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(54) SHOCK-PROOF MECHANICAL MAGNETIC LOCK

(57) The present invention relates to a shock-proof mechanical magnetic lock, comprising an iron plate (211) located on one side, a pull plug (212) vertically protruding from the iron plate (211), a magnet (221) located on the other side, a sleeve (222) located in the magnet (221) and having a top opening for inserting the pull plug (212), and a stop ring (223) sleeved outside the sleeve (222), the stop ring (223) is fixed on the magnet (221), the bottom of the sleeve (222) is installed on a substrate (226) below the magnet (221) via a bottom connecting piece (227), the magnet (221) and the stop ring (223) can axially move relative to the sleeve (222), and the sleeve (222) and the stop ring (223) are provided with a spring (229) thereof. The improved structure has the following advantages: improving the service life, security and impact resistance of the lock; reducing the cost of processing and assembly; the opening structure at top of the sleeve reducing the probability of the internal balls stuck.

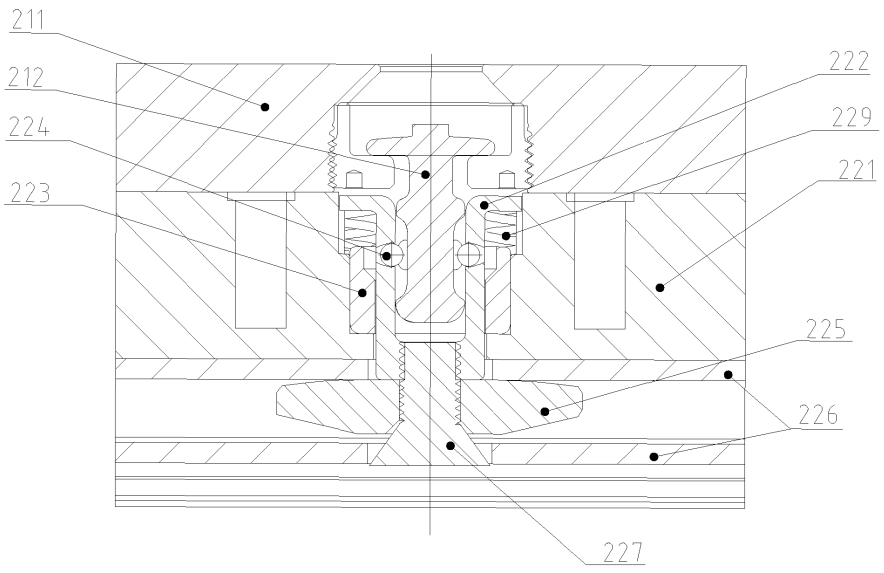

Fig. 3

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Description

Technical field of the invention

[0001] The present invention relates to a lock, specifically, it relates to a shock-proof mechanical magnetic lock.

Background of the invention

[0002] A shock-proof mechanical magnetic lock in the prior art is illustrated in Figure 1 and Figure 2, an iron plate 111 is located on one side of the lock, wherein a pull plug 112 vertically protruding from the iron plate 111, and a magnet 121 is located on the other side of the lock, wherein a sleeve 122 is located in the magnet 121 and has a top opening for inserting the pull plug 112, a stop ring 123 is sleeved outside the sleeve 122. Wherein, the pull plug 112 has a flange in the end. The sleeve 122 comprises a number of round holes located on the sidewall thereof, and each of the round holes receives a ball 124. The upper aperture of the center hole of the stop ring 123 is larger than the lower aperture of the center hole of the stop ring 123. The bottom of sleeve 122 is fixed to a substrate 126 by means of a bottom connecting piece 127, wherein the substrate 126 is positioned below the magnet 121, the stop ring 123 is fixed to the magnet 121, the magnet 121 and the stop ring 123 can vertically move relative to the sleeve 122.

[0003] One end of the bottom connecting piece 127 is fixed to the bottom of sleeve 122 which positioned above the substrate 126; the other end is fixed to the cushion 125 which positioned below the substrate 126. The cushion 125 has upper and lower flat surfaces, which are substantially rectangular in shape.

