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(54) **A REVERSIBLE KEY SYSTEM FOR LOCKS**

(57) The reversible key system for locks according to the present invention comprises a series of reversible keys (1), wherein each thereof has a body (11) provided with a grip (10), a face (14), an opposite face (15) and a cross-section. In particular, the cross-section of the body (11) has a key profile (3) defined by:
-- an encoded side (31) obtained on the face (14), having three longitudinal grooves (301,302,303), all triangular in shape, each having a varying depth in the series of keys(1);
-- an opposite encoded side (32) obtained on the opposite face (15), equal to the encoded side (31) but rotated by 180°.

Advantageously, the key profile (3) helps with the centering of the key within the lock, rendering the insertion of the key into the lock particularly smooth.

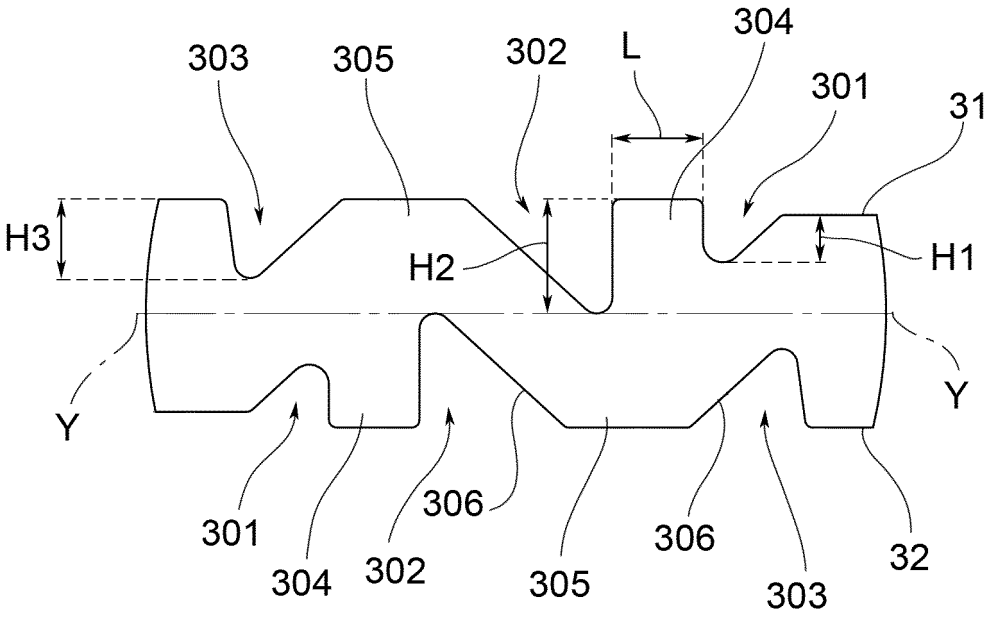

FIG.3

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Description

[0001] The present invention is in reference to a reversible key system for locks.

[0002] The art of keys and cylinders for locks calls for ever increasing security. The shape of the key is the first barrier that impedes the insertion of a non-authorized key into the cylinder of a lock. Insofar as the space within the lock that is able to accommodate the key is finite, such space has to be specially structured in order to allow for the maximum number of unique key shapes, namely encodings, so as to be able to develop a system of conjugate key/cylinder profiles of adequate size and complexity.

[0003] A new system of conjugate key/cylinder profiles must furthermore be different from previous systems in such a way that the encoding may be exclusive to the manufacturer and the final user may benefit from the security offered by such exclusivity.

[0004] Furthermore, the new key system must ensure optimal sliding of the key within the relative lock and must ensure the most correct positioning thereof in relation to the pin combinations (the encoding reading elements obtained on the key).

[0005] The object of the present invention is that of supplying a new key profiles system that resolves the problems of the known art and that satisfies the requirements of the sector for a reversible key, that is to say provided with a symmetrically rotated profile so that it may also be inserted into the lock when rotated by 180 degrees.

[0006] This purpose is achieved by means of a key system according to claim 1. The dependent claims describe preferred embodiments of the invention.

[0007] The features and advantages of the key system according to the present invention will appear more clearly from the following description, given as a nonlimiting example according to the appended figures, wherein:

- Figures 1a and 1b show a reversible key horizontally inserted into the key/cylinder system according to the present invention, in an initial configuration (1a) and in a configuration rotated by 180° (1b);
- Figures 2a and 2b show a key of the key/cylinder system according to the present invention, and in particular an axonometric view (2a) and a front view (2b);
- Figures 3, 4 show a key (Figure 3) and a cylinder (Figure 4) of the key/cylinder system according to the present invention, having the same profile;
- Figure 5 shows a sectional view of the profile of a key of the key/cylinder system according to the present invention, in a paracentric key embodiment variant;
- Figure 6 shows a sectional view of the profile of a key of the key/cylinder system according to the present invention, in a further paracentric key embodiment variant;
- Figure 7 shows a sectional view of the profile of a key of the key/cylinder system according to the present invention, in a non-paracentric key embodiment variant.

[0008] The key/cylinder system according to the present invention comprises a plurality of keys 1 and a plurality of cylinders 21.

[0009] The key 1, object of the present invention, is a reversible key insofar as it is provided with a symmetrically rotatable profile, in such a way that it may also be inserted into a lock when rotated by 180 degrees (Figures 1a and 1b). In fact, reversible keys, contrary to traditional keys, may be inserted into a lock from both sides, that is to say independently of the insertion orientation. The key 1 is also called a "horizontal key" insofar as it is horizontally inserted in relation to the lock 2.

[0010] The key/cylinder system according to the present invention comprises a cylinder 21 that is part of a lock assembly 2 comprising a cylinder housing that supports, in a rotating manner, the cylinder 21 itself, and that includes, for example, pins, sliders and other mechanisms that are adapted to impede the rotation of the cylinder up and until an appropriately configured key 1 is inserted therewithin in order to actuate the lock 2.

