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(54) LOCKING STRUCTURE FOR EXTENSIONABLELADDER

(57) A locking mechanism for an extending ladder, the extending ladder comprises a plurality of telescopically collapsible columns (1) and a plurality of rungs (2), the locking mechanism comprises: a connection sleeve (3) for connecting the column (1) with corresponding rung (2); a plug pin (4) disposed inside the connection sleeve (3); a push button (6) and an automatic unlocking switch (7). The automatic unlocking switch (7) is rotatably disposed, a plughole (31) is provided on the bottom surface of the connection sleeve (3), a pushing protrusion (32) is provided protruding upward on the top surface of the connection sleeve (3). The locking mechanism not only capable of unlocking the single column step by step, but also automatically unlocking the adjacent upper locking mechanism after a lower locking mechanism is unlocked.

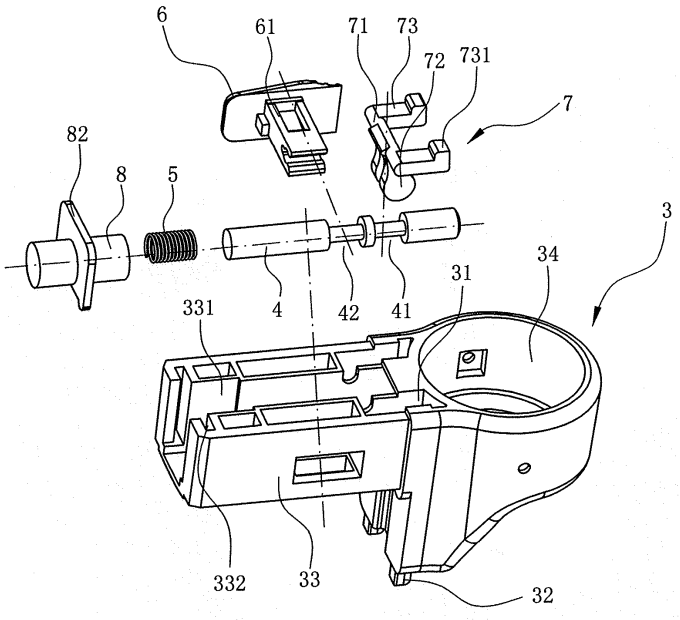

Fig. 3

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Description

Field of the Invention

[0001] The present invention relates to an extending ladder including a plurality of stiles disposed in a nested arrangement and being able to slip relatively, in particular to a locking mechanism for an extending ladder.

Description of the Prior Art

[0002] A ladder is generally required for maintenance or repair arising in houses, apartments, farms, factories and other places, and needs to be stored in someplace when not used. A longer ladder allows a person to reach a higher place. However, it is not convenient for handling and takes up more space for storage. An extending ladder may be extended for use and folded for storage.

[0003] At present, there are lots of patent documents about the extending ladder. For example, US Patent No. US7048094 disclosed such an extending ladder which is convenient and safe in use. The extending ladder comprises a first stile, a second stile and a plurality of rungs extending between the first stile and the second stile; the first stile comprises a first column and a second column, the first column comprises an internal surface, and the second column is connected with the first column in a nested arrangement to form a telescopic mechanism in relative lengthwise movement; a latch mechanism for selectively locking the second column relative the first column; a button operatively coupled to the latch mechanism for actuating the latch mechanism; and a sleeve is disposed about an external surface of the second column and is provided with an external guiding surface for contacting the internal surface of the first column; the patent is characterized in that, the button is positioned in proximity to the first column and provided with a depression dimensioned to receive a tip portion of a thumb of a hand applying a push force in a direction away from the first column and toward the second stile to retract the latch mechanism to the second column, thereby unlocking the second column. The above stated extending ladder has a latch mechanism with a push button.

[0004] For another example, a Chinese Utility Model Patent CN200985735Y (Patent No.: ZL200620141000.4), titled Extending Ladder, is also disclosed such a locking mechanism with a push button.

[0005] The disadvantage of the above stated extending ladders is that the ladder may be folded only by pushing the button on each rung one at a time, which is rather time-consuming to fold the extending ladder.

Summary of the Invention

[0006] It is an object of the present invention to provide a locking mechanism for an extending ladder, which is not only capable of unlocking the single column step by step, but also automatically unlocking the adjacent upper locking mechanism after a lower locking mechanism is unlocked.

[0007] For achieving the above stated object, the extending ladder comprises a plurality of telescopically collapsible columns and a plurality of rungs, the locking mechanism for the extending ladder comprises a connection sleeve for connecting the column with corresponding rung; a plug pin disposed inside the connection sleeve, which can move horizontally and transversely with respect to the connection sleeve and be exposed outside to lock the column with the next lower column together; a spring disposed inside the connection sleeve, which can keep the plug pin in the trend of being exposed outside; and a push button which can drive the plug pin to move transversely, characterized in that an automatic unlocking switch connected with the plug pin is disposed inside the connection sleeve, and when the extending ladder collapses and the upper connection sleeve resists against the next lower connection sleeve, the automatic unlocking switch can be triggered and drive the plug pin to move transversely for unlocking the column with the next lower column.

[0008] Preferably, the automatic unlocking switch is rotatably disposed, when rotating the automatic unlocking switch can drive the plug pin to move transversely; a plughole is provided on the bottom surface of the connection sleeve, a pushing protrusion is provided protruding upward on the top surface of the connection sleeve, and the pushing protrusion of the lower connection sleeve can be inserted into the plughole of the adjacent upper connection sleeve to push the automatic unlocking switch in the upper connection sleeve to rotate. Therefore, the rotation operation for unlocking is more stable, and the automatic unlocking switch may also be disposed inside the connection sleeve in a horizontal movement manner. The automatic unlocking switch of the pushing protrusion is of an inclined plane fitting structure, so that the pushing protrusion may push the automatic unlocking switch to move transversely for unlocking the column with the next lower column when the extending ladder collapses and the upper connection sleeve resists against the next lower connection sleeve.