[0004] Limiting screw 128 with one end fixed on the magnet 121, and the screw stems extend through the corresponding holes on substrate 126 and form a nut at the distal end, the diameter of the corresponding holes on the substrate 126 are larger than the screw stem diameter of limiting screw 128, but smaller than the nut diameter. Springs 129, which sleeved outside the limiting screw 128, are stuck between the substrate 126 and the nut of limiting screw 128. In the known lock structure, two limiting screws 128 are arranged on both sides of the sleeve 122, and each of the limiting screws 128 is respectively sleeved by a spring 129.

[0005] When the lock is energized, the door is closed, and at the same time the magnetic field generated by the magnet 121 attracts the iron plate 111, the pull plug 112 is inserted into the internal cavity from the top opening of sleeve 122, which is provided within the magnet 121. As shown in Figure 1, at the time, the balls 124 are surrounded by the portion having a large diameter of the stop ring 123. Therefore, the flange at the end of the pull plug 112 can glide into the sleeve 122. In this case, the locking force only comprises the attraction force generated by the magnet 121. When an external force acts on the iron plate 111, due to the action of attraction force, the iron plate 111 will pull the magnet 121 so as to overcome the elastic force of the springs, then the magnet 121 separates from the substance 126. As shown in Figure 2, the stop ring 123 moves upward relative to the sleeve 122, and the balls 124 are surrounded by the portion having a small diameter of the stop ring 123. The balls 124 are squeezed radially toward the axis of the sleeve and hold the flange at the end of the pull plug 112, and the door cannot be opened.

[0006] The known magnetic lock has a short service life, for example, only has80-120 thousand times of service life. The impact resistance of the lock is poor and cannot meet the requirements of customers. The lock often gets stuck, namely, locking easily occurs between the balls and the pull plug. Two reset springs are easy to fracture. The cushion on the bottom connecting piece has structure defects. When the door rotates, the turning of the lock is insufficient as rotating with the iron plate in multiple directions. Due to the uneven force, leverage effect occurs in the lock. Therefore, the lock is easy to open, which has a lower security.

Description of the invention

[0007] One of the technical problems solved by the present invention is to provide a shock-proof mechanical magnetic lock having a more durable structure, which is also simpler and safer.

[0008] To solve the above technical problems, the present invention adopts the following technical solution:

> A shock-proof mechanical magnetic lock comprises: an iron plate located on one side, a pull plug vertically protruding from the iron plate, a magnet located on the other side, a sleeve located in the magnet and having a top opening for inserting the pull plug, and a stop ring sleeved outside the sleeve. The pull plug has a flange in the end. A mechanism is provided on the sleeve and the stop ring, and the components of the mechanism cooperate with each other to adjust the aperture of internal cavity of the sleeve. The stop ring is fixed to the magnet, and the bottom of sleeve is mounted to a substrate by means of a bottom connecting piece, the substrate is positioned below the magnet. The magnet and the stop ring can axially move relative to the sleeve. A spring is arranged between the sleeve and the stop ring.

[0009] As for the aforesaid shock-proof mechanical magnetic lock, one end of the bottom connecting piece is fixed to the bottom of the sleeve. The other end of the bottom connecting piece is fixed to the cushion, which is positioned below the substrate. The bottom of sleeve passes through the corresponding opening on the substrate, and abuts against the cushion.

[0010] As for the aforesaid shock-proof mechanical magnetic lock, the diameter of the corresponding open-

ing on the substrate is larger than the bottom diameter of the sleeve, but smaller than the maximum diameter of the horizontal cross-section of the cushion.

[0011] As for the aforesaid shock-proof mechanical magnetic lock, the bottom connecting piece is a screw.

[0012] As for the aforesaid shock-proof mechanical magnetic lock, the cushion has upper and lower arc-shaped surfaces.

[0013] As for the aforesaid shock-proof mechanical magnetic lock, the upper sidewalls of the sleeve extend radially outward to form a flange.

[0014] As for the aforesaid shock-proof mechanical magnetic lock, the flange located at the opening of the sleeve has a larger diameter than the diameter of the outer wall of the stop ring.

[0015] As for the aforesaid shock-proof mechanical magnetic lock, the substrate is formed by aluminum groove.