[0011] The key 1 comprises a grip 10 and a body 11, called a pen, that is intended to be inserted, at least partially, into the cylinder 21 of a lock 2 in order to allow for the opening of the same.

[0012] The body 11 comprises, in proximity to the grip 10, a stop 12 that is substantially in the form of a step and that acts as an end stop in order to limit any further insertion of the body 11 of the key 1 into the lock.

[0013] The body 11 comprises, starting from the stop 12, a side 13 that is intended to be incised in order to obtain the encoding of the key 1. In the case of reversible keys the encoding is obtained upon both the side 13 and upon the face 14, and upon the mirror side and face. In the case of reversible keys the encoding is obtained by means of blind encoding holes of a varying depth, wherewith the pins of the lock assembly interact in order to obtain the combination. In the present case, the encoding holes are obtained on the backing body 305.

[0014] The body 11 comprises a key profile 3 corresponding to the cross-section of the body 11 shown for example, in Figure 3. The key profile 3 allows for the pass/no-pass function of the key 1 within the cylinder 21 of the lock. Preferably, the key profile 3, that is to say the cross-section of the key 1, has a length A of about 9.4 mm and a height B of about 2.9 mm.

[0015] The key profile 3 comprises a series of longitudinal grooves that form the guide (pass/no pass) for the insertion of the key 1 into the lock 2. The longitudinal grooves 301,302,303 extend for the entire portion of the body 11.

[0016] The body 11 comprises a face 14 with encoding that is defined by the longitudinal grooves 301,302,303, that translates to an encoded side 31 of the key profile 3.

[0017] The body 11 comprises an opposite face 15 with an encoding that is defined by the longitudinal grooves 301,302,303, which translates to an opposite encoded side 32 of the key profile 3.

[0018] The centerline of the body 11 defines the axis Y, that is to say the axis that longitudinally divides in half the cross-section of the key 1, and C defines the center of the centerline axis Y, as in Figure 5. The encoding of the opposite face 15 is the same as that of the face 14, but rotated by 180° in relation to the center C of the centerline axis Y. In other words, the encoding of the opposite face 15 is the same as that of the face 14, but symmetrical in relation to the Y axis and flipped over from left to right. Therefore, insofar as the encoding of the opposite face 15 (encoded opposite side 32) is the same as that of the face 14 (encoded side 31), for simplicity only the encoding of the face 14 will be described in detail.

[0019] The encoded side 31 comprises three longitudinal grooves 301,302,303 that are always present within the series of keys of the system according to the present invention. Advantageously, the presence of three grooves ensures the correct planar positioning of the key 1 within the lock 2, making it possible to obtain smooth rotation of the key itself. Each groove, in fact, represents a pushing point of the key rotating within the cylinder of the lock 2.

[0020] The grooves 301,302,303 have substantially triangular sections, with a rounded vertex V.

[0021] Preferably, the angle of inclination of the hypotenuse is the same for all three of the grooves 301,302,303.

[0022] Preferably, at least one pair of grooves has a right-angled triangle profile. In such an example, the grooves are oriented in such a way as to be facing one another in correspondence with the vertical sides of the triangles, in such a way that the hypotenuses i converge towards the centerline axis Y. In such an example, the grooves define therebetween a centering tooth 304, of a substantially square or rectangular section, and of a parallelepiped shape. Advantageously, the presence of the centering tooth 304, on both of the faces 14,15 of the key 1, helps with the centering of the key within the lock, by rendering the insertion of the key into the lock particularly smooth.

[0023] Preferably, the centering tooth has a width L of about 1.15 mm.

[0024] In this example, the grooves are oriented in such a way that the respective hypotenuses i define converging planes 306 arranged on the sides of the centering tooth 304. Advantageously, the presence of planes that converge at the sides of the centering tooth 304 helps with the auto-centering of the key within the lock. Advantageously, furthermore, the presence of converging planes reduces the risks of tampering insofar as it impedes any break-in tools from correctly reaching the rotation mechanism of the cylinder 21. Said diligence renders any manipulation of the cylinder by means of lock picks more difficult.

[0025] Advantageously, the fact that the encoding of the opposite face 15 is the same as that of the face 14, but symmetrical and flipped from left to right, renders the structure well balanced, with a centering tooth on each face 14,15, which contributes to the auto-centering of the key within the lock.

[0026] Preferably, at least one pair of grooves has a triangular profile. In this example, the grooves are oriented in such a way as to be facing one another in correspondence with the hypotenuses i. The grooves define therebetween a backing body 305 with a substantially trapezoidal section having the larger base towards the centerline. The backing body 305 helps with the correct positioning of the body 11 (male) of the key in relation to the profile (female) of the cylinder 21 of the lock. Given that, upon the backing body 305, encoding holes are made that interact with the combination pins, it is essential that the backing body may be correctly aligned in relation to the row of pins of the lock.

[0027] Preferably, the backing body 305 has a greater width than that of the centering tooth 304.

[0028] Preferably, the backing body 305 that is present on one face 14,15 of the key 1, is aligned with the centering tooth 304 that is present on the opposite face 15,14.

[0029] The grooves 301,302,303 are of a varying depth in the series of keys of the system according to the present invention. Preferably, in the series of keys, the grooves have three different levels of depth and in particular a maximum depth, an intermediate depth, and a minimum depth. Advantageously, the presence of grooves of a varying depth makes it possible to define a pass/no-pass code that allows to insert, or not, one of the keys 1 of the series of keys into one or more cylinders 21 of the series of cylinders of the key/cylinder system according to the present invention.

[0030] Preferably, at least one of the grooves has such a depth as to reach the centerline axis Y. In this embodiment variant the profile of the key is paracentric, insofar as the grooves touch or cross, at least twice (groove on the face 14 and groove on the opposite face 15), the central axis (or centerline axis Y) of the key 1. This technical solution renders any manipulation of the cylinder 21 by means of lock picks more difficult.