[0009] Preferably, the automatic unlocking switch is composed of a rotating shaft, a vertical portion and a transverse portion, the vertical portion and the transverse portion are respectively jointed with the rotating shaft forming a L-shaped side view of the automatic unlocking switch; the rotating shaft is restrained inside the connection sleeve and capable of rotating around the axis of the rotating shaft, the end of the vertical portion is connected with the plug pin, the end of the transverse portion extends to the position of the corresponding plughole, and the pushing protrusion of the lower connection sleeve can push the end of the transverse portion in the adjacent upper connection sleeve to make the automatic unlocking switch in the upper connection sleeve to rotate after the pushing protrusion is inserted into the plugholes of the upper connection sleeve. The automatic unlocking

switch has an L-shaped side view, which will make the structure the simplest on the premise that the pushing protrusion drives the automatic unlocking switch to rotate, to finally drive the plug pin to move transversely. Of course, the automatic unlocking switch may also be designed into other shapes so long as the rotation of the automatic unlocking switch may drive the plug pin to move transversely.

[0010] Preferably, the automatic unlocking switch has two parallel pairs of vertical portion and transverse portion spaced at an interval, the connection sleeve has two plugholes; a first annular groove is formed at the periphery of the middle part of the plug pin, and the end of each vertical portion is limited inside the first annular groove and touches the plug pin; and each transverse portion is respectively jointed with two ends of the rotating shaft. Through limiting the vertical portion of the automatic unlocking switch inside the first annular groove, the automatic unlocking switch and the plug pin are connected with each other, so it is also convenient to assemble. Two transverse portions are provided to ensure that the pushing protrusion drives the automatic unlocking switch more stably to rotate. Of course, only one of the vertical portion and the transverse portion may be provided, what is needed to do is to form a strip through hole disposed axially on the plug pin and to insert the vertical portion into the strip through hole, in this case, the requirement on assembly of parts is relatively high, furthermore, the structure of this automatic unlocking switch is too simple to rotate stably.

[0011] Preferably, the end of each vertical portion of the automatic unlocking switch is of an arc shape. Then, the arc-shaped vertical portion in the first annular groove touches with the surface of the plug pin, so that when rotating the automatic unlocking switch can easily drive the plug pin to move transversely.

[0012] Preferably, a bump is formed on the end of each transverse portion, extending downward and being inserted into the corresponding plughole, which will ensure the contact between the pushing protrusion of the connection sleeve and the automatic unlocking switch, and a larger rotation angle of the automatic unlocking switch in the same range of movement can be obtained.

[0013] Preferably, the connection sleeve comprises an inserting portion pluggable with the rung and a ring portion forming a circular hole for the column to pass through; a recess is formed in the inserting portion for receiving the plug pin, the automatic unlocking switch and the spring; a through hole is formed on the wall of the circular hole which is communicated with the recess to allow the plug pin to pass through. It is a conventional structure of connection sleeves which can facilitate the connection of the rung and the column to the connection sleeve.

[0014] In order to facilitate convenient assembly, preferably, a spring seat with a containing hole for containing the spring is disposed in the recess, the rear end of the plug pin is inserted in the containing hole, two ends of the spring respectively resist against the rear end of the plug pin and the deepest inner wall of the containing hole.

[0015] The spring seat has protruding edge formed at the periphery of the spring seat, correspondingly, two slots for limiting the protruding edge is formed in the inserting portion. Under the action of providing with the protruding edge and the slots, it is convenient for the spring seat to be limited inside the inserting portion.

[0016] Preferably, a strip hole is transversely formed at the front surface of the inserting portion which is communicated with the recess; a second annular groove is formed at the periphery of the middle part of the plug pin; the push button is located outside the front surface of the plug-in portion, the push button has a connecting portion extending backward from the back side of the push button, passing through the strip hole, limited inside the second annular groove and touching the plug pin. The push button is jointed with the plug pin through being limited inside the second annular groove, which has the advantage of easy installation.

[0017] Compared with the prior art, in this invention, in the case of unlocking a single column step by step, it is needed to unlock from the upper locking mechanism of the extending ladder to the next lower column step by step, during unlocking, the button is just pushed to drive the plug pin to transversely move inward for unlocking the locked adjacent upper and lower columns of the extending ladder; after the lower locking mechanism is unlocked, the adjacent upper locking mechanism together with the rung move down under the effect of gravity until the pushing protrusion of the lower connection sleeve is inserted into the plugholes of the upper connection sleeve, to finally drive the plug pin to transversely move inward for unlocking the column with the next lower column. By parity of reasoning, the upper locking mechanisms may be automatically unlocked step by step. Therefore, the locking mechanism has the characteristic of variety of unlocking manners, and the operation becomes more convenient.

Brief Description of the Drawings

[0018] Fig. 1 is a perspective view of a locking mechanism in accordance with an embodiment of the present invention (in locked state).

[0019] Fig. 2 is a perspective view of the push button, the automatic unlocking switch and the plug pin of the locking mechanism connecting with each other (in locked state).

[0020] Fig. 3 is an exploded perspective view of the locking mechanism in accordance with the embodiment of the present invention.

[0021] Fig. 4 is a sectional view of the locking mechanism in accordance with the embodiment of the present invention when it is used on an extending ladder (in locked state).