[0016] Compared with the prior art, the technical solution of the present invention mainly has the following advantages:

1. Remove the two springs and two limiting screws in the known lock structure, and arrange a spring between the sleeve and the stop ring so as to improve the service life of the lock, for example, the service life can be increased from the original 80-120 thousand times to 500 thousand times now.
2. The cushion sleeved outside the bottom connecting piece has been improved; the current cushion with a spherical surface takes place of the original rectangular cushion. Thus, when the door rotates, the magnet can rotate in multiple directions with the iron plate, so as to avoid the original dull state and improve the impact resistance of the lock. By the impact testing, the present impact resistance can be increased from 120J to 160J.
3. The opening structure at the top of the sleeve is simple and can effectively prevent dust from entering the inside of the lock, which can reduce the probability of the internal balls stuck.
4. Reduce the assembly parts such that the cost of processing and assembly is decreased.
5. Fixing mechanism of the sleeve fits with the substrate by the spherical surface, the random rotating cushion with spherical surface can cooperate with the rotation of the door well. When the door is rotated, the attracted iron plate and magnet can rotate in multiple directions with the door. Thus, it can greatly overcome the defects caused by rotation of the door. Therefore, the door is not easy to open and the security is improved.

Brief Description of the Drawings

[0017]

Figure 1 is a schematic view of a known magnetic lock in locked state, which is not subjected to the external forces;

Figure 2 is a schematic view of the magnetic lock of Figure 1 in locked state, which is subjected to the external forces;

Figure 3 is a schematic view of the magnetic lock according to the present invention in locked state, which is not subjected to the external forces;

Figure 4 is a schematic view of the magnetic lock of Figure 3 in locked state, which is subjected to the external forces.

Description of the Preferred Embodiment

[0018] Referring to Figure 3 and Figure 4, the shock-proof mechanical magnetic lock of the present invention comprises an iron plate 211 located on one side, a pull plug 212 vertically protruding from the iron plate 211, a magnet 221 located on the other side, a sleeve 222 located in the magnet 221 and having a top opening for inserting the pull plug 212, and a stop ring 223 sleeved outside the sleeve 222. Wherein, the pull plug 212 has a flange in the end. A mechanism is provided on the sleeve 222 and the stop ring 223, and the components of the mechanism cooperate with each other to adjust the aperture of internal cavity of the sleeve 222. In one aspect, the mechanism comprises a number of round holes located on the sidewall of sleeve 222, and each of the round holes receives a ball 224, in another aspect, a step is formed on the inner surface of the sidewall of the stop ring 223, and the upper aperture of the internal cavity of the stop ring 223 is larger than the lower aperture of the internal cavity of the stop ring 223. The stop ring 223 is fixed to the magnet 221, and by means of a bottom connecting piece 227, the bottom of sleeve 222 can be rotatably mounted to substrate 226 positioned below the magnet 221, relative to the substrate 226. The magnet 221 and stop ring 223 can axially move relative to the sleeve 222. A spring 229 is arranged between the sleeve 222 and the stop ring 223.

[0019] One end of the bottom connecting piece 227 is fixed to the bottom of sleeve 222, and the other end of the bottom connecting piece 227 is fixed to the cushion 225, which is positioned below the substrate 226. The bottom of sleeve 222 passes through the corresponding opening on the substrate 226, and abuts against the cushion 225, and the diameter of the corresponding opening on the substrate 226 is larger than the bottom diameter of sleeve 222, but smaller than the maximum diameter of the horizontal cross-section of the cushion 225. Wherein, the bottom connecting piece 227 is preferably a screw. The cushion 225, which sleeved outside the screw stem, is preferably an iron sheet having upper and lower arc-shaped surfaces, wherein the screw stem refers to the portion between the bottom of sleeve 222 and the nut.

[0020] Preferably, each of the upper sidewalls of sleeve 222 extends radially outward to form a flange.

More preferably, the flange of the sleeve 222 in the opening has a larger diameter than the diameter of the outer wall of the stop ring 223.

[0021] As an embodiment, the substrate 226 can be formed by aluminum groove. The number of the round holes on the sidewall of the sleeve 222 can be six, and the balls 224 can be six steel balls.

[0022] The shock-proof mechanical magnetic lock of the present invention achieves the process of locking and unlocking by means of the electromagnetic attracting and releasing. The transformation between the electromagnetic force and mechanical force is achieved by pulling the components so as to generate displacement via electromagnetic attraction.