[0031] As a reference for the description, the profile keys are described starting from the lowered edge 18, which is identifiable insofar as the face 14,15 of the key within that area has a height that is lower in relation to the rest of the plane. Preferably, the lowered edge 18 is lowered by about 0.2 mm in relation to the rest of the plane of the face 14,15 of the key 1.

[0032] The grooves are, starting from the lowered edge 18: first groove 301, second groove 302, third groove 303. The second groove 302 is the central groove.

[0033] The table reported below indicates, for each of the grooves 301,302,303, the preferred depth values, wherein H1 is the depth of the first groove 301, H2 is the depth of the second groove 302, and H3 is the depth of the third groove 303.

	Minimum depth (mm)	Intermediate depth (mm)	Maximum depth (mm)
H1 - First groove 301	0.80	1.10	1.35
H2 - Second groove 302	0.82	1.15	1.45
H3 - Third groove 303	0.60	0.80	1.00

In the example of Figure 5:

	Minimum depth (mm)	Intermediate depth (mm)	Maximum depth (mm)
H1 - First groove 301	0.80		
H2 - Second groove 302			1.45
H3 - Third groove 303			1.00

In the example of Figure 6:

	Minimum depth (mm)	Intermediate depth (mm)	Maximum depth (mm)
H1 - First groove 301			1.35
H2 - Second groove 302			1.45
H3 - Third groove 303	0.60		

In the example of Figure 7:

	Minimum depth (mm)	Intermediate depth (mm)	Maximum depth (mm)
H1 - First groove 301		1.10	
H2 - Second groove 302	0.82		
H3 - Third groove 303	0.60		

[0034] Preferably, the second groove 302, or the central groove, has such a depth as to reach the centerline axis Y, as in Figures 5 and 6.

[0035] Preferably, the first groove 301 has a right-angled triangle section, wherein the hypotenuse is inclined by an angle $\alpha 1$ of about 47.5°.

[0036] Preferably, the second groove 302 has a right-angled triangle section, wherein the hypotenuse is inclined by an angle $\alpha 2$ of about 47.5°.

[0037] Preferably, the third groove 303 has a right-angled triangle section, wherein the hypotenuse is inclined by an angle $\alpha 3$ of about 47.5° in relation to the vertical, and the short side is inclined by and angle $\alpha 4$ of about 7.5° in relation to the vertical.

[0038] Preferably, the first groove 301 and the second groove 302 have a right-angled triangle profile. In this example, the first groove 301 and the second groove 302 are oriented so as to be facing one another in correspondence with the vertical sides of the triangles, in such a way that the hypotenuses i converge towards the centerline axis Y. In this example, the first groove 301 and the second groove 302 define therebetween a centering tooth 304, of a substantially square or rectangular section, and of a parallelepiped shape. Furthermore, the first groove 301 and the second groove 302 define, by means of the respective hypotenuses i thereof, converging planes 306 arranged at the sides of the centering tooth 304.

[0039] Preferably, the second groove 302 and the third groove 303 are oriented so as to be facing one another in correspondence with the respective hypotenuses i which thereby converge towards the exterior of the body 11. The second groove 302 and the third groove 303 define therebetween a backing body 305 with a substantially trapezoidal section having a larger base towards the centerline.

[0040] The same encoding that is adopted for the key 1 is obtained in the cylinder 21 of the lock. The cylinder 21 therefore comprises a seat 22, wherein the body 11 of the key 1 is inserted, having a cylinder profile 4 (shown, for example, in Figure 4) with the same encoding as that of the key profile 3.

[0041] The seat 21 therefore comprises a profile that is defined by three ridges having the same characteristics as those of the respective grooves of the key 1. The ridges, starting from the area in which the lowered edge 18 of the key is located, are: first ridge 501, second ridge 502, third ridge 503. Thus, in the same way as the grooves have a varying depth, the ridges have a varying height in the series of cylinders of the system according to the present invention.

[0042] The ridges 501,502,503 have a substantially triangular section, with a rounded vertex V.

[0043] Preferably, the angle of inclination of the hypotenuse is the same for all three ridges.

[0044] Preferably, at least one pair of ridges has a right-angled triangle profile. In this example, the ridges are oriented such as to be facing one another in correspondence with the vertical sides of the triangles, in such a way that the hypotenuses i converge towards the interior of the seat 22. In this example, the ridges define therebetween a centering recess of a substantially square or rectangular section. In this example, the ridges are oriented in such a way that the respective hypotenuses define converging planes arranged on the sides of the centering recess.

[0045] Preferably, at least one pair of ridges has a triangular profile. In this example, the ridges are oriented in such a way as to be facing one another in correspondence with the hypotenuses. The ridges define therebetween a backing recess with a substantially trapezoidal section having a larger base facing the interior of the seat 22.

[0046] Preferably, the backing recess, arranged on one side of the seat 22, is aligned with the centering recess arranged on the opposite side of the seat 22.

[0047] In the series of cylinders 21 of the system according to the present invention the ridges 501,502,503 have a varying height. Preferably, the ridges have three different height levels and in particular a maximum height, an intermediate height, and a minimum height.

[0048] In summary therefore, the reversible key system according to the present invention comprises:

- a series of reversible keys 1, wherein each thereof has a key profile 3 with an encoded side 31 and an opposite encoded side 32, both having the same encoding but mirrored and rotated from right to left;
- the encoding comprises three longitudinal grooves 301,302,303, triangular in shape and wherein each thereof has at least three possible levels of depth.

[0049] The invention also relates to a key/cylinder system for locks comprising:

- a key system 1 as described above;
- a cylinder system 31, wherein each cylinder is provided with a seat 22 in which the body 11 of one of the keys of the key system is insertable.

[0050] Furthermore, the key/cylinder system comprises at least one master key, insertable into all of the cylinders 21 of the series, wherein all three thereof have the grooves 301,302,303 with the maximum level of depth.

