



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
07.08.2024 Bulletin 2024/32

(21) Application number: **23154783.7**

(22) Date of filing: **02.02.2023**

(51) International Patent Classification (IPC):
E05B 35/00 (2006.01) **E05B 27/00** (2006.01)
E05B 19/00 (2006.01) **E05B 9/04** (2006.01)
E05B 15/16 (2006.01)

(52) Cooperative Patent Classification (CPC):
E05B 35/005; E05B 9/041; E05B 15/1614;
E05B 19/0058; E05B 27/0021

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL
NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
KH MA MD TN

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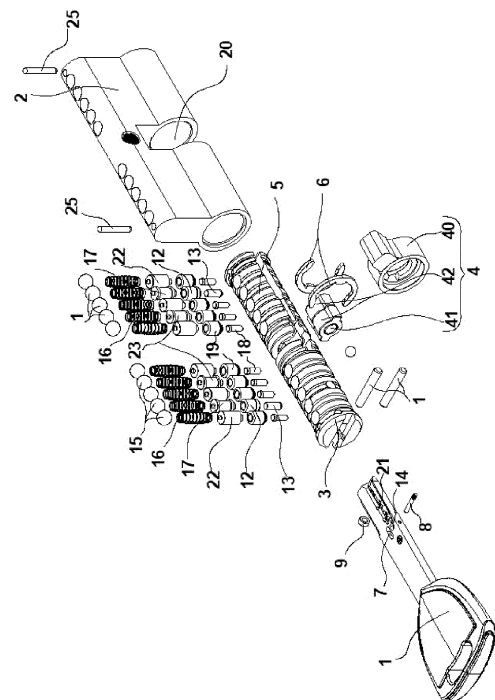
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(54) **BALL LOCK CYLINDER AND LOCK THEREOF**

(57) The disclosure discloses a ball lock cylinder and a lock thereof. The ball lock cylinder comprises a key, a lock case, an outer lock liner, a double-opening and shifting support assembly and an inner lock liner, wherein an oblong hole which penetrates through is formed at a part, corresponding to a keyhole port of the outer lock liner and the inner lock liner, of the key, and the oblong hole is pin-connected with an annular ball which eccentrically rolls in a keyhole; a first groove and a second groove which are in yielding fitting with the annular ball in the key are respectively formed in a lower side and an upper side of the keyhole, in each of the outer lock liner and the inner lock liner; flat-end female beads which can slide up and down and are matched with the annular ball are vertically arranged in longitudinal directions of the outer lock liner and the inner lock liner, and centers of the flat-end female beads are further sleeved with cone-end flat-tail male beads which can slide up and down; and an annular plane of an outer edge of each flat-end female bead is in contact with the annular ball in the key, and a lower cone end face of each cone-end flat-tail female bead is matched with a tooth socket formed in the key beside the annular ball. During unlocking, a mutual reverse movement mode in which the flat-end female beads rise and the cone-end flat-tail male beads fall is formed, so that coping the key by 3D printing is avoided, technical unlocking is effectively avoided and the anti-theft ability is improved.

[Fig. 1]



Description

Technical Field

[0001] The disclosure relates to a lock cylinder technology, and in particular to a ball lock cylinder and a lock thereof.

Background Art

[0002] Locks in the prior art are various. Most of mechanical lock cylinders realize a single locking function through a single row of marbles or double rows of marbles, so that the structure is single, the anti-theft ability is poor, and the technical unlocking cannot be effectively avoided; moreover, in the prior art, most of the marble lock cylinders can be unlocked with tinfoil and an unlocking vibration gun due to single locking; and now a situation of unlocking by coping a key through 3D printing still exists, causing low security of the lock under the existing situation.

[0003] However, domestic lock cylinders that high-end market at home and abroad required pose an increasing demand for a function of preventing the key from being copied by 3D printing, an anti-drilling function, and a function of preventing technical unlocking. There is an urgent need to improve a structure of an existing marble lock cylinder, so as to effectively improve the anti-theft ability of the lock cylinder.

Summary of Invention

[0004] The invention is set out in the appended set of claims.

[0005] This invention provides a ball lock cylinder and a lock thereof, so that the following effects of performing interlocking by adopting multiple combined movable tracks, effectively avoiding technical unlocking, preventing unlocking by coping a key through 3D printing and unlocking with a vibration electric gun, realizing a low mutual unlocking rate and an anti-drilling function and effectively improving the anti-theft ability are achieved.

[0006] At least one embodiment of the disclosure adopts the following technical solution.