[0022] Fig. 5 is a perspective view of the locking mechanism in accordance with the embodiment of the present invention (in unlocked state).

[0023] Fig. 6 is another perspective view of the locking mechanism in accordance with the embodiment of the present invention (in unlocked state).

[0024] Fig. 7 is a perspective view of the push button, the automatic unlocking switch and the plug pin connecting with each other (in unlocked state).

[0025] Fig. 8 is a sectional view of the locking mechanism in accordance with the embodiment of the present invention when it is used on the extending ladder (in unlocked state).

[0026] Fig. 9 is a perspective view of the locking mechanism in accordance with the embodiment of the present invention when it is used on the extending ladder (in unlocked state).

Detailed description of the preferred embodiment

[0027] To enable a further understanding of the innovative and technological content of the invention herein, refer to the detailed description of the invention and the accompanying drawings below:

[0028] The locking mechanism of a preferred embodiment of the present invention is as shown in Fig. 1 to Fig. 9.

[0029] The extending ladder provided with the locking mechanism comprises a plurality of telescopically collapsible columns 1 and a plurality of rungs 2. The locking mechanism comprises a connection sleeve 3 for connecting the column 1 with the corresponding rung 2, a plug pin 4, a push button 6, a automatic unlocking switch 7.

[0030] The connection sleeve 3 comprises an inserting portion 33 pluggable with the rung 2, a recess 331 is formed in the inserting portion 33, the lower end of the recess 331 is opened for receiving parts, the inserting portion 33 is inserted into the rung 2 to fix with the rung 2, the lower opening of the recess 331is shielded by the bottom surface of the rung 2; the connection sleeve 3 has a ring portion forming a circular hole 34 for the column 1 to pass through, and the circular hole 34 is in close fit with the periphery of the upper portion of the column 1, the circular hole 34 and the column 1 are fixed with each other through a screw.

[0031] The plug pin 4 is disposed inside the recess 331 of the connection sleeve 3, which can move horizontally and transversely with respect to the connection sleeve 3 and be exposed outside to lock the column 1 with the next lower column together. A first annular groove 41 is formed at the periphery of the middle part of the plug pin 4. A spring 5 is disposed inside the connection sleeve 3, which can keep the plug pin 4 in the trend of being exposed outside. A through hole 341 is formed on the wall of the circular hole 34 which is communicated with the recess 331 to allow the plug pin 4 to pass through. A lockhole 11 is formed on the wall of the column 1 fixed with the connection sleeve 3, and a lockhole 12 is also inserted in the middle part of upper column 1 of the column 1. When the plug pin 4 passes through the connection sleeve 3 and in turn enters the lockholes 11 and 12 of the two columns 1, the two columns 1 are locked. The above design is a conventional one of the present locking mechanism for extending ladder.

[0032] A spring 5 is disposed inside the recess 331 by structure as follows: a spring seat 8 with a containing hole 81 for containing the spring 5 is disposed in the recess 331, the rear end of the plug pin 4 is inserted in the containing hole 81, two ends of the spring 5 respectively resist against the rear end of the plug pin 4 and the deepest inner wall of the containing hole 81. The spring seat 8 has a protruding edge 82 formed at the periphery of the spring seat 8, correspondingly, two slots 332 for limiting the protruding edge 82 are formed in the inserting portion 33.

[0033] The push button 6 may drive the plug pin 4 to move transversely. The push button 6 is located outside the front surface of the inserting portion 33, and has a connecting portion 61 extending backward from the back side of the push button 6. A strip hole 333 is transversely formed at the front surface of the inserting portion 33 of the connection sleeve which is communicated with the recess 3. Of course, because the inserting portion 33 is inserted into the rung 2, a strip hole corresponding to the strip hole 333 is also formed on the side wall of the rung 2. A second annular groove 42 is formed at the periphery of the middle part of the plug pin 4, and the connecting portion 61 of the push button 6 passes through the strip hole on the rung 2 and the strip hole 333 on the inserting portion 33, is then limited inside the second annular groove 42 and touches the plug pin 4.

[0034] The automatic unlocking switch 7 connected with the plug pin 4 is disposed inside the connection sleeve 3. The automatic unlocking switch 7 is composed of a rotating shaft 71, at least one vertical portion 72 and at least one transverse portion 73, each vertical portion 72 and each transverse portion 73 are respectively jointed with the rotating shaft 71 forming a L-shaped side view of the automatic unlocking switch 7. In this embodiment, the automatic unlocking switch is formed integrally. The automatic unlocking switch 7 is rotatably disposed in the connection sleeve 3 through the rotating shaft 71, when rotating the automatic unlocking switch 7 can drive the plug pin 4 to move transversely. The rotating shaft 71 is restrained inside the connection sleeve 3 and capable of rotating around the axis of the rotating shaft 71. The automatic unlocking switch 7 has two parallel pairs of vertical portion 72 and transverse portion 73 spaced at an interval; the end of each vertical portion 72 is limited inside the first annular groove 41 and touches the plug pin 4, the end of each vertical portion 72 of the automatic unlocking switch is of an arc shape; and each transverse portion 73 is respectively jointed with two ends of the rotating shaft 71; the connection sleeve 3 has two plugholes 31 and two pushing protrusions 32 spaced at an interval, the end of each transverse portion 73 extends to the position of the corresponding plughole 31; a bump 731 is formed on the end of each transverse portion 73,

extending downward and being inserted into the corresponding plughole 31.

