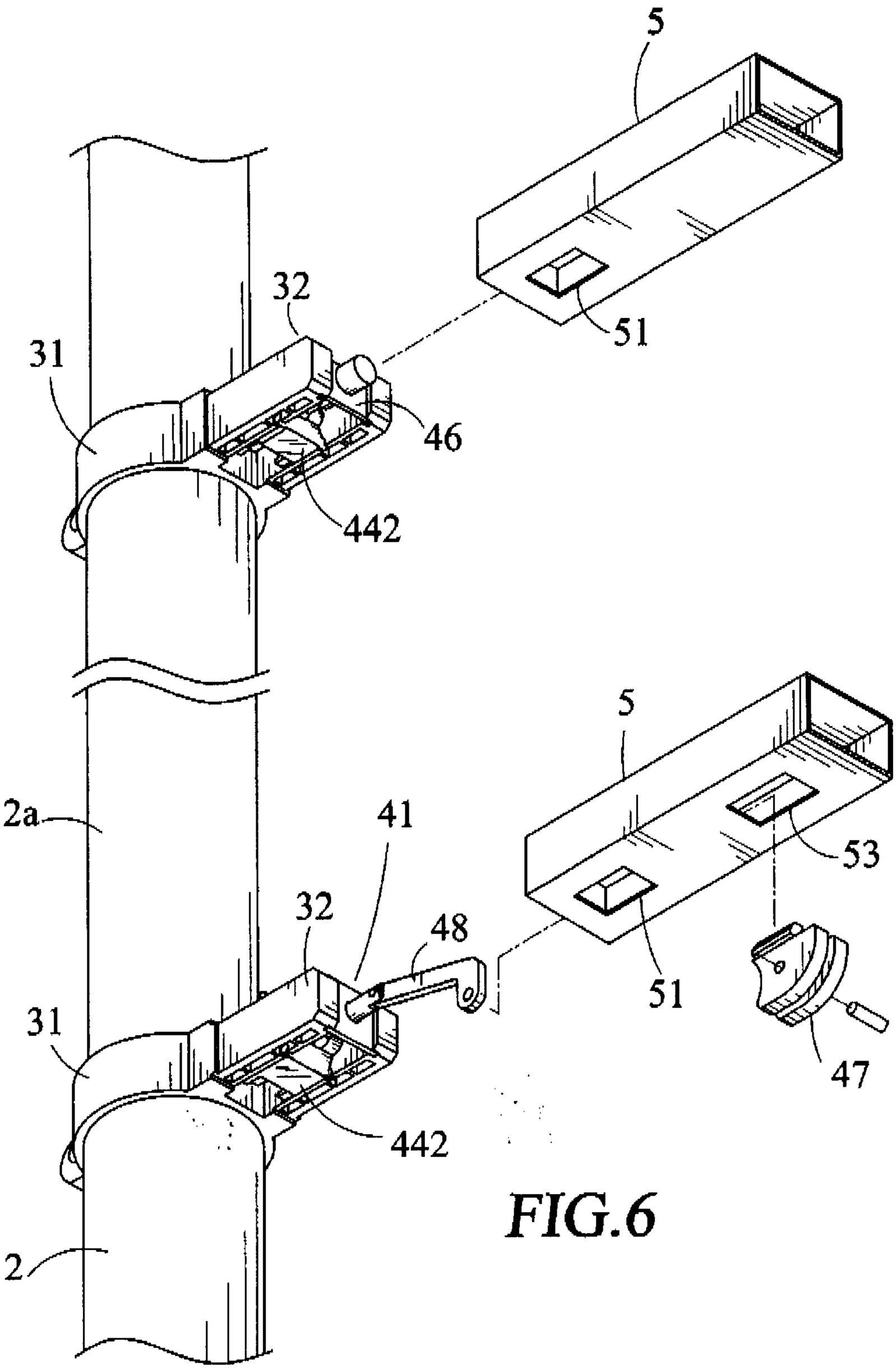


FIG.6