[0051] Innovatively, a key system according to the present invention is easy to use, safe and particularly effective.

[0052] Advantageously, the key system according to the present invention ensures optimal insertion of the key into the relative lock.

[0053] Advantageously, the reversible key system permits insertion into the lock on both sides, and offers greater comfort, above all under poor lighting conditions or for visually impaired people.

[0054] Advantageously, furthermore, the system of profiles according to the present invention makes it possible to obtain large scale master key systems, exploiting the existence of key profiles that are suitable for use in multiple cylinder/lock profiles and vice versa. One practical usage example may be a large hotel where it is necessary to supply single keys for guest rooms and differing levels of master keys for service personnel. It is possible to dedicate a profile to each floor of the hotel, with a relative floor master key for the cleaning staff of the floor itself, and a master key for the security staff with such a profile that it may be inserted into every cylinder of every floor.

[0055] It is understood that a person skilled in the art could make modifications to the key/cylinder system described above, all of which are contained within the scope of protection as defined by the following claims.

Claims

1. A reversible key system for locks, comprising a series of reversible keys (1), each key (1) having:

- a body (11) provided with a grip (10), said body (11) having a face (14) and an opposite face (15), and a cross-section;

- wherein the cross-section of the body (11) has a key profile (3) defined by:

-- an encoded side (31) obtained on the face (14), having three longitudinal grooves (301,302,303), all triangular in shape, each having a varying depth in the series of keys (1);
-- an opposite encoded side (32) obtained on the opposite face (15), equal to the encoded side (31) but rotated by 180°.

2. A reversible key system according to claim 1, wherein two of the three grooves (301,302,303) define a centering tooth (304) with a substantially square or rectangular section.

3. A reversible key system according to claim 2, wherein said two grooves (301,302) are oriented so as to define converging planes (306) arranged at the sides of the centering tooth (304).

4. A reversible key system according to claim 1 or 2, wherein two of the three grooves (301,302,303) are placed side-by-side so that the hypotenuses thereof converge towards the interior of the body (11).

5. A reversible key system according to any one of the preceding claims, wherein two of the three grooves (301,302,303) have a right-angled triangle profile and are placed side-by-side at the vertical sides of the triangles.

6. A reversible key system according to any one of the preceding claims, wherein two of the three grooves (301,302,303) are placed side-by-side so that the hypotenuses thereof converge towards the exterior of the body (11).

7. A reversible key system according to any one of the preceding claims, wherein two of the three grooves (301,302,303) define a backing body (305) with a substantially trapezoidal section having the smaller base towards the exterior of the body (11).

8. A reversible key system according to claim 7 when dependent on claim 2, wherein a backing body (305) present on the face (14) is aligned with a centering tooth (304) present on the opposite face (15).

9. A reversible key system according to any one of the preceding claims, wherein said grooves (301,302,303) have three different levels of depth in the series of keys, and in particular a maximum depth, an intermediate depth, and a minimum depth.

10. A reversible key system according to any one of the preceding claims, wherein once a centerline axis (Y) of the cross-section of the key (1) has been defined, at least one of the three grooves (301,302,303) has a depth such as to reach said centerline axis (Y).

11. A reversible key system according to claim 10, wherein, out of the three grooves (301,302,303), it is the central groove (302) that has a depth such as to reach the centerline axis (Y).

12. A key/cylinder system for locks, comprising:

- a key system (1) according to any one of the preceding claims;
- a cylinder system (31), wherein each cylinder is provided with a seat (22) in which the body (11) of a key of the key system (1) is insertable.