[0007] A ball lock cylinder, comprising a key, a lock case, an outer lock liner, a double-opening and shifting support assembly and an inner lock liner, wherein the outer lock liner and the inner lock liner are respectively arranged at a front end and a rear end of the lock case;

a shifting support groove in which the double-opening and shifting support assembly is mounted is formed in a middle part of the lock case;

an oblong hole which penetrates through from top to bottom is formed at a part, corresponding to a keyhole port of the outer lock liner and the inner lock liner, of the key, and the oblong hole is pin-connected

with an annular ball which has an outer diameter higher than a thickness of the key and eccentrically rolls in the keyhole, through a provided transverse pin;

a first groove and a second groove which are in yielding fitting with the annular ball in the key are respectively formed in a lower side and an upper side of the keyhole matched with the key, in each of the outer lock liner and the inner lock liner, the first groove is located at an outer edge of the keyhole port and communicates with the outer side, the second groove is located at the inner side of the keyhole and its starting end is arranged close to an end of the first groove, and the key drives the annular ball in an eccentric state to roll from the first groove to the bottom and tangentially roll into the second groove so that a center of the annular ball forms a reversed Z-shaped movement track;

flat-end female beads which are capable of sliding up and down and are matched with the annular ball are vertically arranged in longitudinal directions of the outer lock liner and the inner lock liner, centers of the flat-end female beads are sleeved with cone-end flat-tail male beads capable of sliding up and down, the flat-end female beads and the cone-end flat-tail male beads form male-female beads that are matched in a mutual sleeving manner;

an annular plane of an outer edge of each flat-end female bead is in contact with the annular ball in the key, and a lower cone end face of each cone-end flat-tail male bead is matched with a ball tooth socket formed in the key beside the annular ball;

bolt holes are vertically provided in the corresponding parts, above the flat-end female beads, of the lock case in longitudinal directions, and a sealing bead, a bead spring and a male-female flat bead which push each flat-end female bead and each cone-end flat-tail male bead along the longitudinal direction are sequentially mounted in each bolt hole from top to bottom;

the annular ball in the key rolls from the first groove to the bottom and tangentially enters the second groove, while the annular ball is in contact with the flat-end female bead, the lower cone end face of the cone-end flat-tail male bead slides into the ball tooth socket in the key, the flat-end female bead and the cone-end flat-tail male bead are received in the outer lock liner or the inner lock liner under the pushing by the bead spring and the male-female flat bead, and the key is able to drive the outer lock liner or the inner lock liner to rotate.

[0008] Preferably, the double-opening and shifting

support assembly is composed of a shifting support, a central sleeve shaft and two shifting blocks, wherein a center of the shifting support is hollow, the two shifting blocks are coaxially mounted on the central sleeve shaft in an idling and sleeving manner, the two shifting blocks are mounted at a front end and a rear end of the hollow center of the shifting support, and after the key unlocks the outer lock liner or the inner lock liner, the key pushes the shifting blocks at the corresponding sides forward and drives the shifting support to rotate.

[0009] Preferably, a plurality of male beads and female beads which are matched in a mutual sleeving manner are arranged on a front side or a back side, opposite to the key, of the outer lock liner and the inner lock liner, main tooth sockets matched with the male beads and the female beads are formed in the front side and the back side of the key respectively, directional bolt holes are lengthways and vertically formed in the corresponding parts, above the plurality of the male beads and the female beads, of the lock case, a sealing bead, a bead spring, a cylindrical male-female flat bead and an I-shaped male-female flat bead for longitudinally locking the lock liner are sequentially mounted in the directional bolt hole from top to bottom, and the cylindrical male-female flat bead and the I-shaped male-female flat bead are pushed by the bead spring to push downwards male bead or/and the female bead to extend into or out of a marble hole in the outer lock liner or the inner lock liner to limit the lock liner from rotating.

[0010] Preferably, lock liner anti-drilling pins for preventing damage from an external drill bit are bolted into ends of the outer lock liner and the inner lock liner respectively.

[0011] Preferably, housing anti-drilling pins for preventing the damage from the external drill bit are bolted into two ends of the lock case respectively.

[0012] Preferably, clamping springs for clamping ends of the outer lock liner or the inner lock liner are arranged at two sides of the shifting support groove respectively.

[0013] A lock which adopts the ball lock cylinder described above.

[0014] The disclosure has the beneficial effects as follows.