[0023] When the lock is energized, the door is closed, and at the same time the magnetic field generated by the magnet 221 attracts the iron plate 211 located in the other side. Meanwhile, the pull plug 212 is inserted into the internal cavity from the top opening of sleeve 222, which provided within the magnet 221. As shown in Figure 3, at the time, the balls 224 in the sleeve 222 are surrounded by the portion having a large diameter of the stop ring 223, the flange at the end of the pull plug 212 glides across the balls 224 into the internal cavity of sleeve 222. In this case, locking is maintained by the magnetic attraction force generated between the magnet 221 and the iron plate 211, and there is no mechanical force. The locking force is small.

[0024] When an external force acts on the iron plate 211, since there is an attraction force between the magnet 221 and the iron plate 211, the magnet 221 driven by the iron plate 211 leaves the substrate 226. As shown in Figure 4, the stop ring 223 overcomes the elastic force of the spring 229 and moves upward relative to the sleeve 222, until the balls 224 in the sleeve 222 are surrounded by the portion having a small diameter of the stop ring 223. The balls 224 in the sleeve 222 are squeezed radially toward the axis of the sleeve by the stop ring 223 and hold the flange at the end of the inserted pull plug 212 tightly, which produces a self-locking and converts to a mechanical tension. Therefore, the big tension locked state is achieved. In this case, both the attraction force of magnet 221 and the mechanical force generated by the locked balls 224 play a role to achieve the purpose of locking, which maintains a larger locking force.

[0025] When the power is cut, the magnet field of magnet 221 vanishes. The stop ring 223 resets under the action of the elastic force of spring 229, during the process, the stop ring 223 actuates the magnet 221 to move to the substrate 226 and abuts against the substrate 226 again. At the time, the balls 224 in the sleeve 222 are surrounded by the portion having a large diameter of the stop ring 223. When the pre-tension (pre-pressure) acting on the iron plate 211 is lower than the prescribed requirement, the flange at the end of the pull plug 212 is extracted out from the sleeve 222, the iron plate 211 separates from the magnet 221, then unlocking is realized. Since the spring 229 has a predetermined restoring force, if the pre-tension (pre-pressure) is too large, the elastic force is not sufficient to reset the stop ring 223, and the pull plug 212 cannot be extracted out from the sleeve 222. Therefore, it cannot be unlocked. Thus, only when the pre-tension (pre-pressure) is lower than the prescribed value, it can be unlocked.

Claims

1. A shock-proof mechanical magnetic lock, comprising: an iron plate (211) located on one side of the magnetic lock, a pull plug (212) vertically protruding from the iron plate (211), a magnet (221) located on the other side of the magnetic lock, a sleeve (222) located inside the magnet (221) and having a top opening for inserting the pull plug (212), and a stop ring (223) sleeved outside the sleeve (222); the pull plug (212) has a flange in the end, a mechanism is provided on the sleeve (222) and the stop ring (223), and the components of the mechanism cooperate with each other to adjust the aperture of internal cavity of the sleeve (222); the stop ring (223) is fixed to the magnet (221), **characterized in that**, the bottom of sleeve (222) is mounted to a substrate (226) by means of a bottom connecting piece (227), the substrate (226) is positioned below the magnet (221); the magnet (221) and the stop ring (223) can axially move relative to the sleeve (222); a spring (229) is arranged between the sleeve (222) and the stop ring (223).

2. The shock-proof mechanical magnetic lock according to claim 1, **characterized in that**, one end of the bottom connecting piece (227) is fixed to the bottom of sleeve (222), the other end is fixed to the cushion (225), which is positioned below the substrate (226); the bottom of sleeve (222) passes through the corresponding opening on the substrate (226), and abuts against the cushion (225).

3. The shock-proof mechanical magnetic lock according to claim 2, **characterized in that**, the diameter of the corresponding opening on the substrate (226) is larger than the bottom diameter of sleeve (222), and smaller than the maximum diameter of the horizontal cross-section of cushion (225).

4. The shock-proof mechanical magnetic lock according to claim 1 or 2, **characterized in that**, the bottom connecting piece (227) is a screw.

5. The shock-proof mechanical magnetic lock according to claim 2, **characterized in that**, the cushion (225) has upper and lower arc-shaped surfaces.

6. The shock-proof mechanical magnetic lock according to claim 1, **characterized in that**, the upper side-

walls of the sleeve (222) extend radially outward to form a flange.

