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Amended claims in accordance with Rule 137(2) EPC.

(54) **A wafer-type tumbler cylinder and key**

(57) A wafer-type tumbler and key comprises a sleeve (1), a cylinder (2), some wafers (3), some springs (4) and a key (5). A shaft (20) on the cylinder includes a first and a second semicircular columnar body (20a,b). Disposed at the front and rear ends of the first semicircular columnar body are a flange (22) and a drive section (23) and at the inner lateral surface of the first semicircular columnar body is an indentation (201) that provides for insertion into the second semicircular columnar body. On the first and second semicircular columnar bodies (20a,b), one or more slots (24a,b) are disposed to fasten with the wafers (3). In addition to facilitating the placement of the wafers (3) and springs (4) into the shaft, the slots (24a,b) enable the fabrication of a corrugated keyway (21) with a narrower width. The key (5) has a serrated blade, wherein a metal plate is punched to produce its sectional shape into a corrugated contour to prohibit theft.

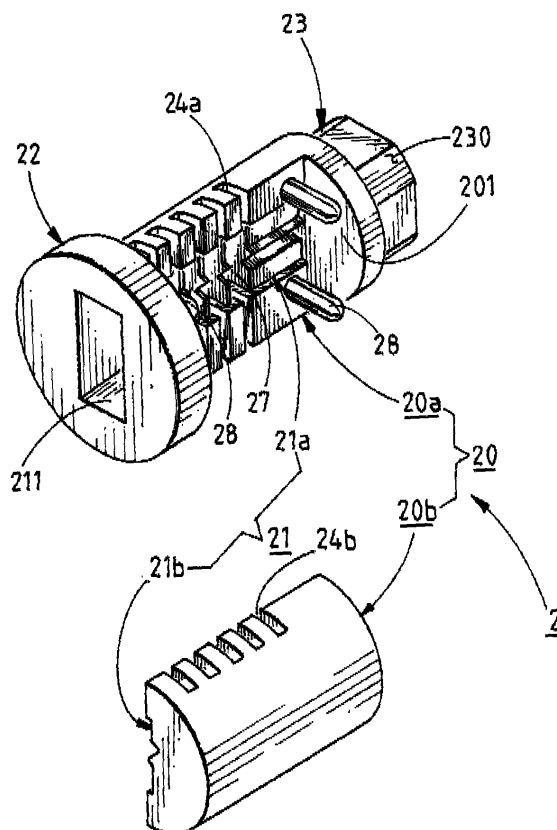


FIG. 2

Description

BACKGROUND OF THE INVENTION

1) FIELD OF THE INVENTION

[0001] The invention relates to a wafer-type tumbler cylinder and key, the cylinder shaft of which facilitates the placement of the wafers and springs and, furthermore, enables the fabrication of a narrow width, corrugated contour keyway; at the same time, the key has a serrated blade, the fabricated cut surfaces of which result in a corrugated contour key.

2) DESCRIPTION OF THE PRIOR ART

[0002] Conventional wafer-type tumblers, as shown in FIG. 14, are typically comprised of a sleeve 1a, a cylinder 2a, and a plurality of wafers 3a and their springs 4a. The sleeve 1a consists of a sleeve body 10 having a bore 11 extending through it lengthwise, a minimum of one lengthwise slot 12 disposed along the inside of the bore 11, and a bearing edge 13 at the leading end of the bore 11. As shown in FIG. 15, the cylinder 2a has a keyway 21 through the center and, furthermore, a flange 22 and a drive section 23 at the front and rear ends, with a shaft 20 movably installed in the bore 11 of the sleeve 1a; the shaft 20 has disposed one or more diametrically oriented, rectangular through-holes 24 and, furthermore, at the two sides of each rectangular through-hole 24 is a C-shaped recess 25 and a horizontally oriented U-shaped recess 26 (as shown in FIG. 16 and 17), for the installation of one or more wafer 3a and spring 4a sets. The cylinder 2a, after the installation of the wafers 3a and their springs 4a, is first fitted into the bore 11 of the sleeve 1a and, furthermore, such that the one end of each wafer 3a is subjected to the elastic force of its spring 4a, and then postured against and inserted into the slot 12 inside the bore 11, thereby obstructing the clockwise and counter-clockwise rotation of the cylinder 2a situated in the bore 11; at the same time, the flange 22 at the front end of the cylinder 2a is seated on the bearing edge 13 at the leading end of the bore 11 in order to inset securely the bore 11; additionally, the drive section 23 at the rear end of the cylinder 2a is mounted with a lock tool or electric driver so as to check whether the tumbler is locked or electrified.

[0003] Because each wafer 3a of the conventional wafer-type tumbler, in addition to a window 31 in the middle thereof, has an opposing spring tab 32 and a locating tab 34; when the wafer 3a is inserted into each rectangular through-hole 24 on the shaft 20 of the cylinder 2a, it is first necessary to install a spring 4a into the C-shaped recess 25 at one side of the rectangular through-hole 24, following which the wafer 3a is then inserted into the rectangular through-hole 24; but during the installation, since the wafer body 30 of the wafer 3a has the spring tab 32, its insertion occurs without any resistance along the C-shaped recess 25; however, the locating tab 34,

disposed in the other side of the wafer body 30, must similarly undergo insertion through the C-shaped recess 25 along the rectangular through-hole 24, and, as a result, friction occurs along the interior wall of the rectangular through-hole 24 at the lateral extent of the C-shaped recess 25, and only after this does the wafer body 30 reach into the horizontally oriented U-shaped recess 26, where it becomes nested onto the bottom of the horizontally oriented U-shaped recess 26 (as shown in FIG. 16 and 17), and also only then is the cylinder 2a installed in the bore 11 of the sleeve 1a, which completes the assembly of one wafer-type tumbler mechanism. As such, during the insertion of each wafer 3a into the rectangular through-hole 24 on the shaft 20, the operation is difficult and adversely affects the production process. After each wafer 3a has been inserted into the rectangular through-hole 24, the locating tab 34 on the wafer body 30 is nested onto the bottom of the horizontally oriented U-shaped recesses 26; however, the height of the locating tab 34 is quite limited and, furthermore, the locating tab 34 is subjected to the outwardly exerted elastic force of the spring 4a, the wafer 3a is often ejected out of the rectangular through-hole 24. Such situation results in a troublesome and inconvenient assembly operation as the cylinder 2a is inserted into the bore 11 of the sleeve 1a, which likewise adversely affects the production process.

[0004] Moreover, based on the locking and unlocking structure of the conventional wafer-type tumbler, it depends entirely on the installation of the shaft 20 on the cylinder 2a with a plurality of wafers 3a; hence, as indicated in FIG. 15, the rectangular keyway 21 must be disposed through the center of the shaft 20 to facilitate insertion of the serrated blade 51 on the key 5a (as shown in FIG. 19), which causes each wafer 3a extending into the end of the slot 12 in the bore 11 to fully react within the outer diameter of the shaft 20, thereby achieving the objective of locking or unlocking. Since the cylinder 2a of the conventional wafer-type tumbler is typically made of aluminum-zinc alloy material in an integrated molding process, and the keyway 21 disposed through the center of the shaft 20 also penetrates the internal section of the shaft 20; as a result, it is not possible to mold a corrugated keyway having a narrow width. It's only possible to mold a keyway with a width of 1.5mm or more, and as indicated in FIG. 14, the shape of the keyhole 211 only can be formed as reverse Z-shaped or other similar contour, which has a triangular projecting element 212 at the two lateral inner sides of the keyhole 211 respectively (one triangular projecting element is concealed by the flange 22, so it's not viewable); the keyway 21 along the internal section of the shaft 20 not only is formed as relatively wide rectangular shape, but also has disposed at most one lengthwise triangular projecting element 212 at one side of the keyway 21, as indicated in FIG. 15 and 18. As a result, the prior art is easily broken by thieves and picked or unlocked by burglars.