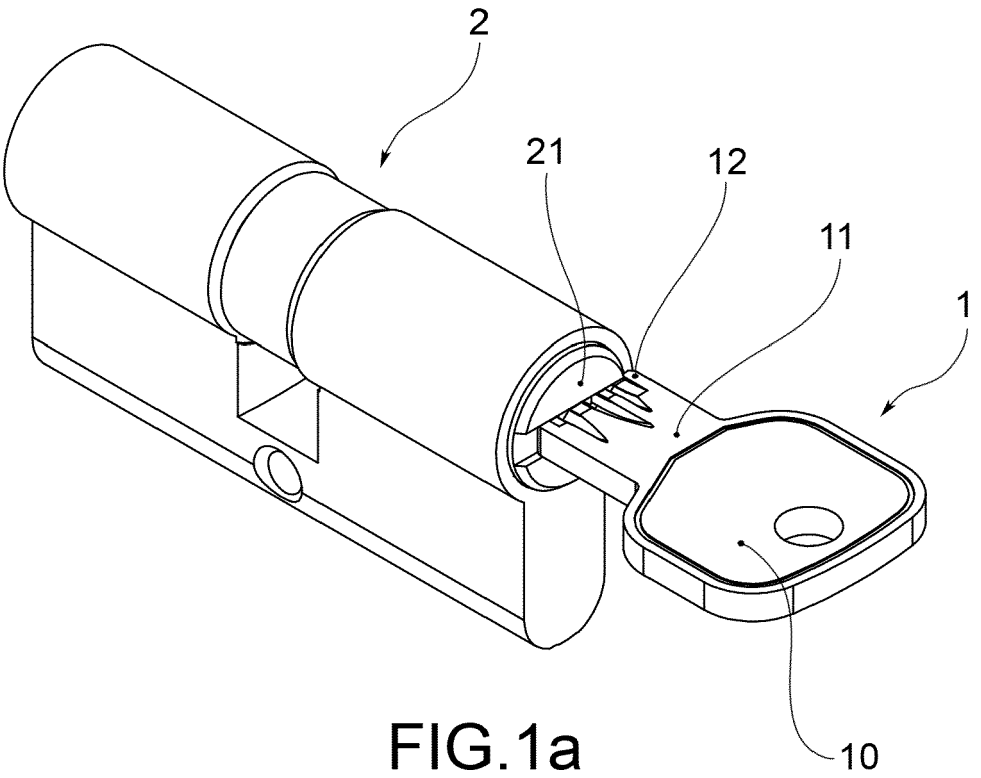


FIG.1a

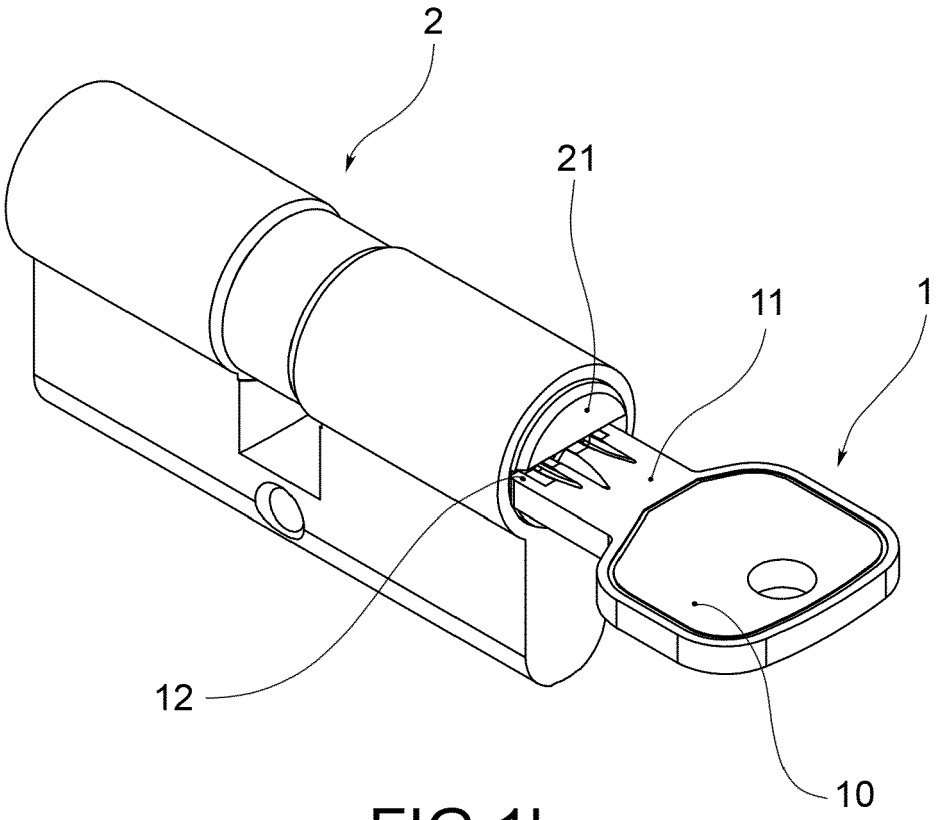


FIG.1b

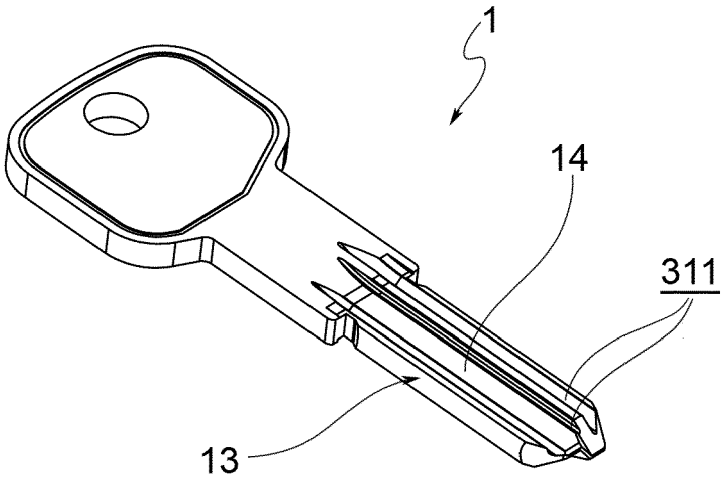


FIG.2a