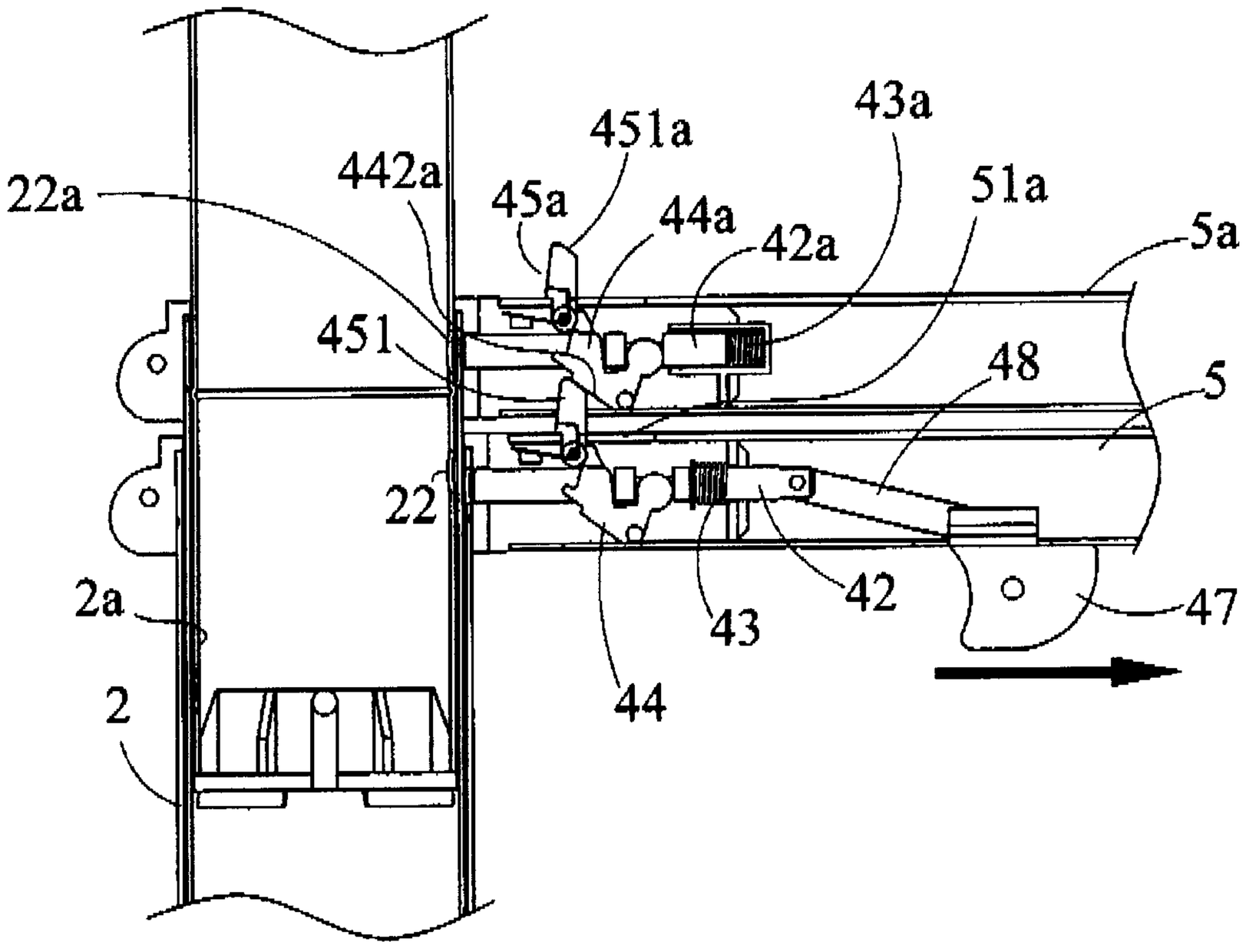


FIG.7

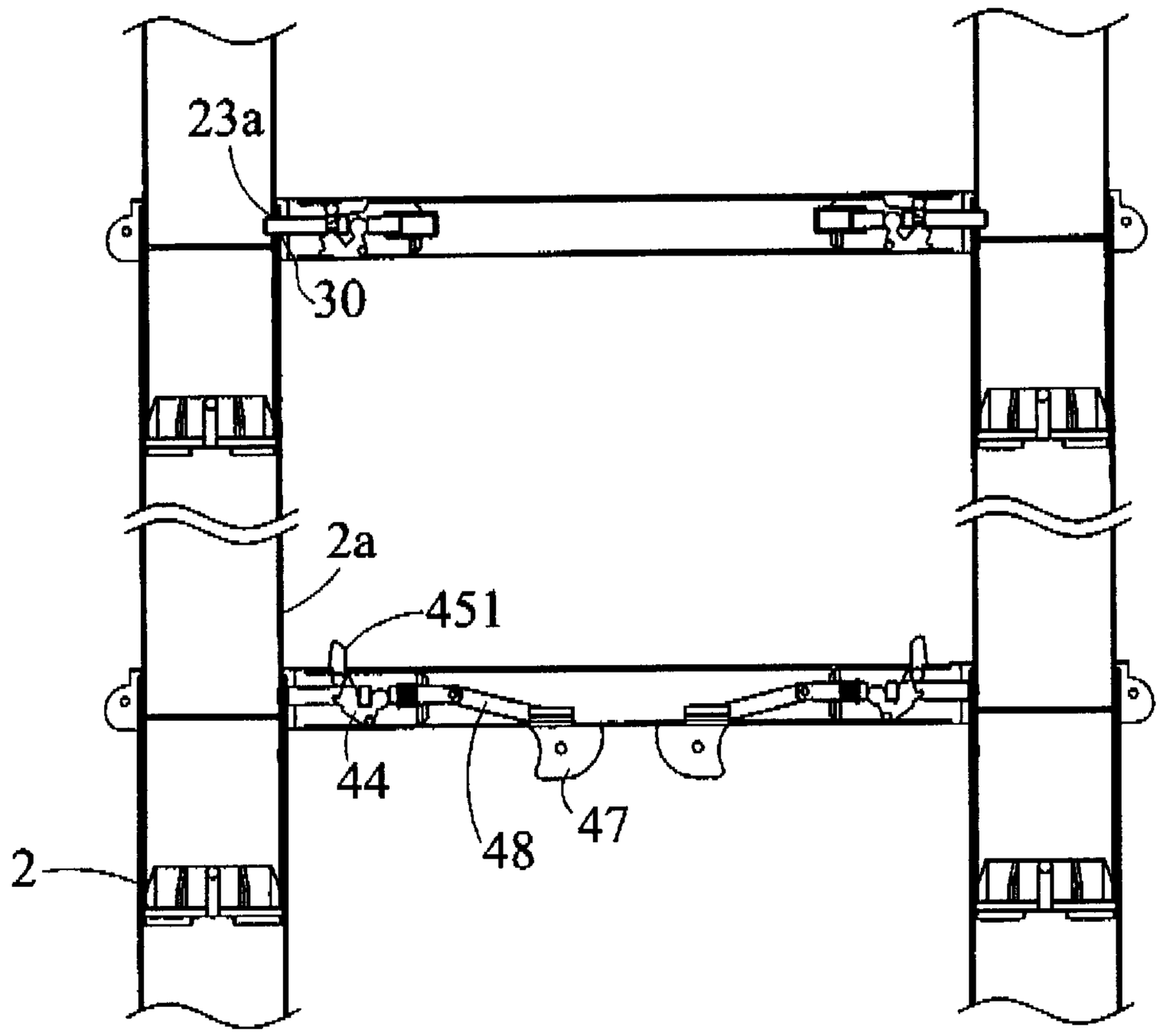