[0005] Due to the shape of the keyway 21 and its keyhole 211 on the shaft 20 of the cylinder 2a in the conven-

tional wafer-type tumbler, the design of which is formed as relatively wide rectangular and reverse Z-shaped contour, and furthermore, the two triangular projecting elements 212 are disposed in opposing position and at close distance along the two lateral inner sides of the keyhole 211; therefore, the serrated blade 51 of the key 5a must be fabricated of a thicker metal plate. Even though the whole key 5a may be formed by punching the metal plate, the serrated blade 51 (as indicated in FIG. 19 and 20) must undergo milling or planing process to form as reverse Z-shaped section by means of a miller or planer, and it also has to undergo cutting or milling process to make a lengthwise V-shaped groove 511 at each of the lateral sides. Therefore, in terms of production, the process is extremely inconvenient and, furthermore, both time and labor consuming.

[0006] In view of the serrated blade 51 of the conventional wafer-type tumbler cylinder and key, there are such inconveniences and shortcomings during the process of production and assembly; such production cost is greater and not cost-effective and also the theftproof capability of the prior art still remained deficient, so the inventor of the invention herein conducted research which culminated in the improved wafer-type tumbler cylinder and key of the present invention.

SUMMARY OF THE INVENTION

[0007] The objective of the invention herein is to provide a cylinder that better facilitates the installation of the wafers and their springs and, furthermore, facilitates the production of a shaft having a corrugated contour keyway with a narrower width to prevent from theft or using metal sheets and other equivalent tools to pry or unlock the wafer-type tumbler cylinder.

[0008] Another objective of the invention herein is to provide a serrated blade of the key, wherein a very thin metal plate is punched to directly produce its sectional shape into a corrugated contour to prohibit theft by the replication of the wafer-type tumbler cylinder and key.

[0009] To achieve the first objective of the invention herein, the shaft of the cylinder consists of a first and a second semicircular columnar body that are insertionally conjoined into an integration, and furthermore, respectively disposed at the front and rear ends of the first semicircular columnar body are a flange and a drive section; although, on the inner lateral surfaces of the first and second semicircular columnar bodies, one or more diametrically oriented U-shaped slots are disposed; only disposed in each U-shaped slot on the first semicircular columnar body are rectangular notches having fitted with the dimensions of the wafers as well as the springs, thereby facilitating the initial placement and positioning of each wafer and its respective spring into each said U-shaped slot and rectangular notch on said first semicircular columnar body, following which the second semicircular columnar body is then fitted thereon for assembling into an integration; thereafter, the cylinder, with the wafers and

their springs installed already, is inserted into the shaft hole of said sleeve to complete the assembly of the wafer-type tumbler of the present invention. The operation for assemblage is easy, quick and convenient.

5 [0010] When the flange and the drive section are respectively disposed at the front and rear ends of the first semicircular columnar body, an inverted U-shaped indentation is left at the inner lateral surface between said flange and drive section of the first semicircular columnar body; as the inner lateral surface of the first and second
10 semicircular columnar body is molded, two corrugated half-keyways are respectively molded along the center, and furthermore, one or more posts and holes are molded at the front and rear ends. As such, the second semicircular columnar body, via the insertion of said posts through said holes, is installed with the first semicircular columnar body into an integration; thus, the keyway along the common center of the first and the second columnar bodies is formed as corrugated contour with a narrower width (approximately 0.5mm), which effectively makes it impossible for thieves to pry or unlock by inserting metal sheets or other equivalent tools.

[0011] Since the keyway disposed in the center of the shaft on the cylinder is extremely narrow in width (approximately 0.5mm) and the sectional shape of the keyway is formed as corrugated contour, the serrated blade of the key is produced by directly punching a metal plate (approximately 0.5mm in width), and also has a thicker plastic grip coated at the opposite end thereof to thereby
25 facilitate the user holding the key for locking and unlocking the wafer-type tumbler. The production is extremely simple and convenient, but it's difficult to replicate by thieves.

[0012] The shaft of the cylinder consists of a first and a second semicircular columnar bodies with identical shape and dimension, which are combined into an integration; furthermore, a semicircular tenon respectively disposed at the front and rear ends of each said semicircular columnar body enables, following the installation
35 with a plurality of wafers and their springs, the respective fitting of a sleeve ring and a drive section onto the front and rear ends to thereby assemble one shaft. As such, it's convenient to produce and assemble different numbers of wafers into different length of shafts, and as the sleeve ring and the drive section are fitted thereon, it is quite convenient to manufacture longer or shorter shafts so as to assemble the wafer-type tumblers with different length or specifications.

[0013] The shaft of the cylinder, between every two diametrically oriented U-shaped slots at the inner lateral side of the two semicircular columnar bodies, includes a relatively wider rectangular notch; at the same time, each of the wafers is a wafer body having a horizontal L-shaped tab; when each wafer is positioned between every two diametrically oriented U-shaped slots, only one spring is disposed in the relatively wider rectangular notch to serve as a common-use spring for every two wafers. Therefore, the component cost of the spring is

reduced by half and it's able to prevent from prying effectively.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014]

Figure 1 is an exploded drawing of the wafer-type tumbler of the invention.

Figure 2 is an exploded drawing of the wafer-type tumbler cylinder of the invention.

Figure 3 is a cross-sectional view of the invention herein when the wafer-type tumbler is not installed with wafers and when the serrated blade of the key is inserted.

Figure 4 is cross-sectional view of the invention herein when the wafer-type tumbler is interlocked.

Figure 5 is a cross-sectional view as the wafer-type tumbler is installed with one wafer and its spring.

Figure 5-1 is a cross-sectional drawing, as viewed from a perspective in FIG. 5, to show the adjacent wafer and its spring of the invention herein.

Figure 6 is an orthographic drawing of the wafer-type tumbler key of the invention.

Figure 7 is a cross-sectional drawing of the serrated blade of the wafer-type tumbler key.

Figure 8 is an isometric drawing of the preferred embodiment of the cylinder in the present invention.

Figure 9 is an exploded drawing of the preferred embodiment of the cylinder in the present invention.

Figure 10 is a cross-sectional drawing of the invention herein, as viewed from the perspective of line 10~10' in FIG. 8.

Figure 11 is an exploded drawing of another preferred embodiment of the cylinder with wafers and a spring.

Figure 12 is a vertically sectional view of the cylinder as viewed from the perspective in FIG. 11.

Figure 13 is a cross-sectional drawing of the invention herein, as viewed from the perspective of line 13~13' in FIG. 12.

Figure 14 is an exploded drawing of the conventional wafer-type tumbler.

Figure 15 is a cross-sectional drawing of the conventional wafer-type tumbler when the wafers are not installed.

Figure 16 is a cross-sectional drawing of the conventional wafer-type tumbler wherein a wafer and its spring are disposed.

Figure 17 is a cross-sectional drawing, as viewed from a perspective in FIG. 16, to show the adjacent wafer and its spring.

Figure 18 is a cross-sectional view of the conventional wafer-type tumbler when the serrated blade of the key is inserted.

Figure 19 is an orthographic drawing of the conventional wafer-type tumbler key.

Figure 20 is a cross-sectional view of the serrated

blade of the key in the conventional wafer-type tumbler.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0015] Referring to FIG. 1, the wafer-type tumbler of the invention herein, in common with the above-mentioned conventional wafer-type tumbler, is comprised of a sleeve 1, a cylinder 2, a plurality of wafers 3 and their springs 4; the structure of the sleeve 1 and the method for installing with the cylinder 2 are the same as those of said conventional wafer-type tumbler. There is no need to go into details. However, a shaft 20 of the cylinder 2, as shown in FIG. 2, consists of a first and a second semicircular columnar body 20a and 20b that are integrated with each other; furthermore, respectively disposed at the front and rear ends of the first semicircular columnar body 20a are a flange 22 and a drive section 23; at the inner lateral surface between said flange 22 and drive section 23 is an inverted U-shaped indentation 201, the length of which matches with the second semicircular columnar body 20b so as to complete the assembly of the shaft 20 on the cylinder 2 (as indicated in FIG. 1.) On the inner lateral surfaces of the first and the second semicircular columnar body 20a and 20b, one or more diametrically oriented U-shaped slots 24a and 24b are disposed for the installation of said wafers 3; however, only in each of the U-shaped slots 24a on said first semicircular columnar body 20a is disposed a rectangular notch 27 matching the dimension of the spring 4, thereby facilitating the placement of each wafer 3 and its spring 4 into each said U-shaped slot 24a and said rectangular notch 27 on said first semicircular columnar body 20a, following which the second semicircular columnar body 20b is then fitted thereon for an integral unity; after that, the shaft 20 of said cylinder 2 is inserted into a shaft hole 11 in said sleeve 1 to assemble the wafer-type tumbler of the present invention, as illustrated in FIG. 5 as well as FIG 5-1.