[0035] Two pushing protrusions 32 are provided protruding upward on the top surface of the connection sleeve 3. The pushing protrusion 32 of the lower connection sleeve can push the end of each transverse portion 73 in the adjacent upper connection sleeve to make the automatic unlocking switch 7 in the upper connection sleeve to rotate after the pushing protrusion 32 is inserted into the plugholes 31 of the upper connection sleeve.

[0036] The operating principle and process of the locking mechanism are as follows.

[0037] As shown in Fig. 1 to Fig. 4, during locking, the upper column 1 moves upward to a proper position where the lockholes 11 and 12 of the adjacent columns 1 are on the same axis; the plug pin 4 is popped up under the action of the spring 5 while being inserted into the lockholes 11 and 12 of the two columns 1, to lock the two columns 1 together.

[0038] As shown in Fig. 5 to Fig. 9, when unlocking a single column step by step, it is needed to unlock from the upper locking mechanism of the extending ladder to the next lower column step by step. When unlocking the columns, it is just needed to push the push button 6 to drive the plug pin 4 to transversely move inward overcoming the elasticity of the spring 5; the plug pin 4 is withdrawn from the lockholes 11 and 12 of the two columns 1 for unlocking the locked adjacent upper and lower columns 1 of the extending ladder, and the upper column 1 moves down under the action of gravity.

[0039] As shown in Fig. 5 to Fig. 9, when automatically unlocking upper locking mechanisms step by step, after a lower locking mechanism is unlocked by pushing the push button, the adjacent upper locking mechanism together with the rung 2 move down under the action of gravity until the pushing protrusion 32 of the lower connection sleeve is inserted into the plugholes 31 of the upper connection sleeve to the push bump 731 of the transverse portion 73, to finally drive the plug pin 4 to transversely move inward for unlocking the column with the next lower column. By parity of reasoning, the upper locking mechanisms may be automatically unlocked step by step.

Claims

1. A locking mechanism for an extending ladder, the extending ladder comprising a plurality of telescopically collapsible columns (1) and a plurality of rungs (2), the locking mechanism comprising:

   a connection sleeve (3) for connecting the column (1) with corresponding rung (2);
   a plug pin (4) disposed inside the connection sleeve (3),which can move horizontally and transversely with respect to the connection sleeve (3) and be exposed outside to lock the column (1) with the next lower column together;
   a spring (5) disposed inside the connection sleeve (3), which can keep the plug pin (4) in the trend of being exposed outside;
   and a push button (6) which can drive the plug pin (4) to move transversely;
   characterized in that an automatic unlocking switch (7) connected with the plug pin (4) is disposed inside the connection sleeve (3), and when the extending ladder collapses and the upper connection sleeve (3) resists against the next lower connection sleeve (3), the automatic unlocking switch (7) can be triggered and drive the plug pin (4) to move transversely for unlocking the column (1) with the next lower column.

2. The locking mechanism for an extending ladder according to claim 1, **characterized in that** the automatic unlocking switch (7) is rotatably disposed, when rotating the automatic unlocking switch (7) can drive the plug pin (4) to move transversely;
   a plughole (31) is provided on the bottom surface of the connection sleeve (3), a pushing protrusion (32) is provided protruding upward on the top surface of the connection sleeve (3), and the pushing protrusion (32) of the lower connection sleeve can be inserted into the plughole (31) of the adjacent upper connection sleeve to push the automatic unlocking switch (7) in the upper connection sleeve to rotate.

3. The locking mechanism for an extending ladder according to claim 2, **characterized in that** the automatic unlocking switch (7) is composed of a rotating shaft (71), a vertical portion (72) and a transverse portion (73), the vertical portion (72) and the transverse portion (73) are respectively jointed with the rotating shaft (71) forming a L-shaped side view of the automatic unlocking switch (7);
   the rotating shaft (71) is restrained inside the connection sleeve (3) and capable of rotating around the axis of the rotating shaft (71), the end of the vertical portion (72) is connected with the plug pin (4), the end of the transverse portion (73) extends to the position of the corresponding plughole (31), and the pushing protrusion (32) of the lower connection sleeve can push the end of the transverse portion (73) in the adjacent upper connection sleeve to make the automatic unlocking switch (7) in the upper connection sleeve to rotate after the pushing protrusion (32) is inserted into the plugholes (31) of the upper connection sleeve.

4. The locking mechanism for an extending ladder according to claim 3, **characterized in that** the automatic unlocking switch (7) has two parallel pairs of vertical portion (72) and transverse portion (73) spaced at an interval, the connection sleeve (3) has two plugholes (31);

a first annular groove (41) is formed at the periphery of the middle part of the plug pin (4), and the end of each vertical portion (72) is limited inside the first annular groove (41) and touches the plug pin (4); and each transverse portion (73) is respectively jointed with two ends of the rotating shaft (71).

5. The locking mechanism for an extending ladder according to claim 4, **characterized in that** the end of each vertical portion (72) of the automatic unlocking switch is of an arc shape.

6. The locking mechanism for an extending ladder according to claim 4, **characterized in that** a bump (731) is formed on the end of each transverse portion (73), extending downward and being inserted into the corresponding plughole (31).

7. The locking mechanism for an extending ladder according to any one of claims 1 to 6, **characterized in that** the connection sleeve (3) comprises an inserting portion (33) pluggable with the rung (2) and a ring portion forming a circular hole (34) for the column (1) to pass through;
a recess (331) is formed in the inserting portion (33) for receiving the plug pin (4), the automatic unlocking switch (7) and the spring (5);
a through hole (341) is formed on the wall of the circular hole (34) which is communicated with the recess (331) to allow the plug pin (4) to pass through.