[0015] The key can drive the annular ball in the eccentric state to roll from the first groove of the outer lock liner or inner lock liner to the bottom and tangentially roll into the second groove, so that the center of the annular ball forms a reverse Z-shaped movement track; male-female beads formed by the flat-end female balls and the cone-end flat-tail male balls that are matched in a mutual sleeving manner are arranged at the parts, corresponding to the annular ball, of the outer lock liner or the inner lock liner, an annular plane of an outer edge of each flat-end female bead is in contact with the annular ball in the key, and a lower cone end face of each cone-end flat-tail female bead is matched with a ball tooth socket formed in the key beside the annular ball, so that when unlocking, a reverse movement mode in which the flat-end female

beads rise and the cone-end flat-tail male beads fall is formed. The reverse movement mode in combination with the reverse Z-shaped movement track formed by the annular ball makes the marble unable to be accessed by the existing technical unlocking and unlocking with the vibration electric gun, and the key cannot be copied by 3D printing, so that the security performance is effectively improved, the technical unlocking is effectively avoided and the anti-theft ability is improved.

[0016] Secondly, the lock liner anti-drilling pins for preventing the damage from the external drill bit are bolted into the ends of the outer lock liner and the inner lock liner respectively, and the housing anti-drilling pins for preventing the damage from the external drill bit are bolted into the two ends of the lock case respectively, so that violent unlocking with the vibration electric gun is effectively prevented.

Brief Description of Drawings

[0017]

Fig. 1 is schematic diagram of an exploded structure of the disclosure;

Fig. 2 is a schematic diagram of a partial exploded structure of a key and a lock liner in the disclosure;

Fig. 3 is a schematic diagram of an assembly structure of the key and the lock liner in the disclosure;

Fig. 4 is a schematic diagram of an exploded structure in which the key corresponds to the lock liner in the disclosure;

Fig. 5 is an enlarged schematic diagram of a sectional structure when the key is inserted into the lock liner in the disclosure;

Fig. 6 is an enlarged schematic diagram of a cross-sectional structure when the key is inserted into the lock liner in the disclosure;

Fig. 7 is a schematic diagram of a front view structure when the key is inserted into the lock liner in the disclosure;

Fig. 8 is an enlarged schematic diagram of a G-G sectional structure in Fig. 7;

Fig. 9 is an enlarged schematic diagram of an H-H sectional structure in Fig. 7;

Fig. 10 is a structural schematic diagram of a top-view structure of the disclosure;

Fig. 11 is an enlarged schematic diagram of a B-B sectional structure in Fig. 10;

Fig. 12 is a perspective structural diagram of the disclosure.

Description of Embodiments

[0018] A ball lock cylinder applied to a lock, as shown in Figs. 1 to 6, comprises a key 1, a lock case 2, an outer lock liner 3, a double-opening and shifting support assembly 4 and an inner lock liner 5, wherein the outer lock liner 3 and the inner lock liner 5 are respectively arranged at a front end and a rear end of the lock case 2; a shifting support groove 20 in which the double-opening and shifting support assembly 4 is mounted is formed in a middle part of the lock case 2, and clamping springs 6 for clamping ends of the outer lock liner 3 or the inner lock liner 5 are arranged at two sides of the shifting support groove 20 respectively; an oblong hole 7 which penetrates through from top to bottom is formed at a part, corresponding to a keyhole port of the outer lock liner 3 and the inner lock liner 5, of the key 1, and the oblong hole 7 is pin-connected with an annular ball 9 which has an outer diameter higher than a thickness of the key 1 and eccentrically rolls in a keyhole, through a provided transverse pin 8; a first groove 10 and a second groove 11 which are in yielding fitting with the annular ball 9 in the key 1 are respectively formed in a lower side and an upper side of the keyhole matched with the key 1, in each of the outer lock liner 3 and the inner lock liner 5; the first groove 10 is located at an outer edge of the keyhole port and communicates with the outer side; the second groove 11 is located at the inner side of the keyhole and its starting end is arranged close to an end of the first groove 10; and the key 1 drives the annular ball 9 in an eccentric state to roll from the first groove 10 to the bottom and tangentially roll into the second groove 11 so that a center of the annular ball 9 forms a reversed Z-shaped movement track.

[0019] As shown in Fig. 1 to Fig. 12, flat-end female beads 12 which can slide up and down and are matched with the annular ball 9 are vertically arranged in longitudinal directions of the outer lock liner 3 and the inner lock liner 5, centers of the flat-end female beads 12 are sleeved with cone-end flat-tail male beads 13 capable of sliding up and down, and the flat-end female beads 12 and the cone-end flat-tail male beads 13 form male-female beads that are matched in a mutual sleeving manner; an annular plane of an outer edge of each flat-end female bead 12 is in contact with the annular ball 9 in the key 1, and a lower cone end face of each cone-end flat-tail female bead 13 is matched with a tooth socket 14 formed in the key 1 beside the annular ball 9; bolt holes are vertically provided in the corresponding parts, above the flat-end female beads 12, of the lock case 2 in longitudinal directions, and a sealing bead 15, a bead spring 16 and a male-female flat bead 17 which push each flat-end female bead 12 and each cone-end flat-tail male bead 13 along the longitudinal direction are sequentially mounted in each bolt hole from top to bottom.