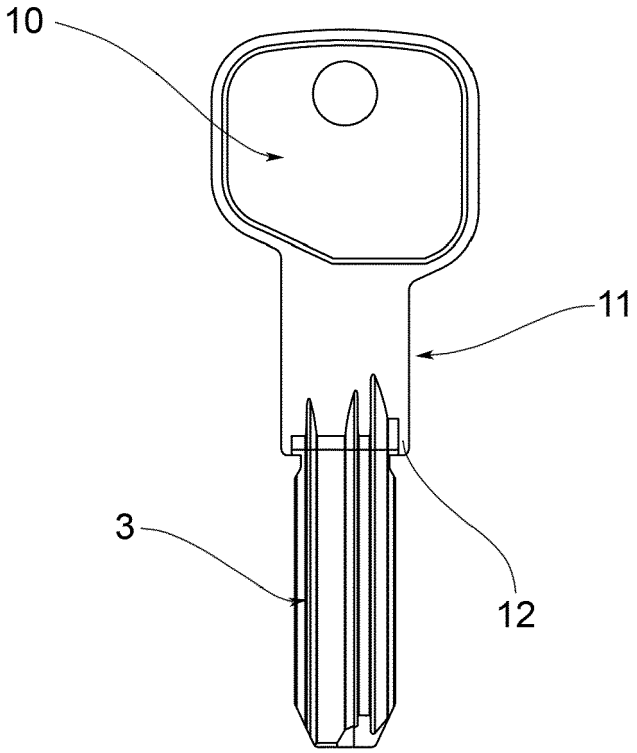


FIG.2b

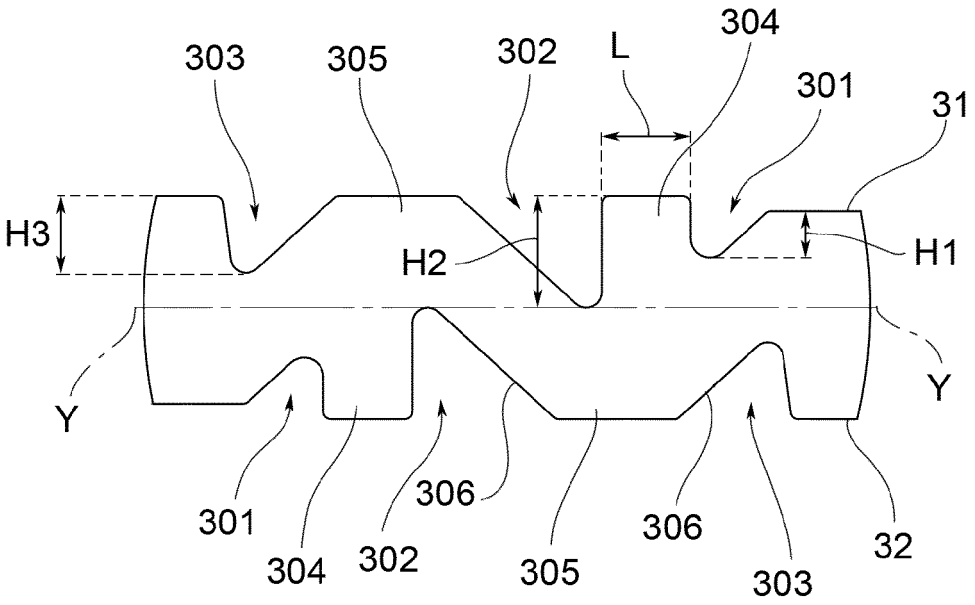

303
305
302
L
304
301
31
H3
H2
H1
Y
Y
301
304
302
306
305
306
303
32