[0016] When said first and second semicircular columnar body 20a and 20b are molded into shape, two half-keyways 21a and 21b are formed as corrugated contour in the center of the inner lateral surfaces thereof; furthermore, one or more posts 28 (as shown in FIG. 2) and holes 29 (which are concealed by the second semicircular columnar body 20b, so please refer to FIG. 4) are disposed at the front and rear ends of each said inner lateral surface. As such, the second semicircular columnar body 20b, via the insertion of said posts 28 through said holes 29, is correspondingly fixed with the first semicircular columnar body 20a into a unity so as to complete the assemblage of the cylinder 2, as indicated in FIG. 1, 3 and 4; at the same time, along the common center of the first and second semicircular columnar body 20a and 20b, a keyway 21 (as shown in FIG. 4) is formed as corrugated contour, with a narrower width of 0.5mm, thereby preventing theft by means of a metal sheet or other equiv-

alent tool inserted for burglarizing.

[0017] Since the keyway 21 disposed at the center of the cylinder 2 is approximately 0.5mm in width and is fabricated as corrugated passage, a serrated blade 51 of a key 5 (as depicted in FIG. 6 and 7) is produced by directly punching an approximately 0.5mm or thinner metal plate, and a plastic grip 52 is coated onto the opposite end thereof, thereby facilitating the user holding the key for locking and unlocking the wafer-type tumbler; it is not necessary to mill and plane any lengthwise grooves nor other milling and planing processes. To facilitate the insertion of said very thin serrated blade 51 into the keyway 21 in the shaft 20 of the cylinder 2, it is then necessary, in the center of the flange 22 at the front end of said shaft 20, to dispose a rectangular, flared key-hole 211 that is in line with said keyway 21. As for the drive section 23 at the rear end of said shaft 20, in addition to the depiction shown in FIG. 1 and FIG. 2 wherein the drive section 23 is shaped as square or rectangular rod body 230, said drive section 23 may be shaped as threaded, circular, oblate, tubular or other shaped rod body (not shown in the drawings) to make the design of said drive section 23 match with a lock tool or electric driver, thereby enabling said drive section 23 to fasten with said lock tool or electric driver by means of screws or rivets.

[0018] Furthermore, since the wafers 3 of the wafer-type tumbler of the invention herein do not require mounting in rectangular through-holes 24 (as depicted in FIG. 14 of the prior art), said wafers 3 can be fixed on said shaft 20 securely, as shown in FIG 1, by a window 31 in the center of each wafer body 30 of the wafer 3 along with a spring tab 32 at one side thereof, and there is no need to dispose any locating tab 34 thereon.

[0019] Referring to FIG. 8 and 9, these two figures are isometric and exploded drawings of the preferred embodiment of a cylinder 2' of the present invention. A shaft 20' on the cylinder 2' consists of a first and a second semicircular columnar body 20'a and 20'b (both of identical shape and dimension) that are conjoined into an integral unity; furthermore, respectively disposed at the front and rear ends of each semicircular columnar body 20'a and 20'b is a semicircular tenon 202 and 203 which is respectively fitted onto a sleeve ring 22a and a drive section 23 to constitute a cylinder 2', as indicated in FIG. 8. The said semicircular tenons 202 at the front ends of said semicircular columnar body 20'a and 20'b are correspondingly coupled to form a circular tenon, and the said semicircular tenons 203 at the rear ends thereof are correspondingly coupled to form a circular tenon. To enable the precise placement of the sleeve ring 22a and the drive section 23 onto the front and rear ends of the integrated semicircular columnar bodies 20'a and 20'b, as well as to prevent dislodging and comparative rotation, the sleeve ring 22a has an inner hole 221 in a ring body 220a, which is a D-shaped hole with a minimum of one secant planar edge 222 along one lateral wall, and furthermore, an opening 223 through one side of the ring body 220a, wherein the center of said opening 223 is

aligned and parallel with said secant planar edge 222; a facet 204 is disposed correspondingly along the outer extent of the semicircular tenon 202 of the semicircular columnar body 20'b. As such, the circular tenon that is coupled by means of said semicircular tenons 202 at the front ends of said semicircular columnar body 20'a and 20'b is installed with the sleeve ring 22a, and then a drill is used, through the opening 223, to pierce into the front semicircular tenon 202 having said facet 204 thereof, thereby enabling the insertion of a pin 6 for securing and fixing, as depicted in FIG. 10.

[0020] Additionally, the drive section 23, along the inner end of its square or rectangular rod body 230, has an extended sleeve 231 so as to enable the conjoinment with the circular tenon coupled by means of the semicircular tenons 203 at the rear ends of said semicircular columnar body 20'a and 20'b.

[0021] The extended sleeve 231 has disposed a D-shaped cavity 234 having a minimum of one secant planar edge 232 along the inner wall at one side thereof such that an aperture 233 is formed at one side of the extended sleeve 231, of which the center is aligned and parallel with said secant planar edge 232; similarly a facet 204 is correspondingly disposed along the outer extent of the semicircular tenon 203 at the rear end of said semicircular columnar 20'b. As such, the semicircular tenons 203 are assembled into a circular tenon, which is installed with said extended sleeve 231, and in common with the depiction shown in FIG. 10 as well as previous arrangement, a pin 6a illustrated in FIG 9 is fixed with said extended sleeve.

[0022] As for the molding process of said first and second semicircular columnar bodies 20'a and 20'b with identical shape and dimension, the structural and installation arrangement of the corresponding half-keyways 21a, 21b and the rectangular notches 27', the integration of more than one pair of posts 28 and holes 29, as well as the arrangement of wafers 3 and their springs 4, are the same with the first and second semicircular columnar body 20a, 20b of the cylinder 2 in the first embodiment of the invention herein; therefore, it shall not be further elaborated. Furthermore, the semicircular tenons 202 and 203 disposed on the two ends of the first and second semicircular columnar bodies 20'a and 20'b, in addition to the shape of semicircle, they may also be shaped as semi-square, semi-rectangular, semi-hexagonal or semi-polygonal tenons, or even as semi-oval or semi-oblate tenons; moreover, the shape of the inner hole 221 in the ring body 220a of the sleeve ring 22a accords with that of the D-shaped cavity 234 in the extended sleeve 231 on the drive section 23; at the same time, the shape of the rod body 230 on said drive section 23 may also be disposed as threaded, circular, oblate, tubular or other shaped rod body (not shown in the drawings.)

[0023] FIG. 11 is an exploded drawing of another preferred embodiment of the shaft 20 of the cylinder 2' in the invention herein with wafers 3 and a spring 4. Said shaft 20 also consists of a first and second semicircular

columnar body 20'a and 20'b with identical shape and dimension, which are conjoined into an integral unity, and the preferred embodiment of the semicircular columnar bodies 20'a and 20'b, between every two diametrically oriented U-shaped slots 24a and 24b disposed in the inner lateral surfaces thereof, is modified by disposing a relatively wider rectangular notch 27'; meanwhile, each wafer 3 is modified by disposing a horizontal L-shaped tab 33 at one side of its wafer body 30. As such, between every (or every two) correspondingly U-shaped slot 24a, 24b of each semicircular columnar body 20'a and 20'b is installed a wafer 3 respectively, and only one spring 4 is positioned in each relatively wider rectangular notch 27', wherein said spring 4 is served as a shared spring for every two wafers 3a and 3b, as shown in FIG. 12 and 13. This embodiment of the shaft 20 on the cylinder 2' can similarly be utilized in the preceding embodiment of the shaft 20 on the cylinder 2.