[0020] As shown in Figs. 1 to 12, a plurality of male beads 18 and female beads 19 which are matched in a mutual sleeving manner are arranged on a front side or a back side, opposite to the key 1, of the outer lock liner 3 and the inner lock liner 5, main tooth sockets 21 matched with the male beads 18 and the female beads 19 are formed in the front side and the back side of the key 1 respectively, directional bolt holes are lengthways and vertically formed in the corresponding parts, above the plurality of the male beads 18 and the female beads 19, of the lock case 2, a sealing bead 15, a bead spring 16, a cylindrical male-female flat bead 22 and an I-shaped male-female flat bead 23 for longitudinally locking the lock liner are sequentially mounted in the directional bolt hole from top to bottom, and the cylindrical male-female flat bead 22 and the I-shaped male-female flat bead 23 are pushed by the bead spring 16 to push downwards male bead 18 or the female bead 19 to extend into or out of a marble hole in the outer lock liner 3 or the inner lock liner 5 to limit the lock liner from rotating.

[0021] As shown in Fig. 1, lock liner anti-drilling pins 24 for preventing the damage from an external drill bit are bolted into the ends of the outer lock liner 3 and the inner lock liner 5 respectively, and housing anti-drilling pins 25 for preventing the damage from the external drill bit are bolted into the two ends of the lock case 2 respectively. The double-opening and shifting support assembly 4 is composed of a shifting support 40, a central sleeve shaft 41 and two shifting blocks 42, wherein a center of the shifting support 40 is hollow, the two shifting blocks 42 are coaxially mounted on the central sleeve shaft 41 in an idling and sleeving manner, the two shifting blocks 42 are mounted at a front end and a rear end of the hollow center of the shifting support 40, and after the key 1 unlocks the outer lock liner 3 or the inner lock liner 5, the key pushes the shifting blocks 42 at the corresponding sides forward and drives the shifting support to rotate.

[0022] When in use, the annular ball 9 in the key 1 rolls from the first groove to the bottom 10 and tangentially enters the second groove 11; while the annular ball 9 is in contact with the flat-end female bead 12, the lower cone end face of the cone-end flat-tail male bead 13 slides into a ball tooth socket in the key 1, the flat-end female bead 12 and the cone-end flat-tail male bead 13 are received in the outer lock liner 3 or the inner lock liner 5 under the pushing by the bead spring 16 and the male-female flat bead 17, and the mutual cooperation among the three components allows a plane to be exactly flushed with a lock liner surface so that the lock can be unlocked, and the key 1 can drive the outer lock liner 3 or the inner lock liner 5 to rotate. When the key is pulled out, the annular ball 9 rolls along the second groove 11 to the bottom, tangentially enters the first groove 10 and rolls out completely, and the flat-end female beads 12 and the cone-end flat-tail male beads 13 fall down at the same time to lock completely, so that the interlocking of a whole lock cylinder structure is realized, the lock has a better anti-theft ability, technical unlocking is avoided, the key

cannot be copied by 3D printing, the security performance is effectively improved, and the unlocking with a vibration electric gun is effectively prevented.

[0023] The above-mentioned embodiments are only preferred embodiments of the disclosure, not limiting the scope of the disclosure, so that all equivalent changes made by the shape, structure and principle of the disclosure should be covered by the protection scope of the disclosure.

Industrial Applicability

[0024] The ball lock cylinder and lock thereof according to the invention will find application in both interior and exterior doors.

Claims

1. A ball lock cylinder, comprising a key, a lock case, an outer lock liner, a double-opening and shifting support assembly and an inner lock liner, wherein the outer lock liner and the inner lock liner are respectively arranged at a front end and a rear end of the lock case, **characterized in that:**

a shifting support groove in which the double-opening and the shifting support assembly is mounted is formed in a middle part of the lock case;

an oblong hole which penetrates through from top to bottom is formed at a part, corresponding to a keyhole port of the outer lock liner and the inner lock liner, of the key, and the oblong hole is pin-connected with an annular ball which has an outer diameter higher than a thickness of the key and eccentrically rolls in the keyhole, through a provided transverse pin;