7. The shock-proof mechanical magnetic lock according to claim 6, **characterized in that**, the flange located at the opening of the sleeve (222) has a larger diameter than the diameter of the outer wall of stop ring (223).

8. The shock-proof mechanical magnetic lock according to claim 1, **characterized in that**, the substrate (226) is formed by aluminum groove.

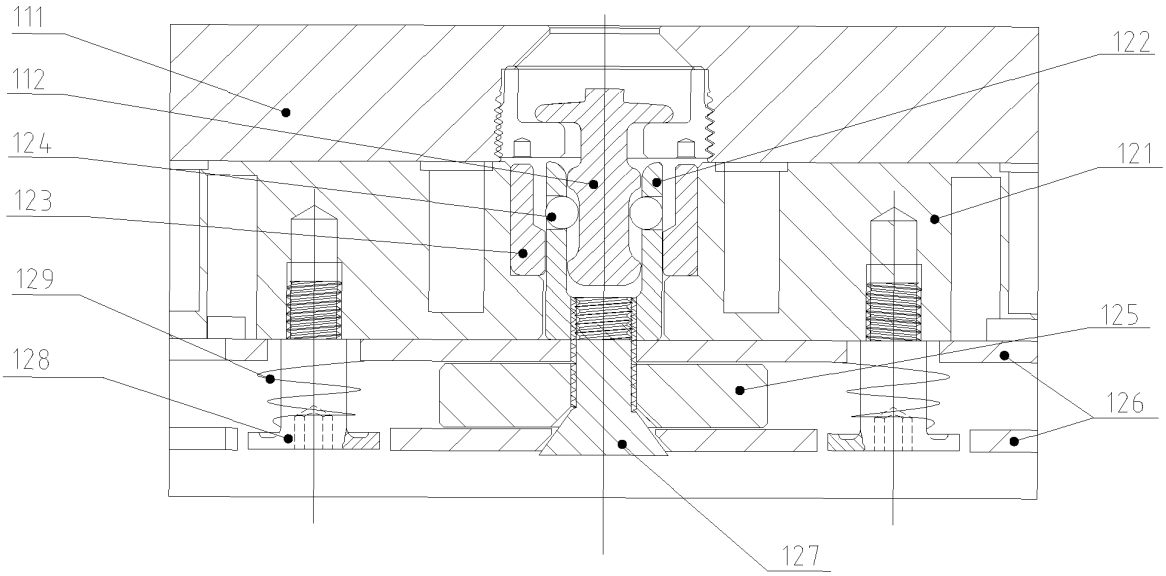
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Fig. 1

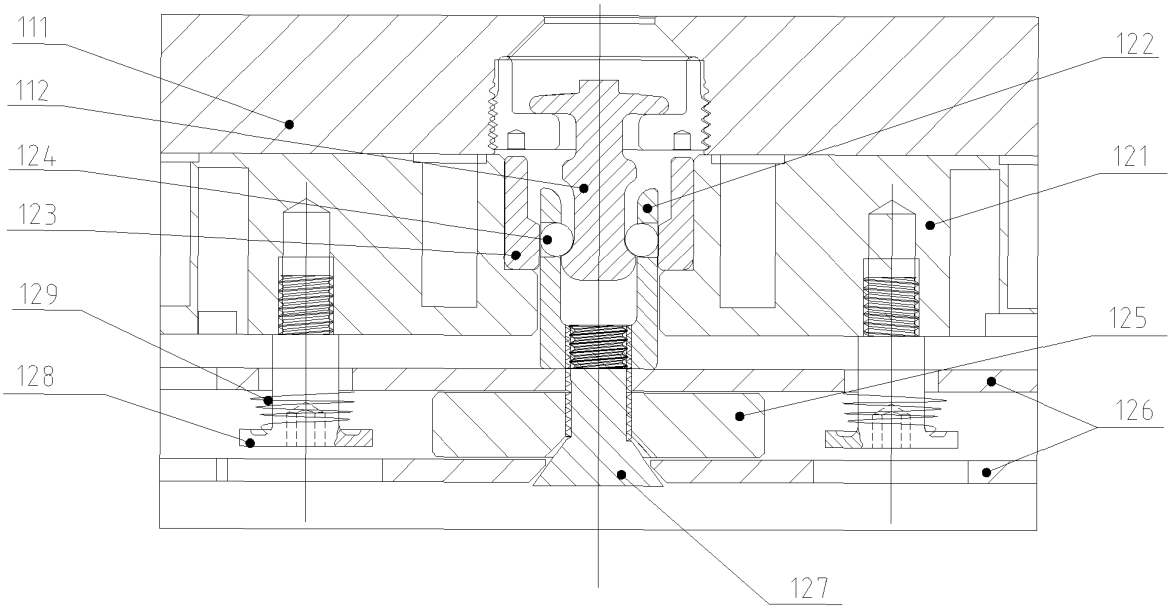
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Fig. 2