Claims

1. A wafer-type tumbler cylinder and key comprising a sleeve, a cylinder, a plurality of wafers, a plurality of springs and a key, further including:

a shaft of said cylinder having a first and a second semicircular columnar body conjoined into an integral unity;

a flange and a drive section respectively disposed at the front and rear ends of said first semicircular columnar body;

an inverted U-shaped indentation at the inner lateral surface between said flange and said drive section on said first semicircular columnar body, the length of said inverted U-shaped indentation matching with said second semicircular columnar body for the assembly of said shaft on said cylinder 2;

one or more diametrically oriented, U-shaped slots on the inner lateral surfaces of said first and said second semicircular columnar body respectively to constitute a rectangular window for the installation of said wafers; and

a serrated blade disposed on the key that is produced by directly punching an approximately 0.5mm or thinner metal plate.

2. The wafer-type tumbler cylinder and key of Claim 1, wherein said cylinder further includes:

a first semicircular columnar body consisting of:

a rectangular notch corresponding to the dimension of said spring of said wafer disposed in each said diametrically oriented U-shaped slot;

one or more pair of posts respectively dis-

posed at the front and rear ends along the inner lateral side of said first semicircular columnar body;

a half-keyway disposed along the center of the inner lateral side thereof;

a second semicircular columnar body consisting of:

one or more pair of holes disposed at the front and rear ends along the inner surface of said second semicircular columnar body, corresponding to the positions of said posts disposed on said first semicircular columnar body;

a half-keyway matching with said half-keyway in said first semicircular columnar body, disposed along the center of the inner lateral side of said second semicircular columnar body; and

each said wafer and said spring, first fixed in each said diametrically oriented U-shaped slot and said rectangular notch on said first semicircular columnar body, then fitted with said second semicircular columnar body, by means of inserting into said inverted U-shaped indentation to integrate into said cylinder.

3. The wafer-type tumbler cylinder and key of Claim 1, wherein the shaft of the cylinder, coupled by said first and second semicircular columnar bodies with identical shape and dimension, includes a semicircular tenon respectively disposed at the front and rear ends of each said first and second semicircular columnar body in order to install with a sleeve ring and a drive section respectively, thereby facilitating the assembly of said shaft.

4. The wafer-type tumbler cylinder and key of Claim 3, wherein said cylinder includes:

said sleeve ring having an inner hole, with a minimum of one secant planar edge along one lateral wall to form a D-shaped hole, an opening at one side of said sleeve ring, and the center of said opening aligned and parallel with said secant planar edge;

one semicircular tenon at the front end of said second semicircular columnar body having a facet disposed along the outer extent thereof, and as such, a circular tenon is combined by two semicircular tenons at the front ends of said first and second semicircular columnar bodies, thereby conjoining with said sleeve ring and securely fixing by means of a pin;

said drive section having an extended sleeve along the inner end of a square or rectangular

rod body thereof, wherein said extended sleeve comprises:

a D-shaped cavity with a minimum of one secant planar edge along the inner wall thereof;
an aperture of which the center is aligned and parallel with said secant planar edge;

one semicircular tenon at the rear end of said second semicircular columnar body having a facet correspondingly disposed along the outer extent thereof, and as such, a circular tenon is combined by two semicircular tenons at the rear ends of said first and second semicircular columnar bodies, thereby fastening with said extended sleeve on said drive section and securely fixing by another pin.

5. The wafer-type tumbler cylinder and key of Claim 1 and 3, wherein said first and second semicircular columnar bodies of the shaft on the cylinder have disposed a relatively wider rectangular notch between the inner side of every two diametrically oriented U-shaped slots, which are respectively installed with a wafer, and as such, only one spring is positioned in said relatively wider rectangular notch, thereby serving as a shared spring for every two wafers.
6. The wafer-type tumbler cylinder and key of Claim 5, wherein each said wafer further comprises a horizontal L-shaped tab at one side thereof.
7. The wafer-type tumbler cylinder and key of Claim 3, wherein the semicircular tenon may be in a form of semi-square, semi-rectangular, semi-hexagonal, semi-polygonal, semi-oval, or semi-oblate shape and the sleeve ring is a ring body having an inner hole which corresponds to the shape of a D-shaped cavity in an extended sleeve on the drive section.
8. The wafer-type tumbler cylinder and key of Claim 2, wherein the half-keyways constitute a complete keyway, after said first and second semicircular columnar bodies of said cylinder are integrated into a unity, such that the keyway is formed as corrugated contour, with a narrower width of 0.5mm approximately.
9. The wafer-type tumbler cylinder and key of Claim 1 and 3, wherein the drive section may be disposed as square, rectangular, circular, oblate, threaded or tubular rod body.

Amended claims in accordance with Rule 137(2) EPC.

1. A wafer-type tumbler cylinder and key comprising a sleeve (1), a cylinder (2), a plurality of wafers (3), a plurality of springs (4) and a key (5), further including:

a shaft (20) of said cylinder (2) having a first (20a) and a second (20b) semicircular columnar body conjoined into an integral unity;
a flange (22) and a drive section (23) respectively disposed at the front and rear ends of said first semicircular columnar body;
an inverted U-shaped indentation (201) being left at the inner lateral surface between said flange and said drive section of said first semicircular columnar body, the length of said inverted U-shaped indentation matching with said second semicircular columnar body for the assembly of said shaft of said cylinder (2);
one or more diametrically oriented, U-shaped slots (24a, b) on the inner lateral surfaces of said first and said second semicircular columnar body respectively to constitute a rectangular window for the installation of said wafers;
a half-keyway (21a) disposed along the center of the inner lateral side of the first semicircular columnar body;
a half-keyway (21b) matching with said half-keyway in said first semicircular columnar body, disposed along the center of the inner lateral side of said second semicircular columnar body; wherein the half-keyways constitute a complete keyway, after said first and second semicircular columnar bodies of said cylinder are integrated into a unity, such that the keyway is formed as corrugated contour, with a narrower width of 0.5 mm approximately;
and
a serrated blade (51) disposed on the key that is produced by directly punching an approximately 0.5 mm or thinner metal plate.

2. The wafer-type tumbler cylinder and key of Claim 1, wherein said cylinder further includes:

said first semicircular columnar body (20a) comprising:

a rectangular notch (27) corresponding to the dimension of said spring of said wafer disposed in each said diametrically oriented U-shaped slot;
one or more pair of posts (28) respectively disposed at the front and rear ends along the inner lateral side of said first semicircular columnar body;

and
 said second semicircular columnar body
 (20b) comprising:
 one or more pair of holes (29) disposed at
 the front and rear ends along the inner sur-
 face of said second semicircular columnar
 body, corresponding to the positions of said
 posts disposed on said first semicircular co-
 lumnar body;

each said wafer (3) and said spring (4), first fixed
 in each said diametrically oriented U-shaped
 slot and said rectangular notch on said first sem-
 icircular columnar body, then fitted with said sec-
 ond semicircular columnar body, by means of
 inserting into said inverted U-shaped indenta-
 tion to integrate into said cylinder.

3. The wafer-type tumbler cylinder and key of Claim
 1, wherein the shaft of the cylinder (2'), coupled by
 said first and second semicircular columnar bodies
 (20'a, b) with identical shape and dimension, in-
 cludes a semicircular tenon (202, 203) respectively
 disposed at the front and rear ends of each said first
 and second semicircular columnar body in order to
 install with a sleeve ring and a drive section respec-
 tively, thereby facilitating the assembly of said shaft.