a first groove and a second groove which are in yielding fitting with the annular ball in the key are respectively formed in a lower side and an upper side of the keyhole matched with the key, in each of the outer lock liner and the inner lock liner, the first groove is located at an outer edge of the keyhole port and communicates with the outer side, the second groove is located at the inner side of the keyhole and its starting end is arranged close to an end of the first groove, and the key drives the annular ball in an eccentric state to roll from the first groove to the bottom and tangentially roll into the second groove so that a center of the annular ball forms a reversed Z-shaped movement track;

flat-end female beads which are capable of sliding up and down and are matched with the annular ball are vertically arranged in longitudinal directions of the outer lock liner and the inner lock liner, centers of the flat-end female beads

are sleeved with cone-end flat-tail male beads capable of sliding up and down, the flat-end female beads and the cone-end flat-tail male beads form male-female beads that are matched in a mutual sleeving manner;

an annular plane of an outer edge of each flat-end female bead is in contact with the annular ball in the key, and a lower cone end face of each cone-end flat-tail male bead is matched with a ball tooth socket formed in the key beside the annular ball;

bolt holes are vertically provided in the corresponding parts, above the flat-end female beads, of the lock case in longitudinal directions, and a sealing bead, a bead spring and a male-female flat bead which push each flat-end female bead and each cone-end flat-tail male bead along the longitudinal direction are sequentially mounted in each bolt hole from top to bottom;

the annular ball in the key rolls from the first groove to the bottom and tangentially enters the second groove, while the annular ball is in contact with the flat-end female bead, the lower cone end face of the cone-end flat-tail male bead slides into the ball tooth socket in the key, the flat-end female bead and the cone-end flat-tail male bead are received in the outer lock liner or the inner lock liner under the pushing by the bead spring and the male-female flat bead, and the key is able to drive the outer lock liner or the inner lock liner to rotate.

2. The ball lock cylinder according to claim 1, **characterized in that** the double-opening and shifting support assembly is composed of a shifting support, a central sleeve shaft and two shifting blocks, wherein a center of the shifting support is hollow, the two shifting blocks are coaxially mounted on the central sleeve shaft in an idling and sleeving manner, the two shifting blocks are mounted at a front end and a rear end of the hollow center of the shifting support, and after the key unlocks the outer lock liner or the inner lock liner, the key pushes the shifting blocks at the corresponding sides forward and drives the shifting support to rotate.
3. The ball lock cylinder according to claim 1, **characterized in that** a plurality of male beads and female beads which are matched in a mutual sleeving manner are arranged on a front side or a back side, opposite to the key, of the outer lock liner and the inner lock liner, main tooth sockets matched with the male beads and the female beads are formed in the front side and the back side of the key respectively, directional bolt holes are lengthways and vertically formed in the corresponding parts, above the plurality of the male beads and the female beads, of the lock case,

a sealing bead, a bead spring, a cylindrical male-female flat bead and an I-shaped male-female flat bead for longitudinally locking the lock liner are sequentially mounted in the directional bolt hole from top to bottom, and the cylindrical male-female flat bead and the I-shaped male-female flat bead are pushed by the bead spring to push downwards male bead or/and the female bead to extend into or out of a marble hole in the outer lock liner or the inner lock liner to limit the lock liner from rotating. 5 10

4. The ball lock cylinder according to claim 1, **characterized in that** lock liner anti-drilling pins for preventing damage from an external drill bit are bolted into ends of the outer lock liner and the inner lock liner respectively. 15
5. The ball lock cylinder according to claim 1, **characterized in that** housing anti-drilling pins for preventing the damage from the external drill bit are bolted into two ends of the lock case respectively. 20
6. The ball lock cylinder according to claim 1, **characterized in that** clamping springs for clamping ends of the outer lock liner or the inner lock liner are arranged at two sides of the shifting support groove respectively. 25
7. A lock **characterized by** adopting the ball lock cylinder as claimed in any one of claims 1 to 6. 30