FIG.3

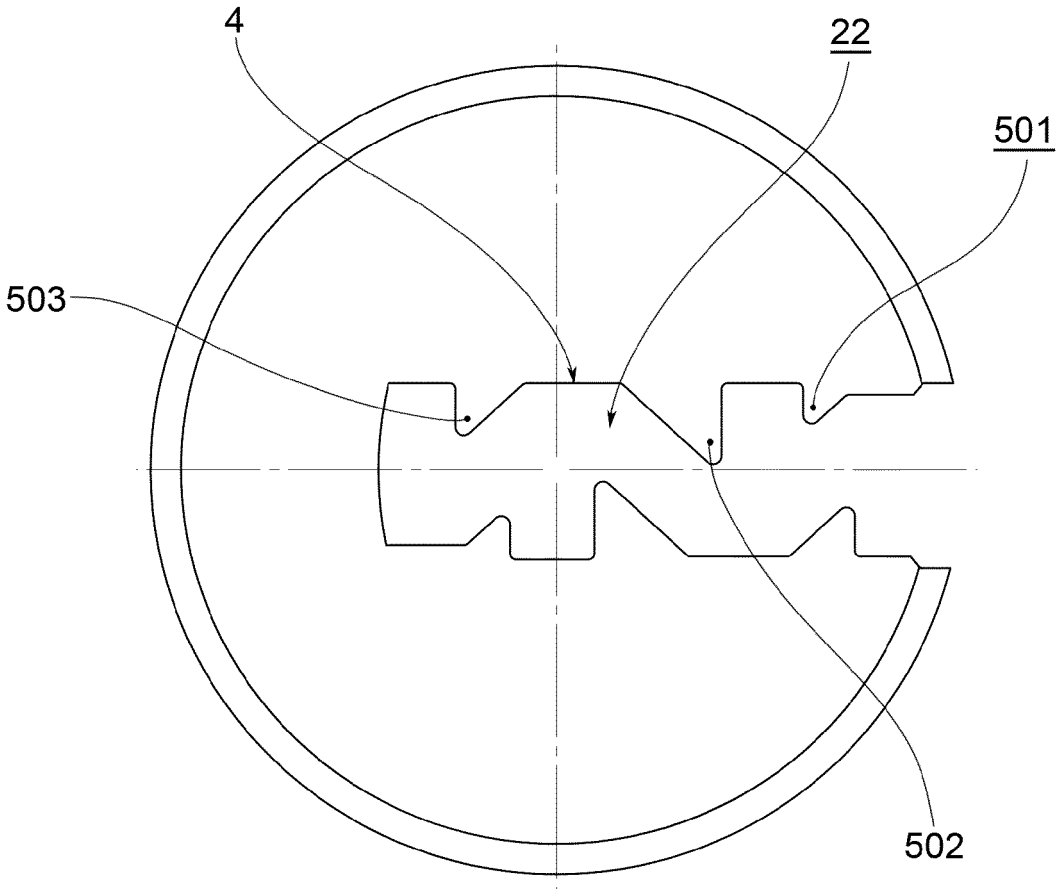

4
22
501
503
502

FIG.4

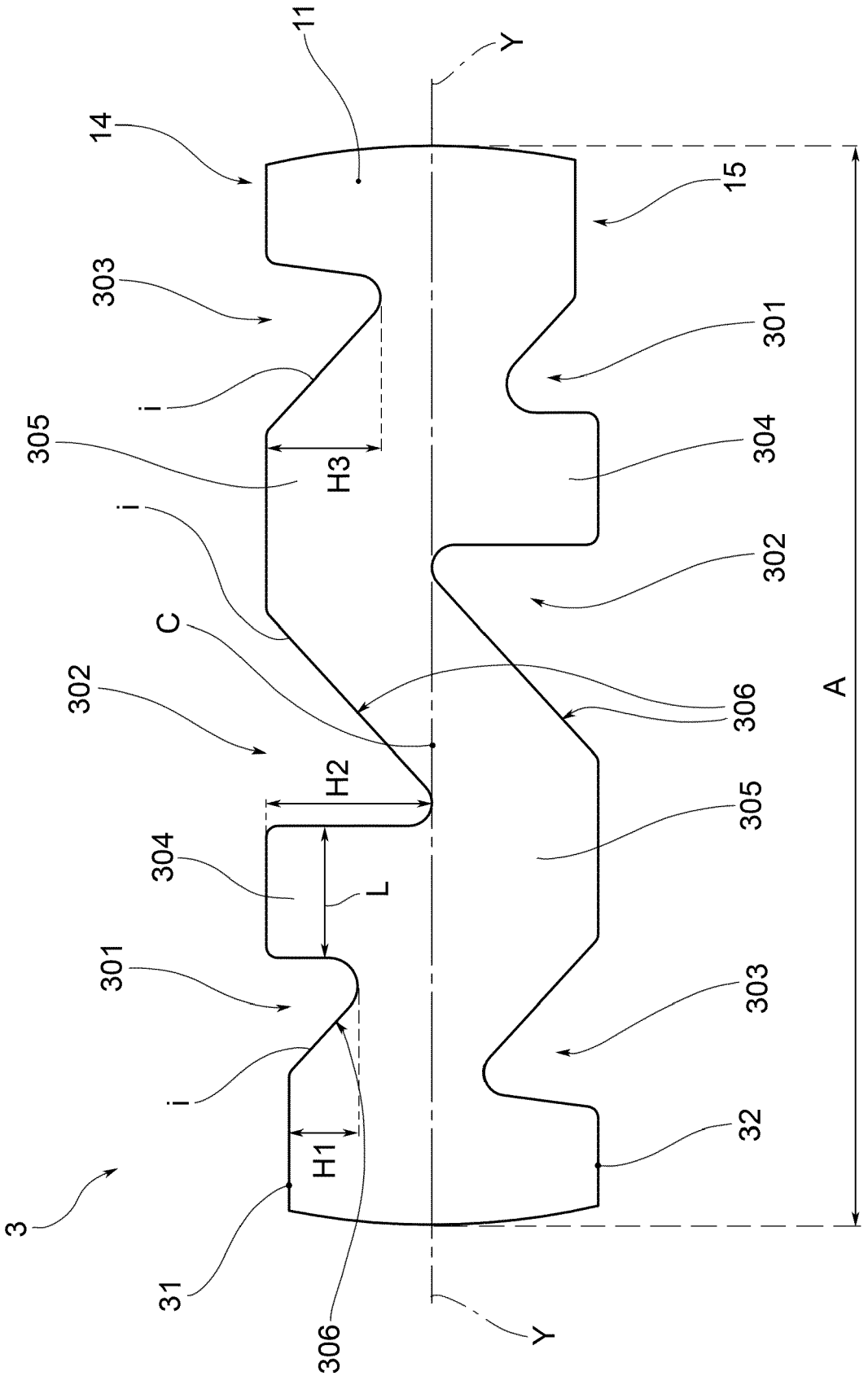
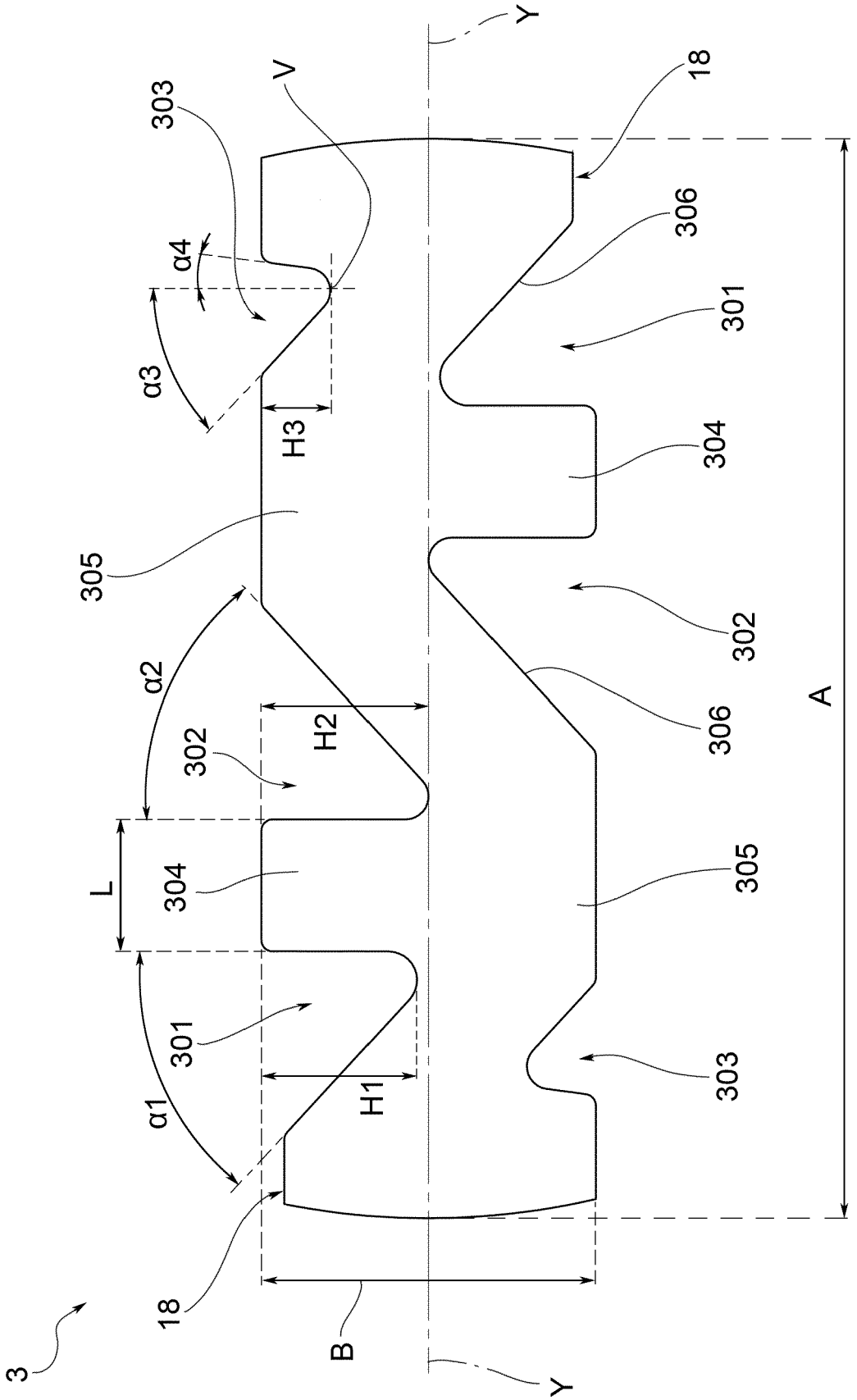