4. The wafer-type tumbler cylinder and key of Claim
 3, wherein said cylinder (2') includes:

said sleeve ring (22a) having an inner hole (221),
 with a minimum of one secant planar edge (222)
 along one lateral wall to form a D-shaped hole,
 an opening (223) at one side of said sleeve ring
 (22a), and the center of said opening (223)
 aligned and parallel with said secant planar edge
 (222);
 one semicircular tenon (202) at the front end of
 said second semicircular columnar body (20'b)
 having a facet (204) disposed along the outer
 extent thereof, and as such, a circular tenon is
 combined by two semicircular tenons (202) at
 the front ends of said first and second semicir-
 cular columnar bodies, thereby conjoining with
 said sleeve ring (22a) and securely fixing by
 means of a pin (6);
 said drive section (23) having an extended
 sleeve (231) along the inner end of a square or
 rectangular rod body thereof, wherein said ex-
 tended sleeve (231) comprises:

a D-shaped cavity (234) with a minimum of
 one secant planar edge (232) along the inner
 wall thereof;
 an aperture (233) of which the center is
 aligned and parallel with said secant planar
 edge (232);

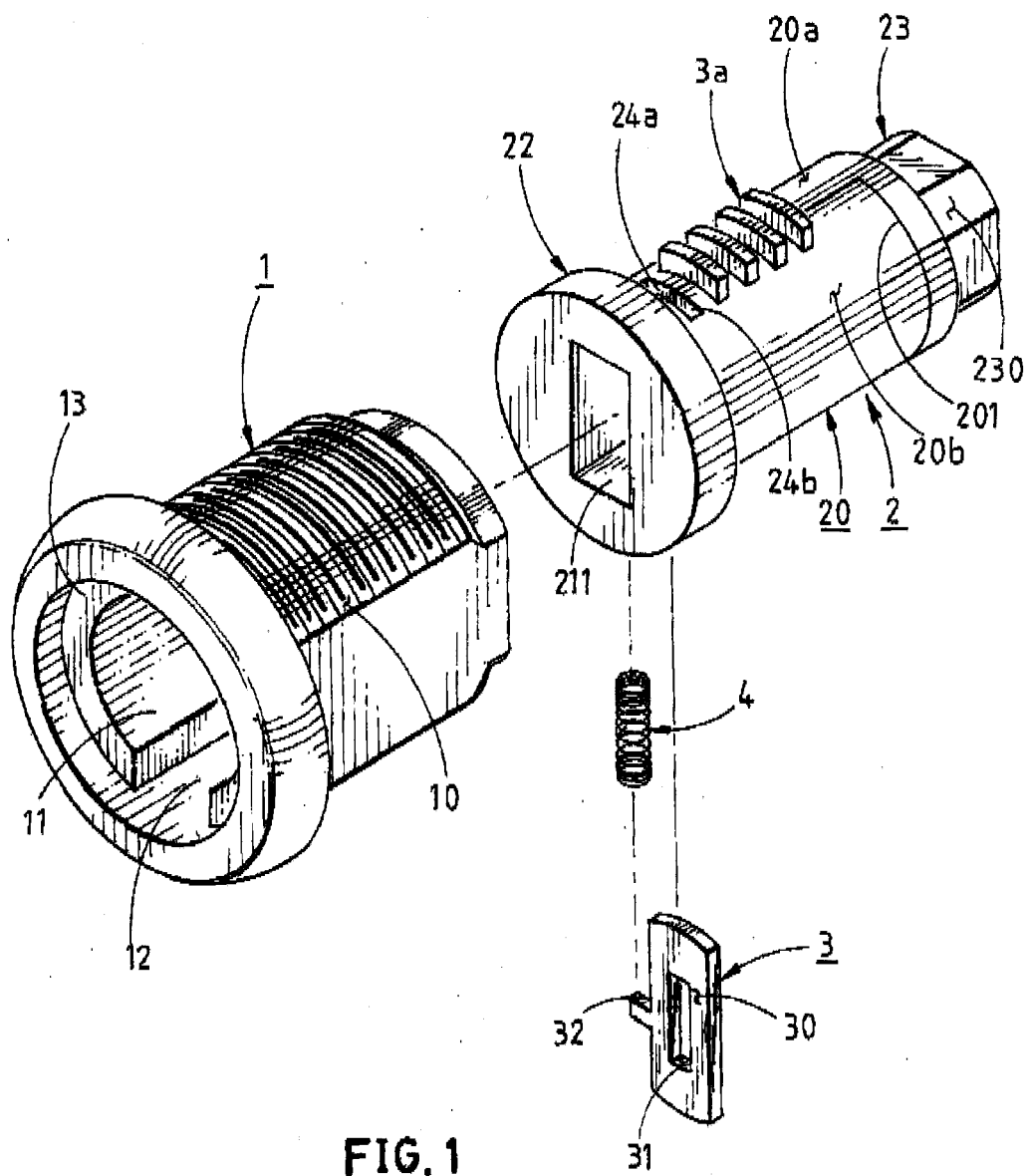
one semicircular tenon (203) at the rear end of
 said second semicircular columnar body (20'b)
 having a facet (204) correspondingly disposed
 along the outer extent thereof, and as such, a
 circular tenon (203) is combined by two semicir-
 cular tenons (203) at the rear ends of said first
 and second semicircular columnar bodies,
 thereby fastening with said extended sleeve
 (231) on said drive section (23) and securely
 fixing by another pin (6a).

5. The wafer-type tumbler cylinder and key as in
 Claim 1 or 3, wherein said first and second semicir-
 cular columnar bodies (20a,b; 20'a,b) of the shaft
 (20) on the cylinder (2, 2') have disposed a relatively
 wider rectangular notch (27') between the inner side
 of every two diametrically oriented U-shaped slots
 (24a,b), which are respectively installed with a wafer
 (3), and as such, only one spring (4) is positioned in
 said relatively wider rectangular notch (27'), thereby
 serving as a shared spring for every two wafers.

6. The wafer-type tumbler cylinder and key of Claim
 5, wherein each said wafer (3) further comprises a
 horizontal L-shaped tab (33) at one side thereof.

7. The wafer-type tumbler cylinder and key of Claim
 3, wherein the semicircular tenon (202, 203) may be
 in a form of semi-square, semi-rectangular, semi-
 hexagonal, semi-polygonal, semi-oval, or semi-ob-
 late shape and the sleeve ring (22a) is a ring body
 (220a) having an inner hole (221) which corresponds
 to the shape of a D-shaped cavity (234) in an ex-
 tended sleeve (231) on the drive section (23).

8. The wafer-type tumbler cylinder and key as in
 Claim 1 or 3, wherein the drive section (23) may be
 disposed as square, rectangular, circular, oblate,
 threaded or tubular rod body.