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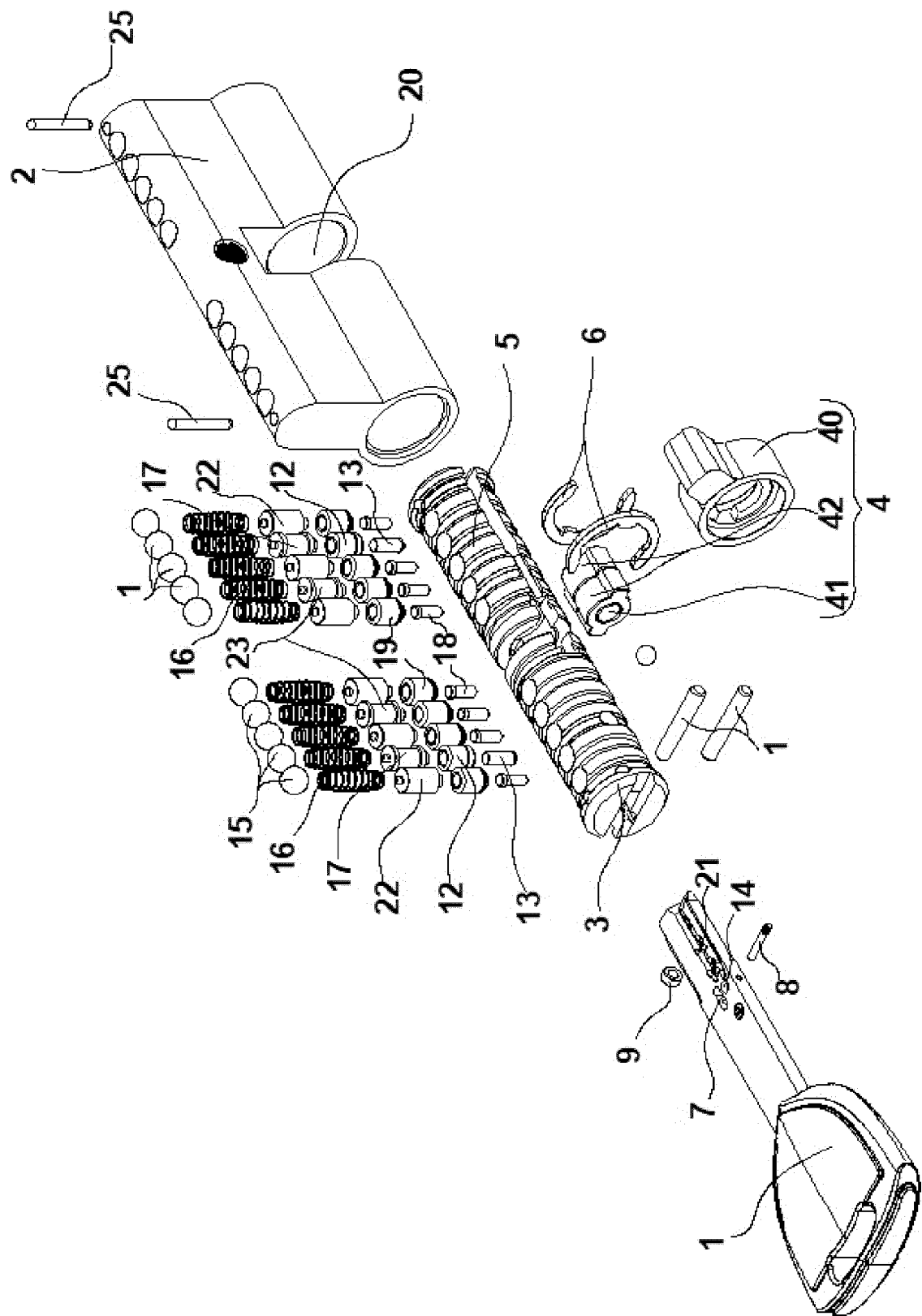
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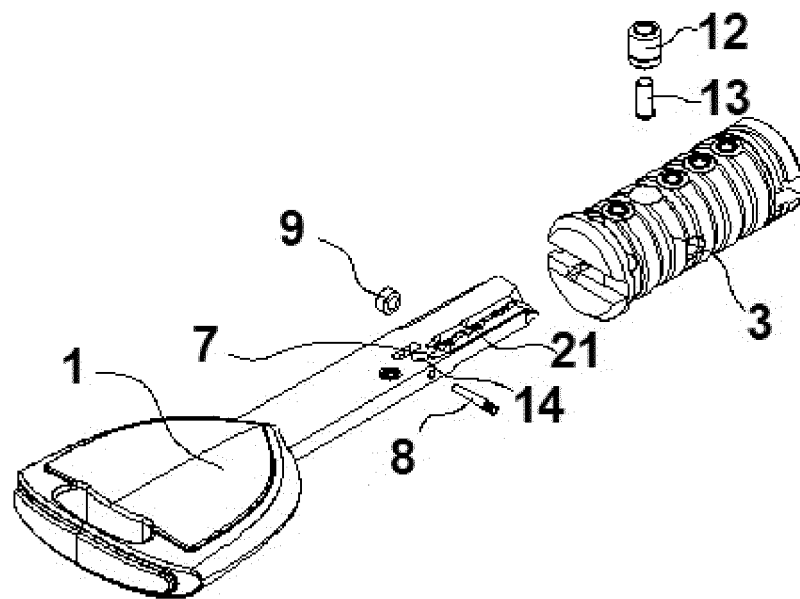
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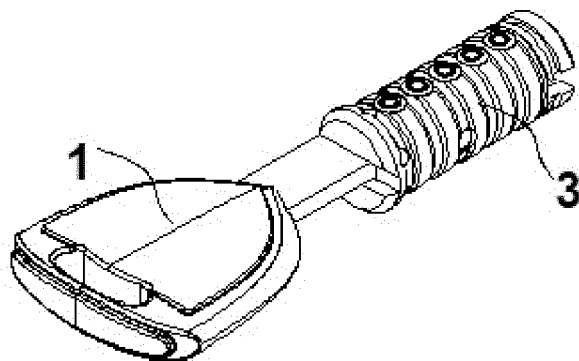
[Fig. 1]