11
Y
14
15
303
301
i
305
H3
304
i
302
C
306
302
H2
A
305
304
L
301
303
i
H1
32
3
31
306
Y

FIG.5


Y
V
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303
18
B
3
Y

FIG.6

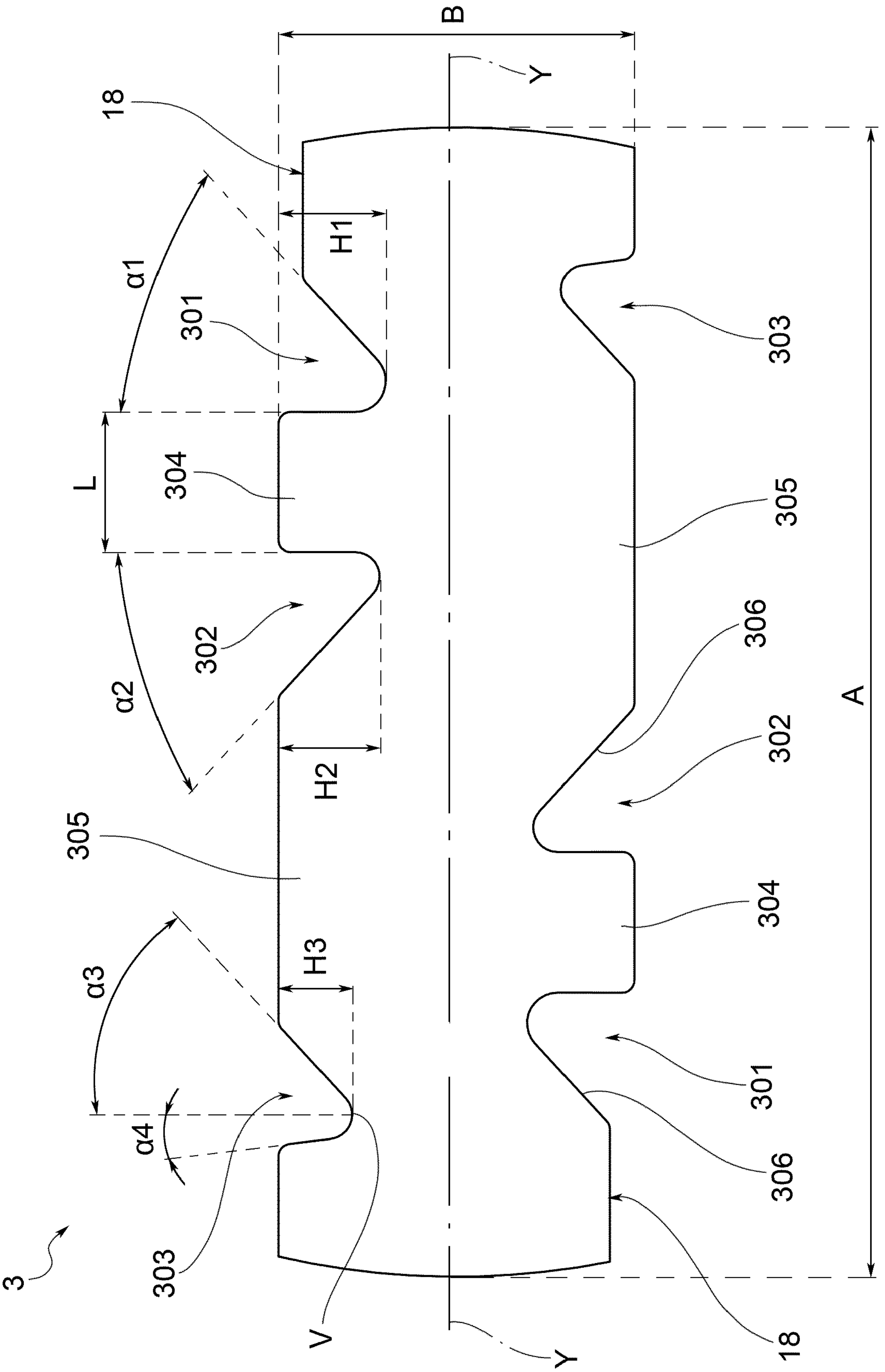

FIG.7

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EUROPEAN SEARCH REPORT

Application Number
EP 23 17 8517

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X A	EP 1 452 673 A2 (WILKA SCHLIESSTECHNIK GMBH) 1 September 2004 (2004-09-01) * figures 1,2a *	1,12 2-11	INV. E05B19/00
X	US 2004/000178 A1 (TSENG) 1 January 2004 (2004-01-01) * figure 7 *	1-12	
X	DE 10 2018 107501 A1 (DOM SICHERHEITSTECHNIK) 19 July 2018 (2018-07-19) * figure 6 *	1-12	
			TECHNICAL FIELDS SEARCHED (IPC)
			E05B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	12 October 2023	Van Beurden, Jason

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1452673 A2	01-09-2004	AT 469279 T	15-06-2010
		DE 10306371 A1	02-09-2004
		EP 1452673 A2	01-09-2004
		PL 364652 A1	23-08-2004
US 2004000178 A1	01-01-2004	TW I238216 B	21-08-2005
		US 2004000178 A1	01-01-2004
DE 102018107501 A1	19-07-2018	NONE	

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