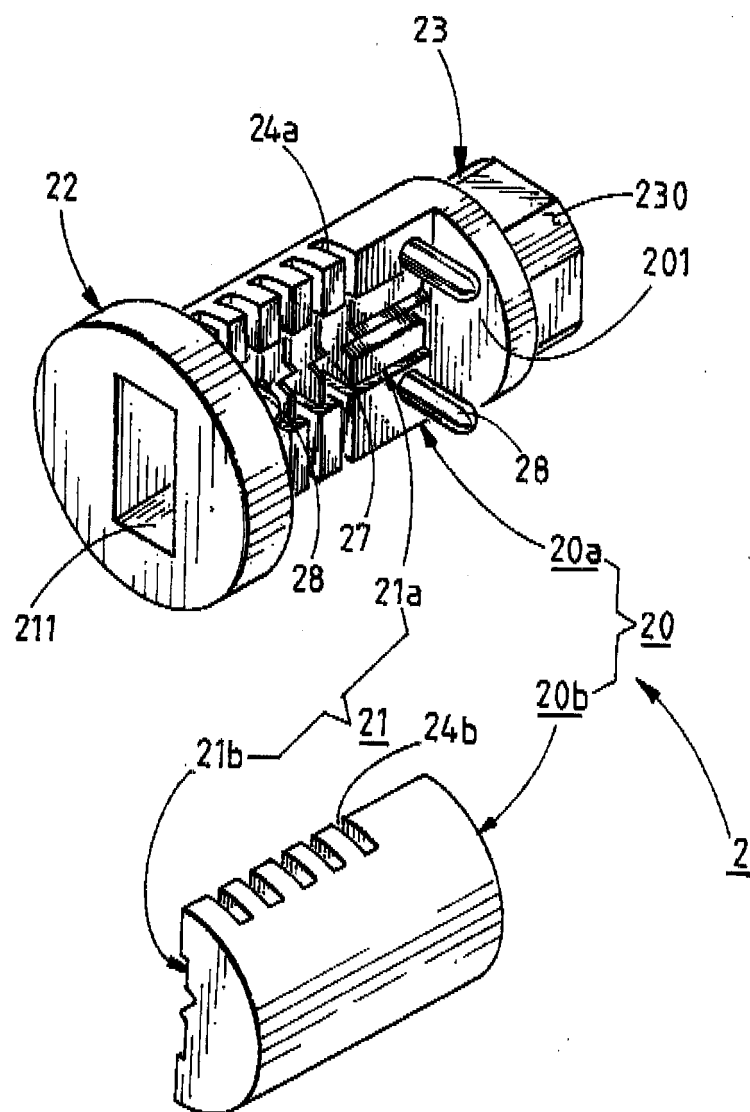


FIG. 2

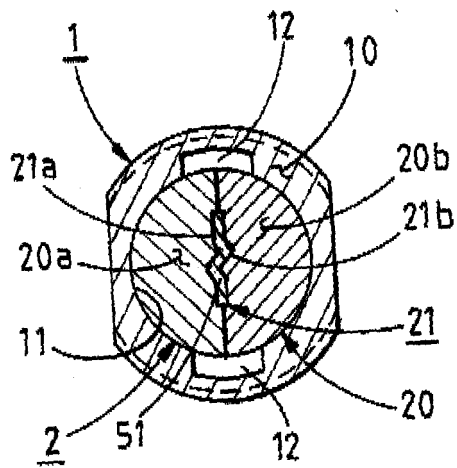


FIG. 3

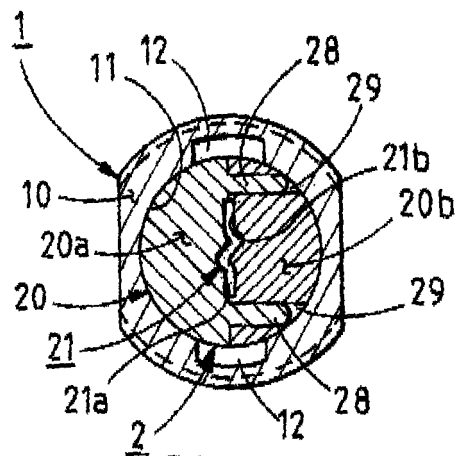


FIG. 4

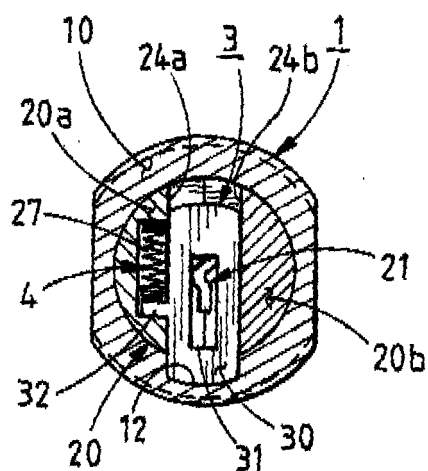


FIG. 5

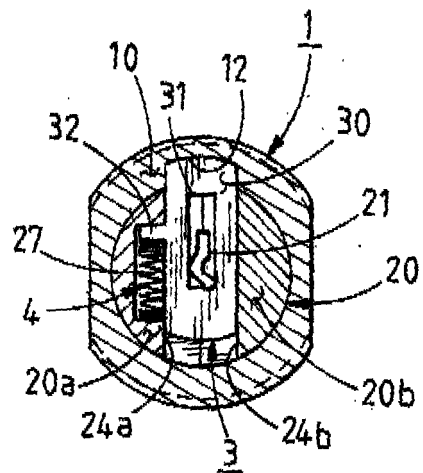


FIG. 5-1

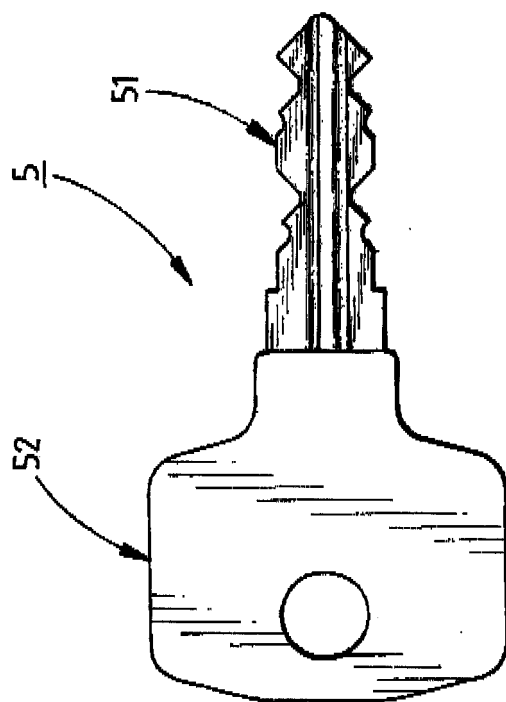