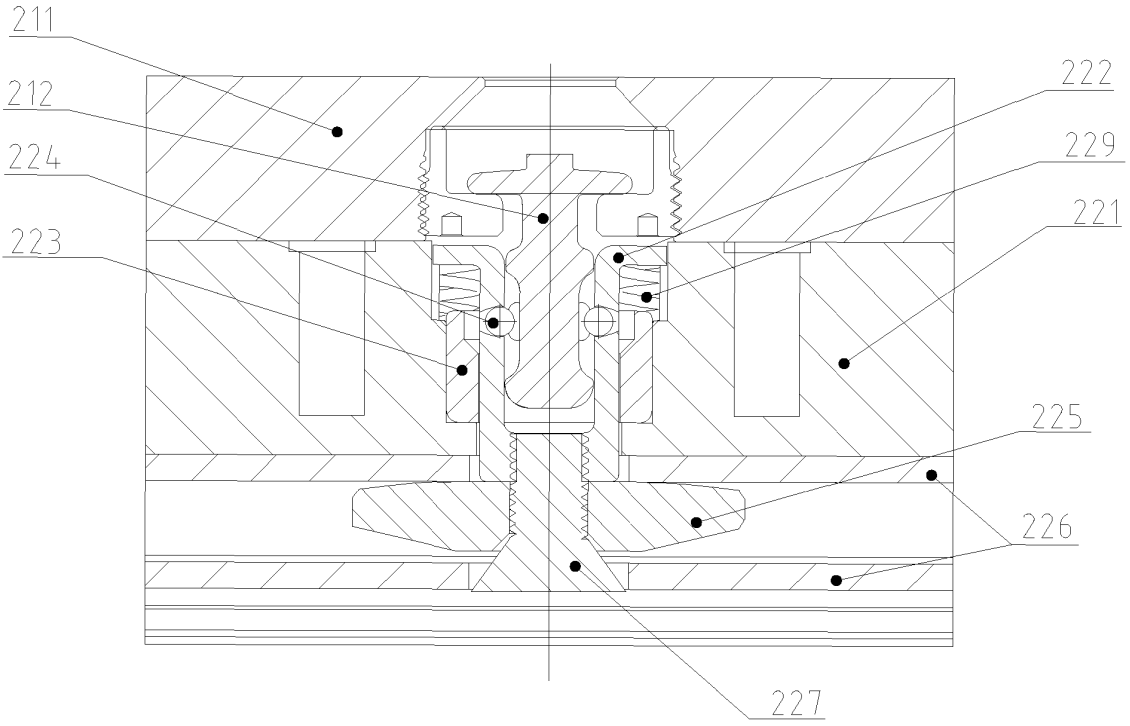
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Fig. 3