8. The locking mechanism for an extending ladder according to claim 7, **characterized in that** a spring seat (8) with a containing hole (81) for containing the spring (5) is disposed in the recess (331), the rear end of the plug pin (4) is inserted in the containing hole (81), two ends of the spring (5) respectively resist against the rear end of the plug pin (4) and the deepest inner wall of the containing hole (81).

9. The locking mechanism for an extending ladder according to claim 8, **characterized in that** the spring seat (8) has protruding edge (82) formed at the periphery of the spring seat (8), correspondingly, two slots (332) for limiting the protruding edge (82) are formed in the inserting portion (33).

10. The locking mechanism for an extending ladder according to claim 7, **characterized in that** a strip hole (333) is transversely formed at the front surface of the inserting portion (33) which is communicated with the recess (3);
a second annular groove (42) is formed at the periphery of the middle part of the plug pin (4);
the push button (6) is located outside the front surface of the plug-in portion (33), the push button (6) has a connecting portion (61) extending backward from the back side of the push button (6), passing through the strip hole (333), limited inside the second annular groove (42) and touching the plug pin (4).

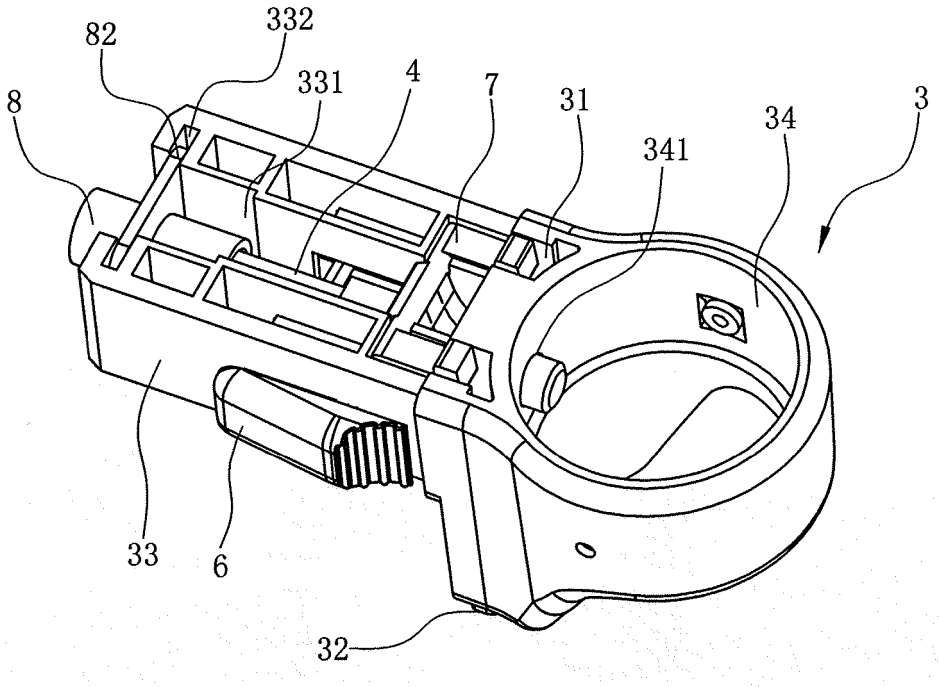

Fig. 1

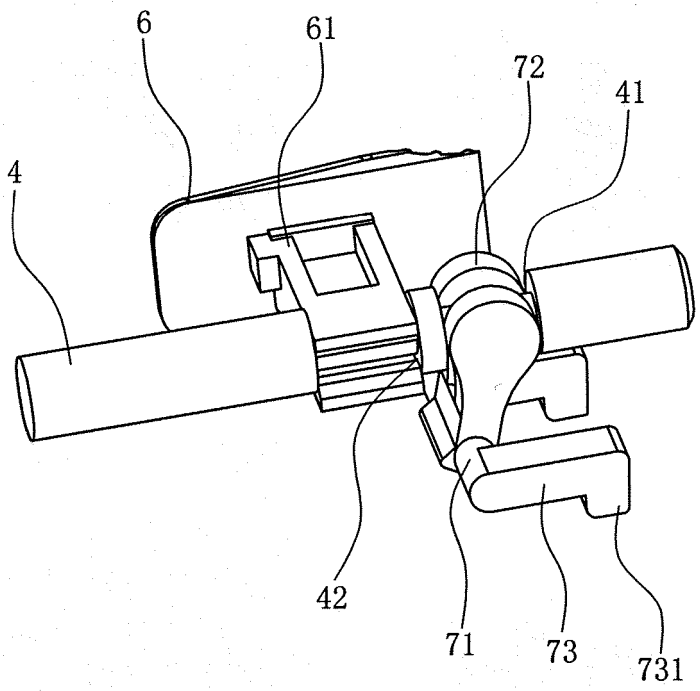

Fig. 2

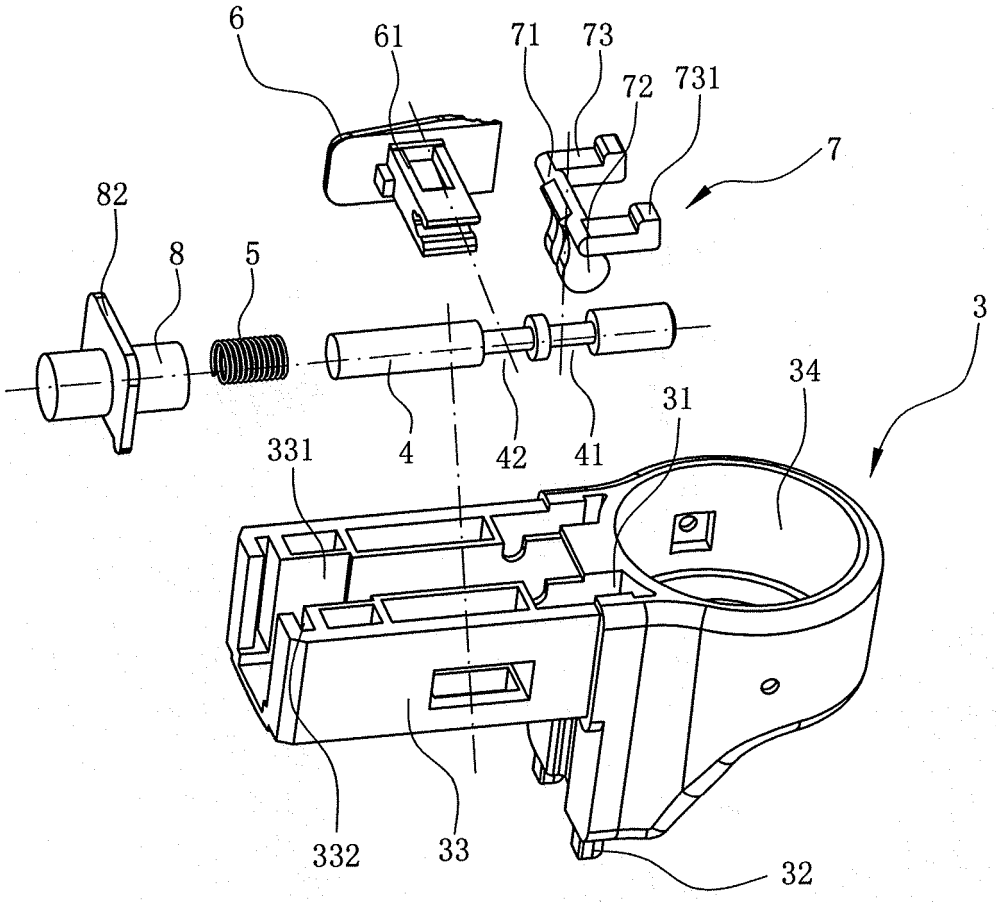

Fig. 3

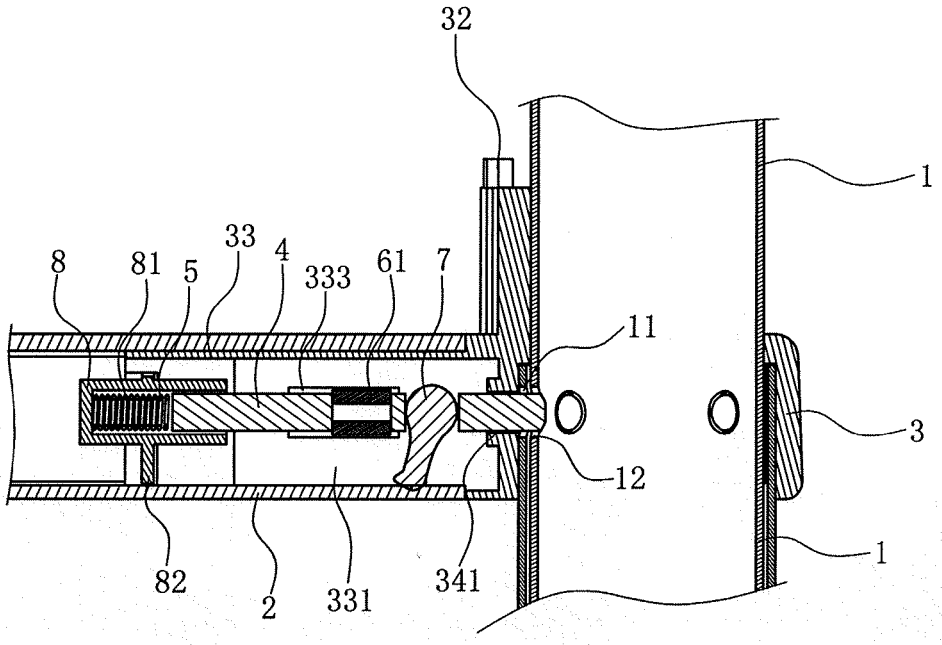

Fig. 4

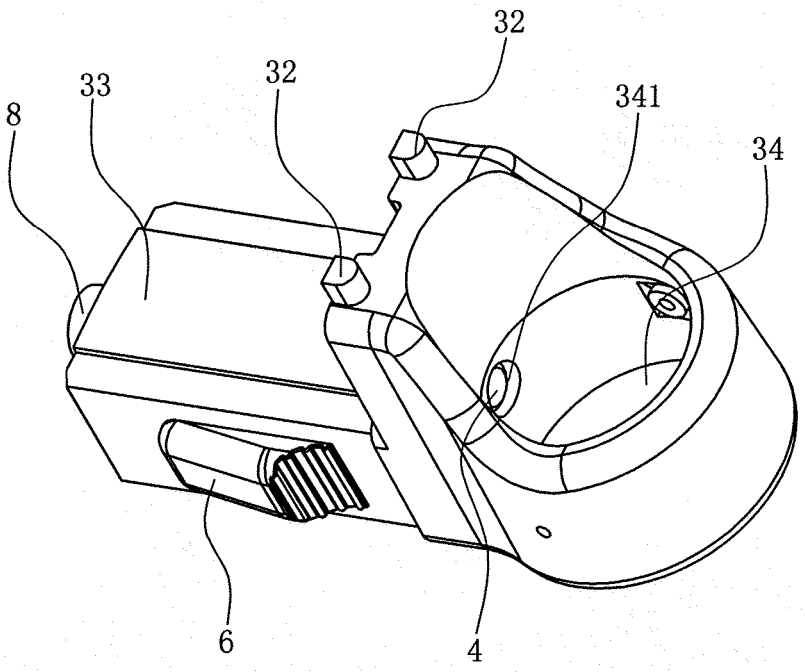

Fig. 5

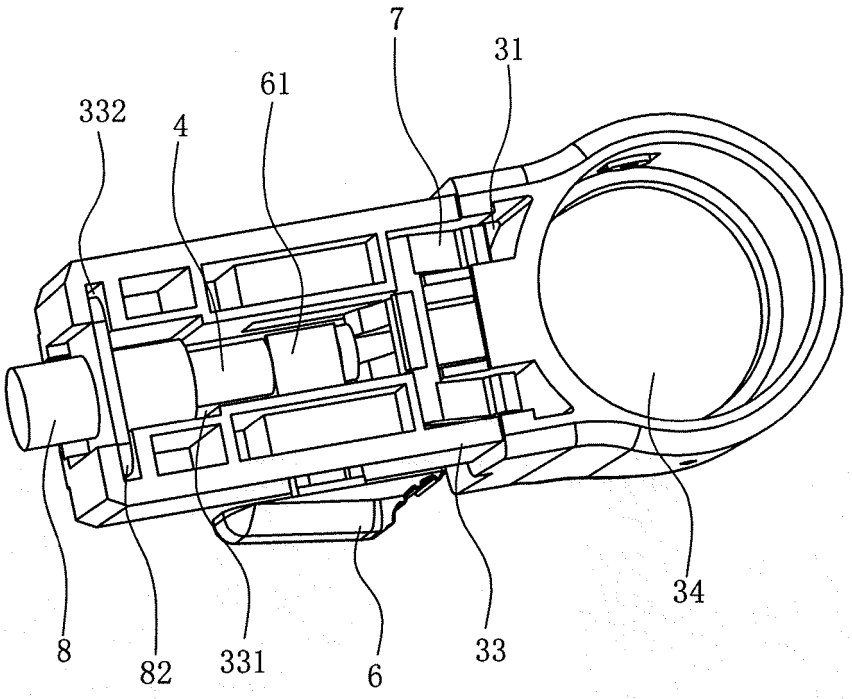

Fig. 6

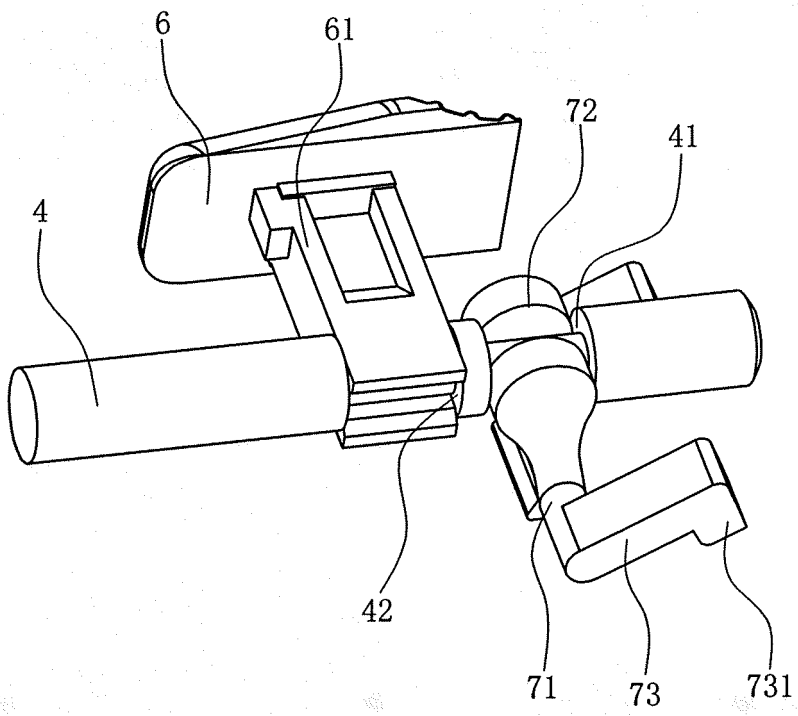