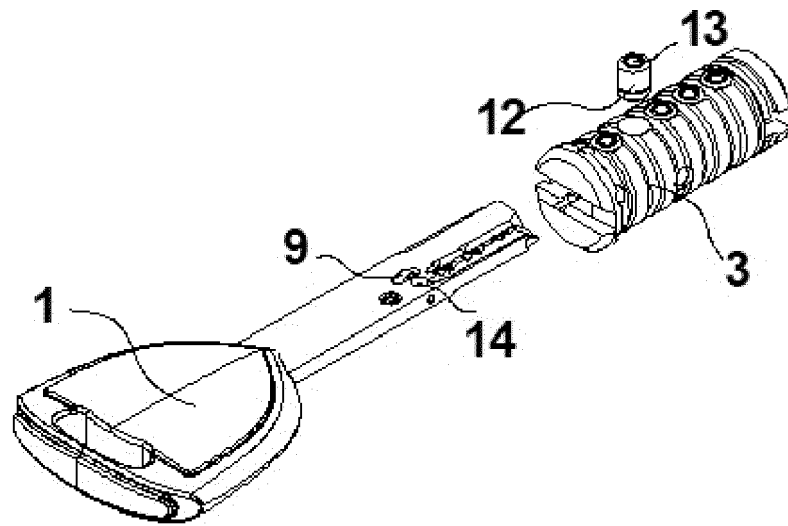
[Fig. 2]



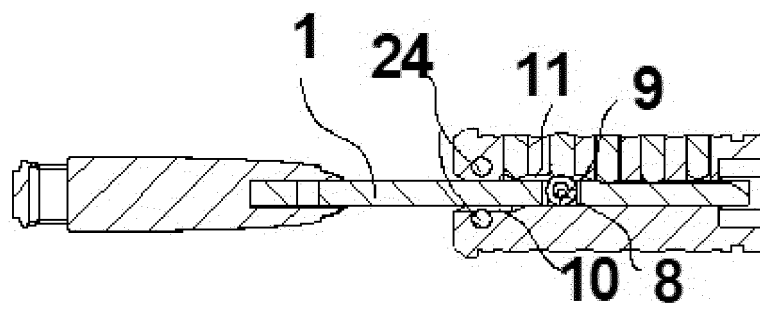
[Fig. 3]



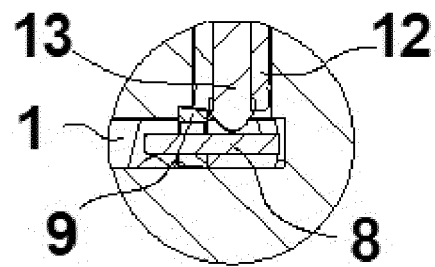
[Fig. 4]



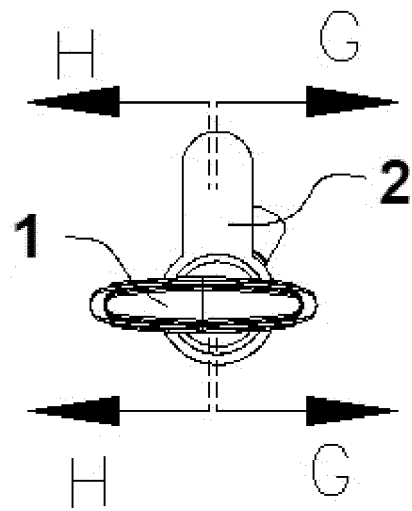
[Fig. 5]