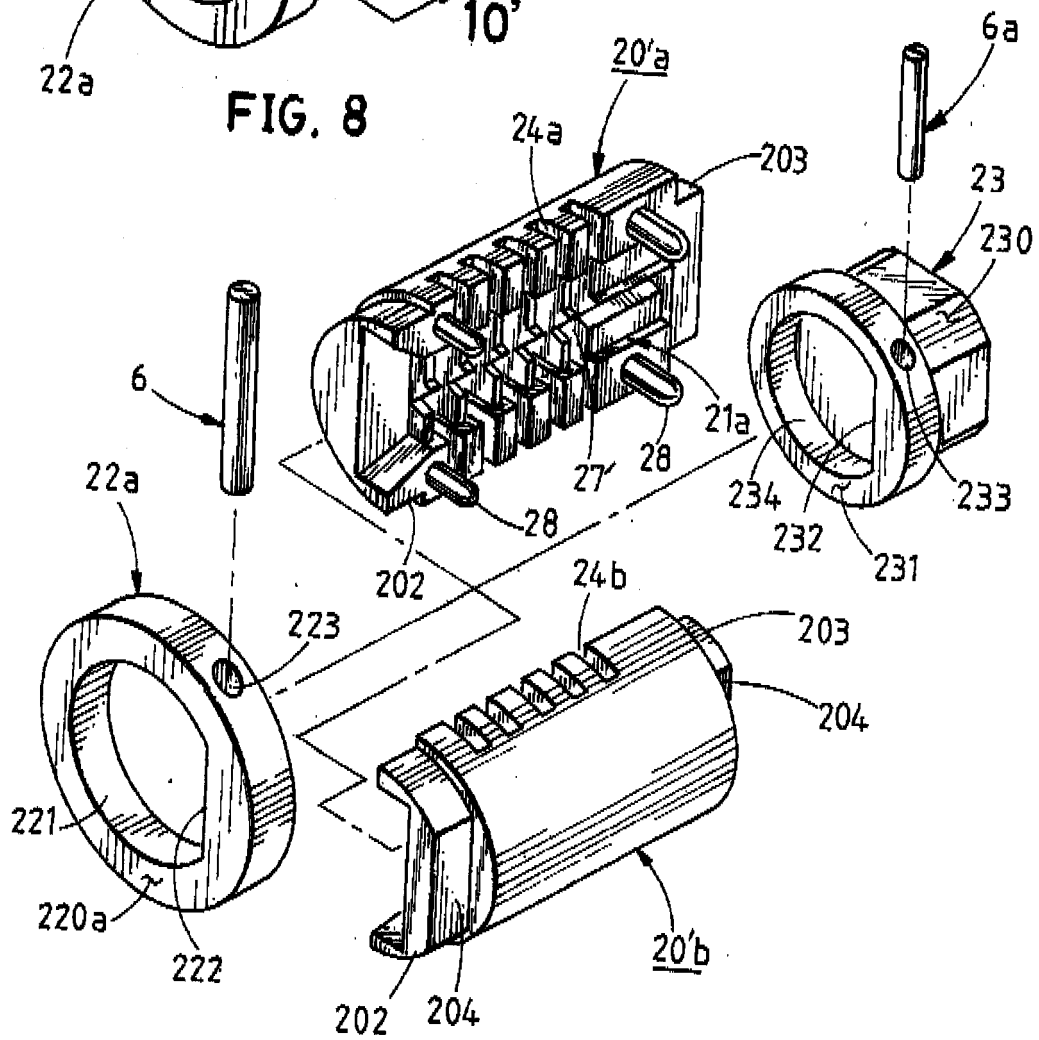
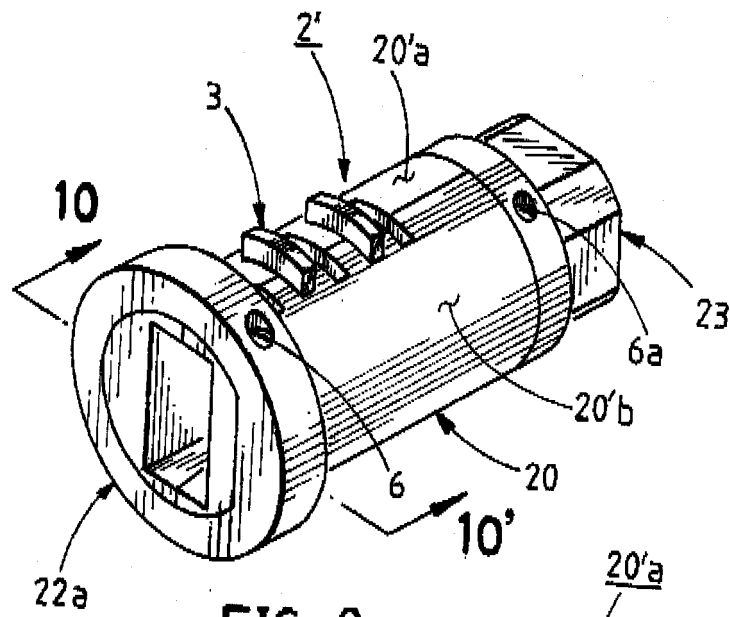
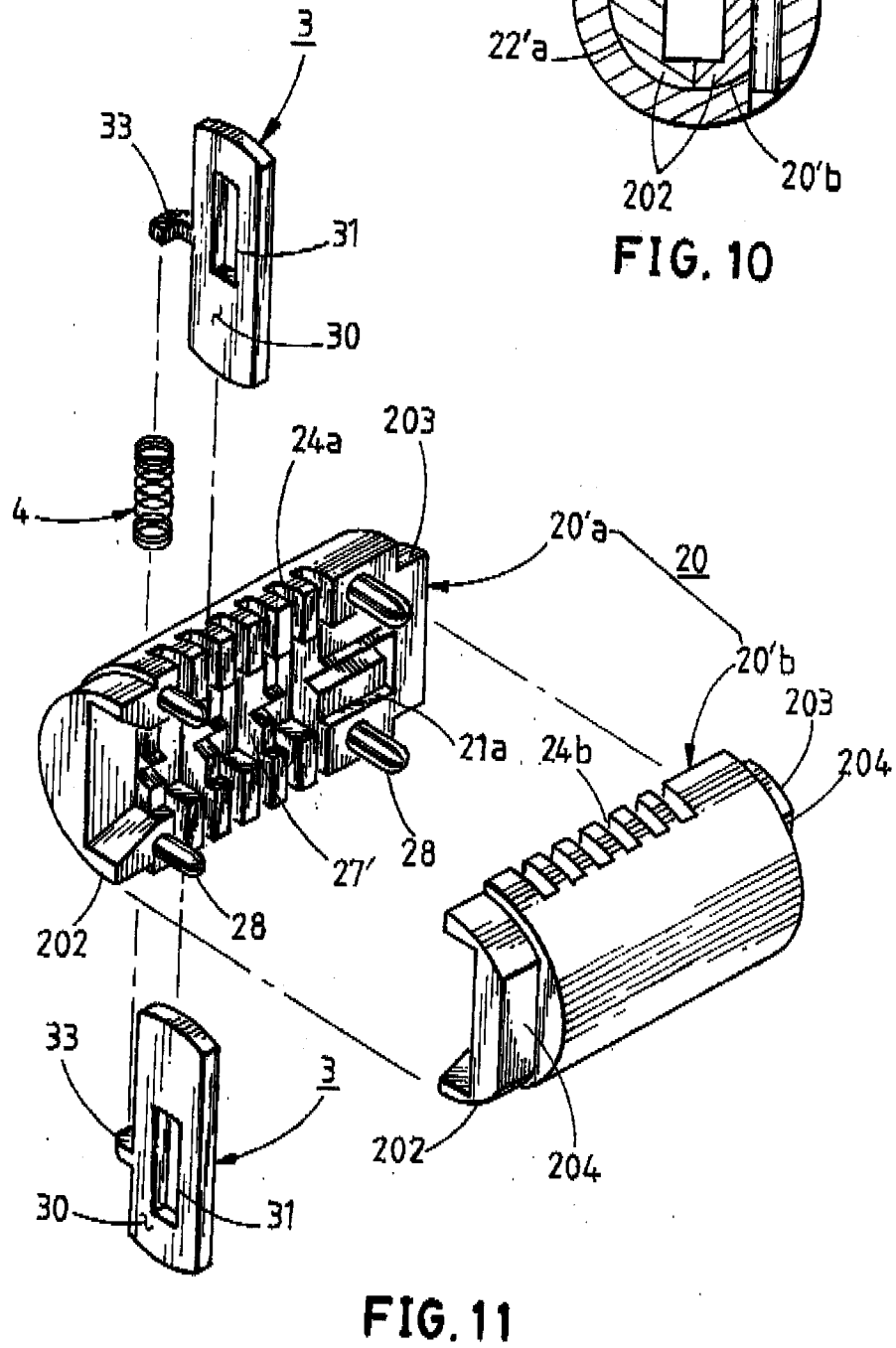
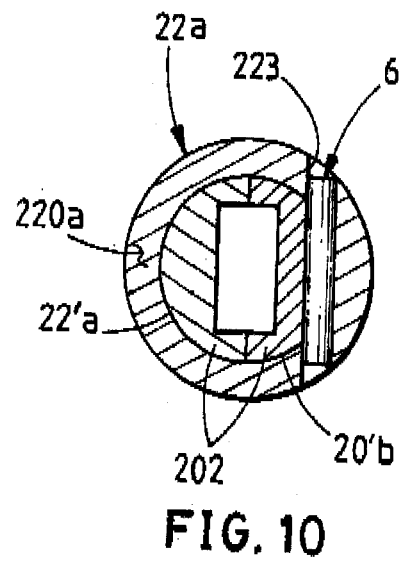


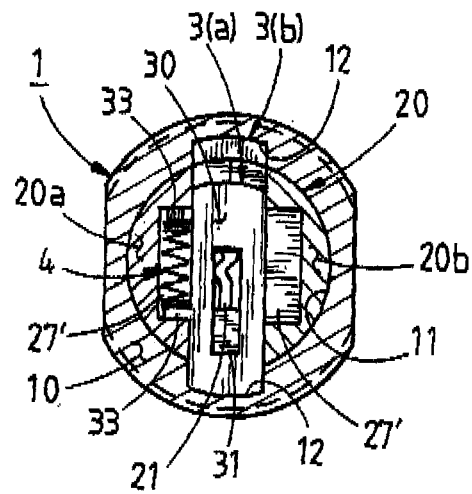
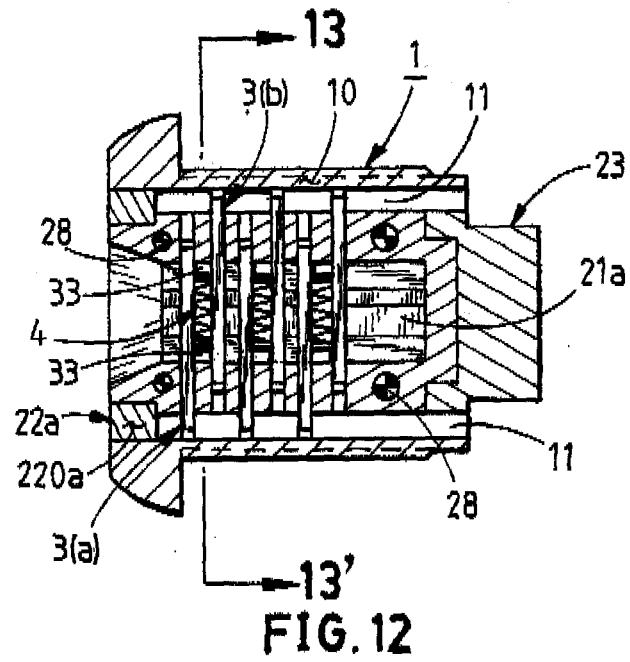
FIG. 6