Fig. 7

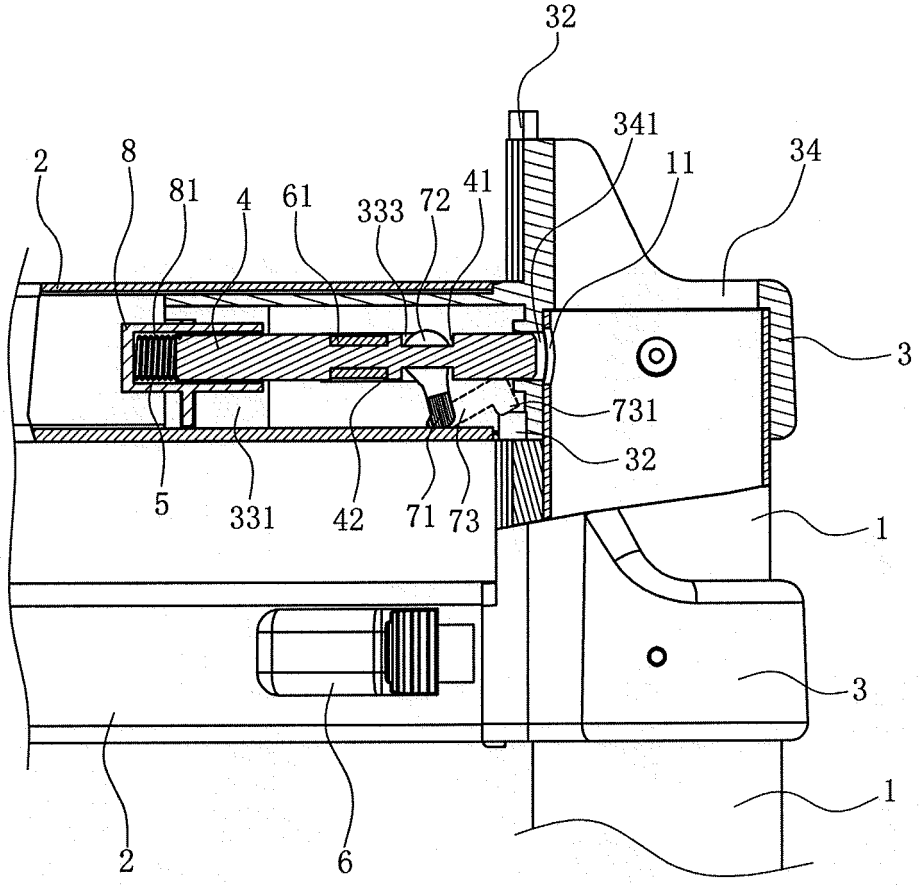

Fig. 8

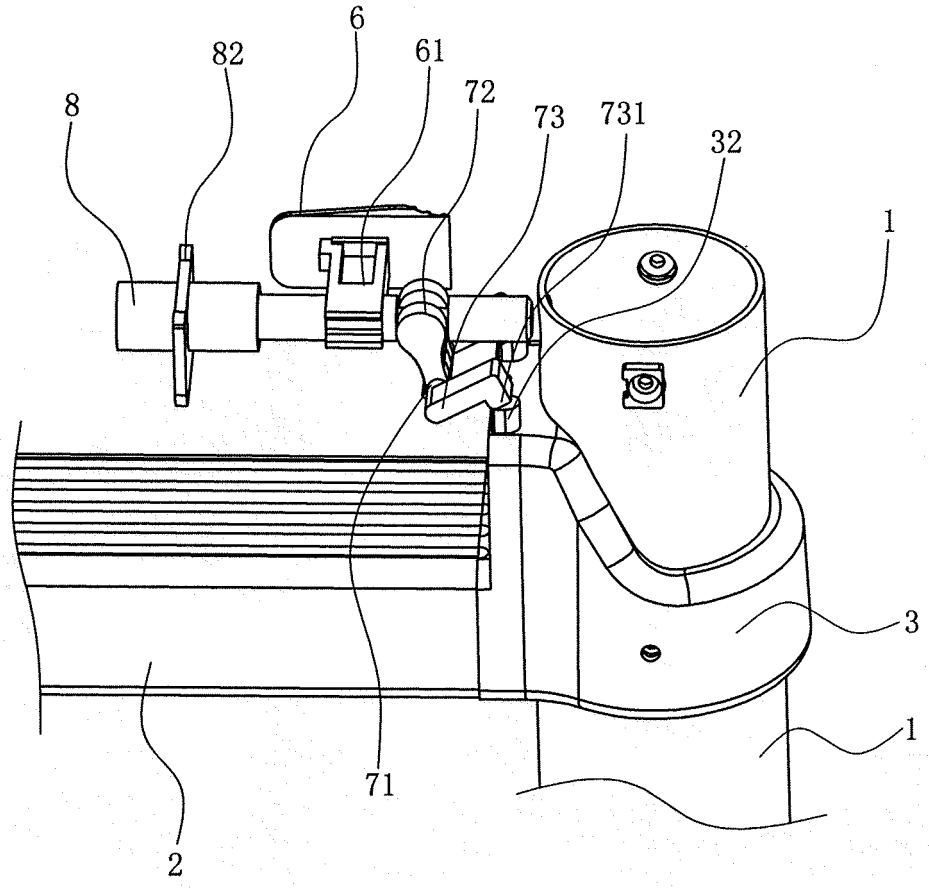

Fig. 9

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2011/001700

A. CLASSIFICATION OF SUBJECT MATTER

E06C 7/06 (2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: E06C, B63B 27, B63B 29

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, EPODOC, CNKI, CNPAT: extend and retract, connect, link, couple, join, WANG Wanxing, bolt, pin, lock+, spring, auto+, fold+, collapse, pucker, telescopic, extension, ladder?, deblocking, unblock, unlock+, tripper

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 102003136 A (WANG, Wanxing), 06 April 2011 (06.04.2011), claims 1-10	1-10
PX	CN 201883928 U (WANG, Wanxing), 29 June 2011 (29.06.2011), claims 1-10	1-10
Y	CN 201246097 Y (WANG, Wanxing), 27 May 2009 (27.05.2009), claim 1, and figure 2	1-3
Y	CN 200985737 Y (SU, Zhengping), 05 December 2007 (05.12.2007), description, particular embodiments, and figures 3-4	1-3
Y	CN 200971751 Y (FAN, Gang), 07 November 2007 (07.11.2007), description, particular embodiments	1
Y	CN 2881052 Y (HE, Haitao), 21 March 2007 (21.03.2007), abstract, and figure 1	1
A	JP 2000054616 A (MORINO MASARU), 22 February 2000 (22.02.2000), the whole document	1-10
A	EP 2157276 A2 (CORE DISTRIB INC.), 24 February 2010 (24.02.2010), the whole document	1-10

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
22 December 2011 (22.12.2011)	**19 January 2012 (19.01.2012)**
Name and mailing address of the ISA/CN: State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No.: (86-10) 62019451	Authorized officer **CUI, Ruimei** Telephone No.: (86-10) **62085032**

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