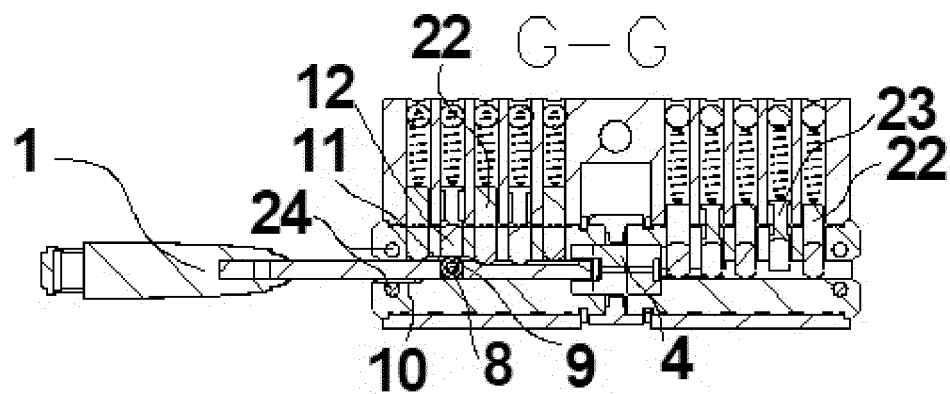
[Fig. 6]



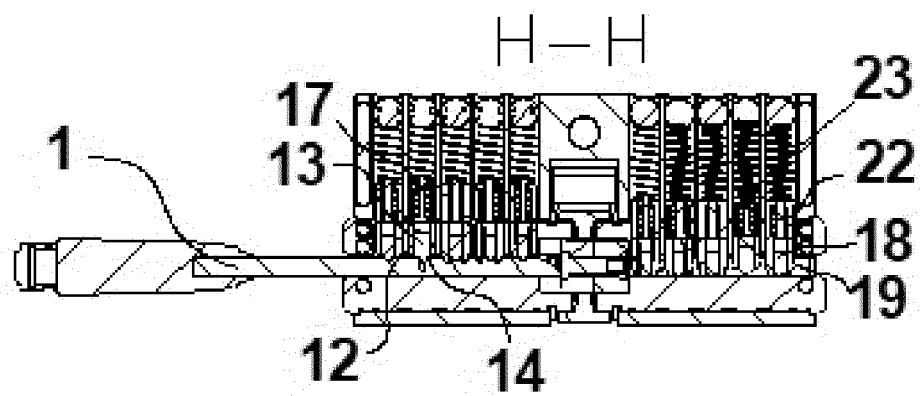
[Fig. 7]



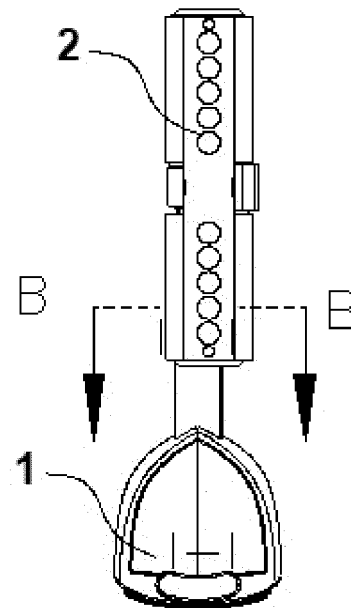
[Fig. 8]



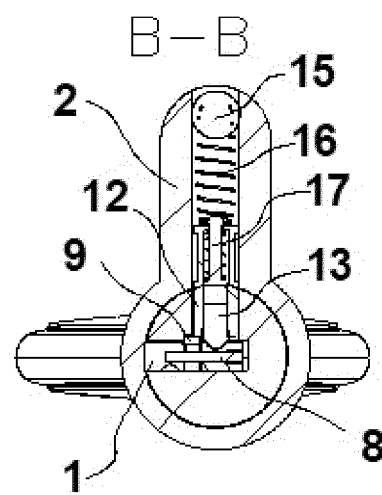
[Fig. 9]



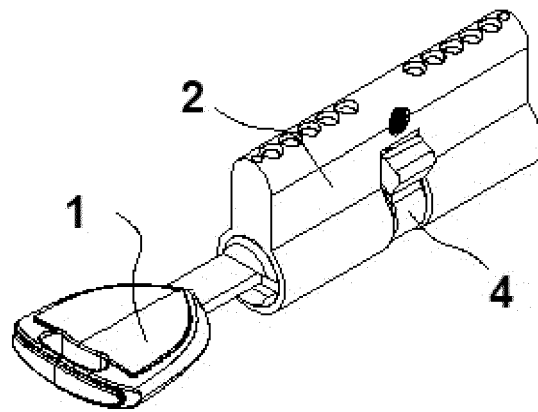
[Fig. 10]



[Fig. 11]



[Fig. 12]





EUROPEAN SEARCH REPORT

Application Number

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The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		19 July 2023	Geerts, Arnold
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