FIG. 7







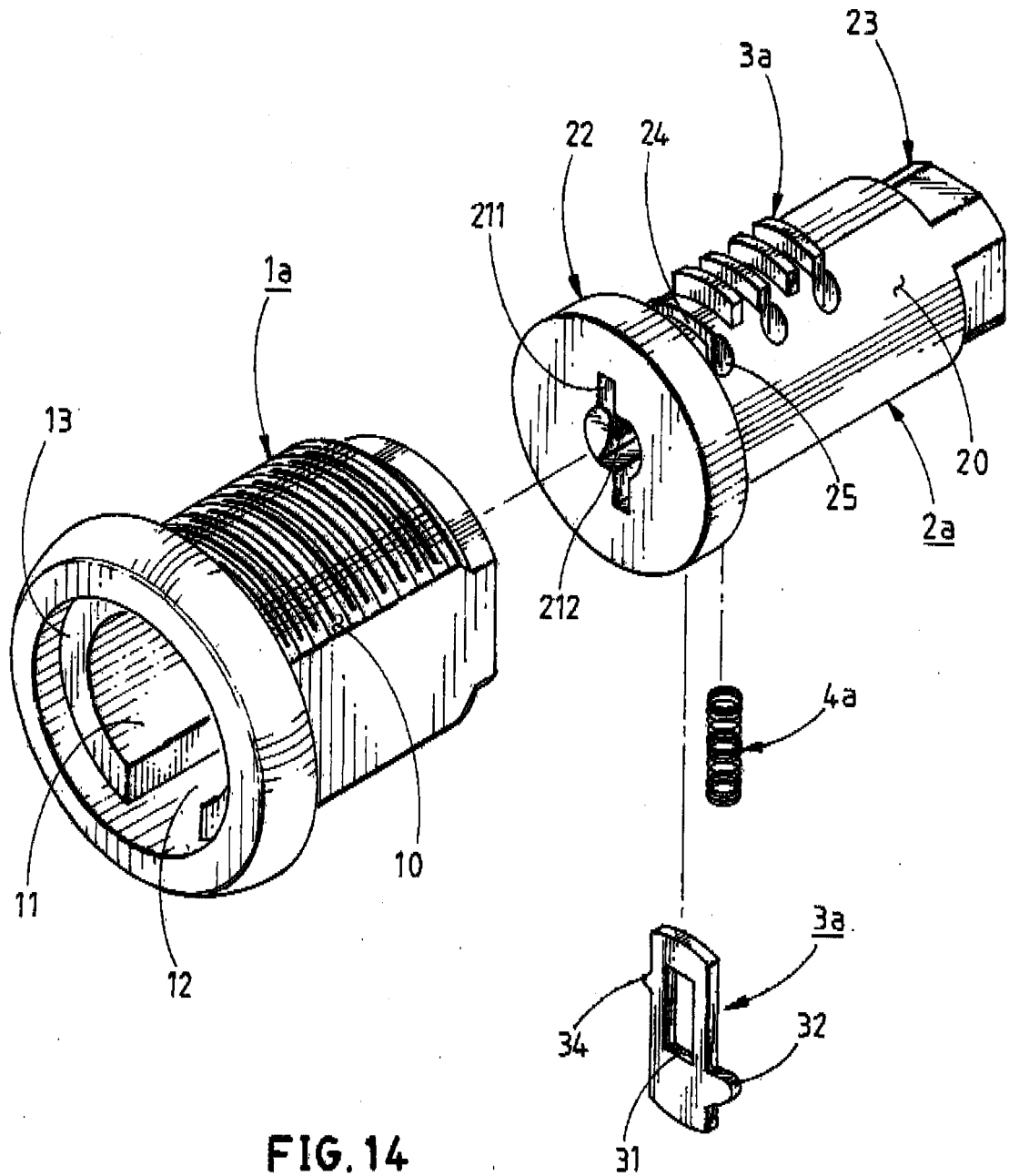


FIG. 14
PRIOR ART

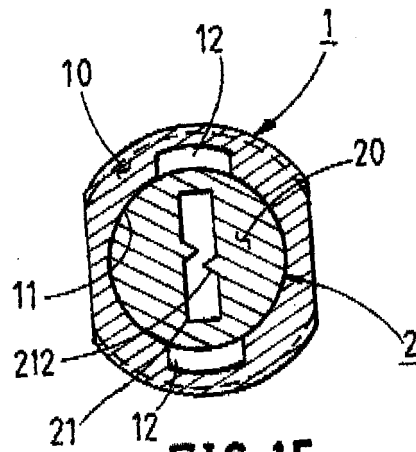


FIG. 15
PRIOR ART

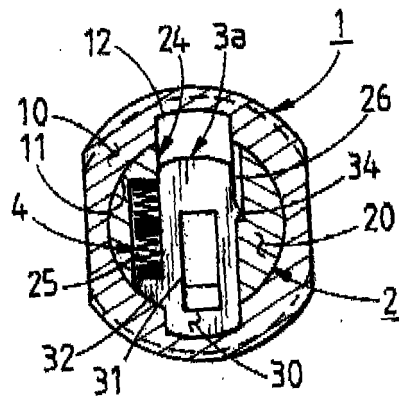


FIG. 16
PRIOR ART

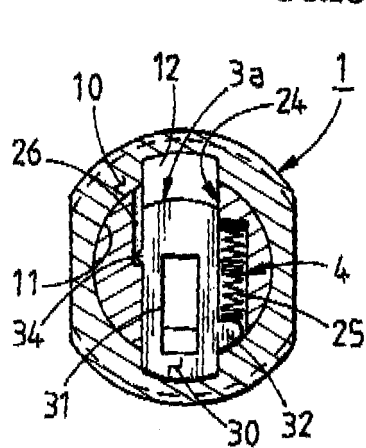


FIG. 17
PRIOR ART

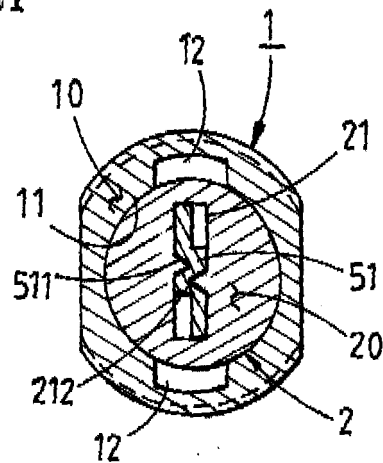


FIG. 18
PRIOR ART

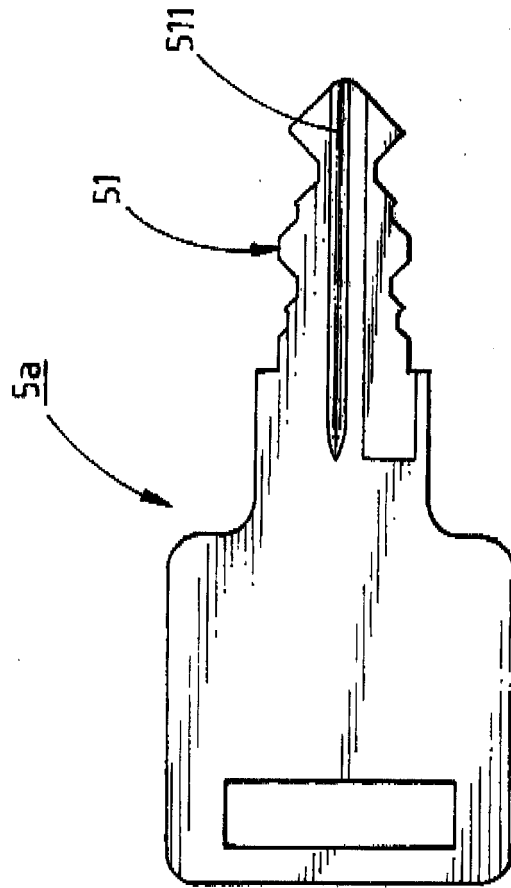
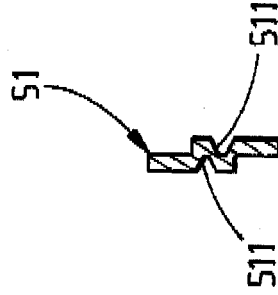


FIG. 20
PRIOR ART





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 10 8691

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Place of search The Hague		Date of completion of the search 5 October 2007	Examiner Westin, Kenneth
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EPO FORM 1503 03.82 (P04C01)

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EP 07 10 8691

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