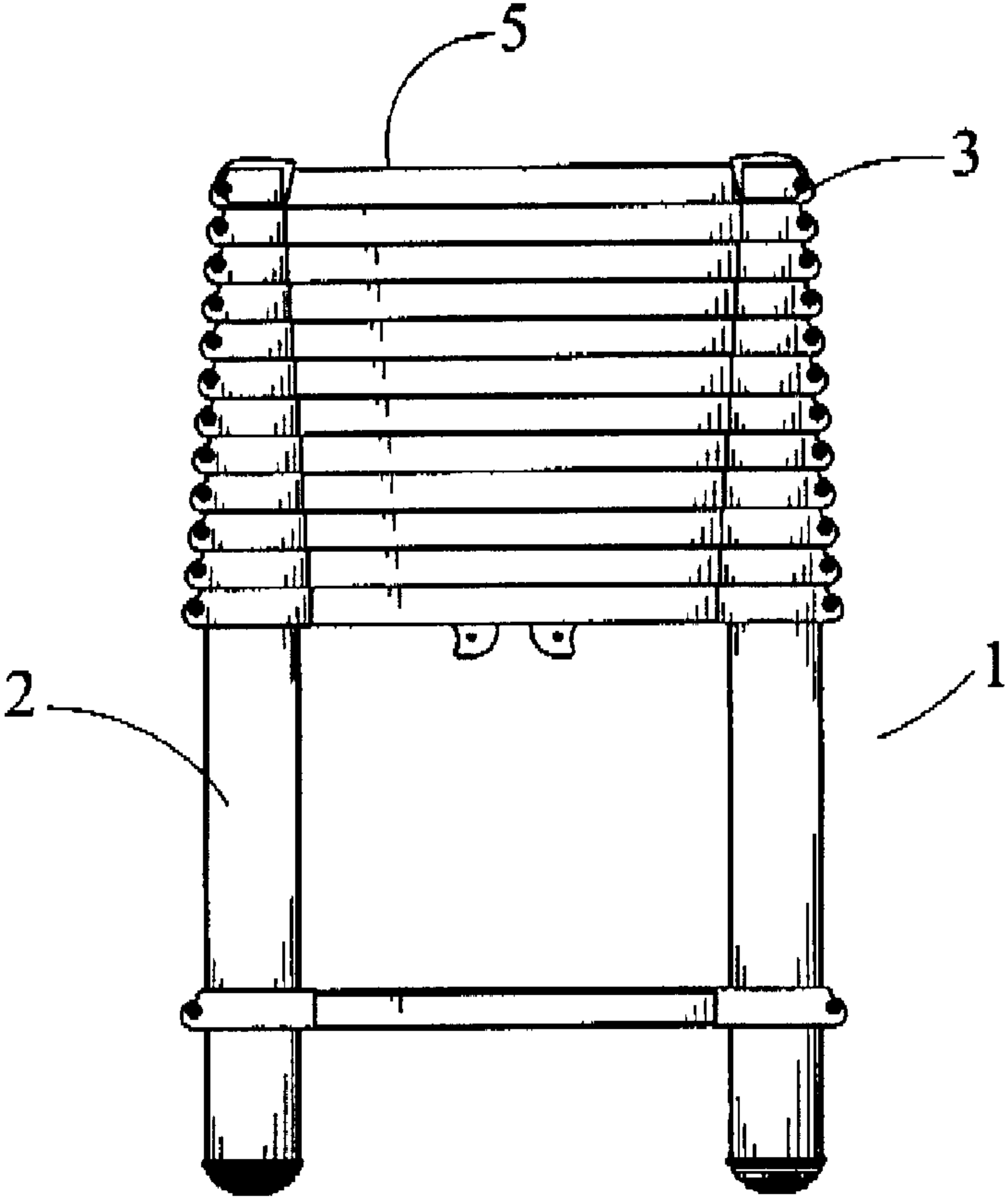


FIG.8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