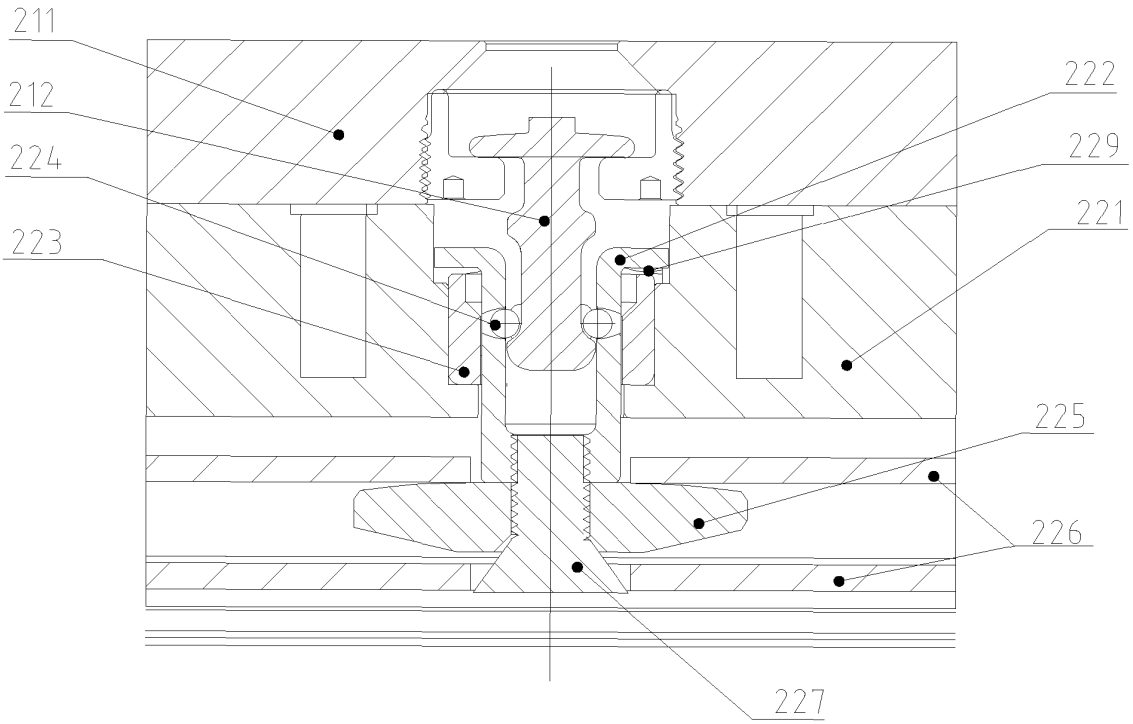
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Fig. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2013/073043

A. CLASSIFICATION OF SUBJECT MATTER

See the extra sheet
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: E05B

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) CNPAT, CNKI, WPI, EPODOC: MAGNET+, SPRING?, BALL?, SPHER+, ELECTRO+, MOV+, SLID+, SLIP+, GLID+, SLEEVE, HOLLOW, HOLE, PROJECT+, PROTRUD+, FLANGE, CONCAV+, PREVENT+, SHAK+, BOUNC+, BUMP, STRIK+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 202596318 U (SHANGHAI ONE TOP CORP.) 12 December 2012 (12.12.2012) claims 1-8	1-8
PX	CN 102619404 A (SHANGHAI ONE TOP CORP.) 01 August 2012 (01.08.2012) claims 1-8	1-8
A	CN 101240676 A (SHANGHAI OUYI ELECTRICAL&HARDWARE CO LTD) 13 August 2008 (13.08.2008) description, pages 4 to 6 and figures 1 to 5	1-8
A	CN 101532351 A (SHANGHAI ONE TOP CORP.) 16 September 2009 (16.09.2009) the whole document	1-8
A	CN 201206370 Y (LIANG, Meiqing) 11 March 2009 (11.03.2009) the whole document	1-8
A	DE 19639545 C1 (IKON PRAEZISIONSTECHNIK AG) 18 December 1997 (18.12.1997) the whole document	1-8

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

* Special categories of cited documents:

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&"document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
25 May 2013 (25.05.2013)	04 July 2013 (04.07.2013)
Name and mailing address of the ISA 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 ZHENG, Shihua Telephone No. (86-10) 62084084

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2013/073043

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2005103926 A1 (HR TEXTRON INC et al.) 19 May 2005 (19.05.2005) the whole document	1-8

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2013/073043

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 202596318 U	12.12.2012	None	
CN 102619404 A	01.08.2012	None	
CN 101240676 A	13.08.2008	CN 101240676 B	11.05.2011
CN 101532351 A	16.09.2009	CN 101532351 B	21.12.2011
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		WO 2005075765 A2	18.08.2005
		WO 2005075765 A3	13.10.2005
		US 2006091683 A1	04.05.2006
		US 7125058 B2	24.10.2006

Form PCT/ISA /210 (patent family annex) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2013/073043

A. CLASSIFICATION OF SUBJECT MATTER

E05B 47/02 (2006.01) i

E05B 15/00 (2006.01) i

Form PCT/ISA /210 (extra sheet) (July 2009)