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(54) **CYLINDER LOCK AND LOCK PIN SUITABLE AND INTENDED FOR A CYLINDER LOCK**

(57) A cylinder lock 10 with a first and a second lock housing 12, 16, at least one lock cylinder, a carrier 20 which is provided with a carrier cam 22 and which is received between the first and the second lock housing 12, 16 and which through rotation of the lock cylinder can be brought from a first position into a second position. The cylinder lock 10 is further provided with a bridge 26, which connects the first lock housing 12 with the second lock housing 16. To prevent sabotage whereby the connection between the bridge 26 and the lock housing 12 is broken by drilling, the cylinder lock 10 is provided with a drill protection which is implemented as a ball 28 from hardened steel, while the bridge 26 near an axial end thereof is provided with a chamber 32 in which the ball 28 is received. Further, there is described a new lock pin 200 for making lock picking more difficult.

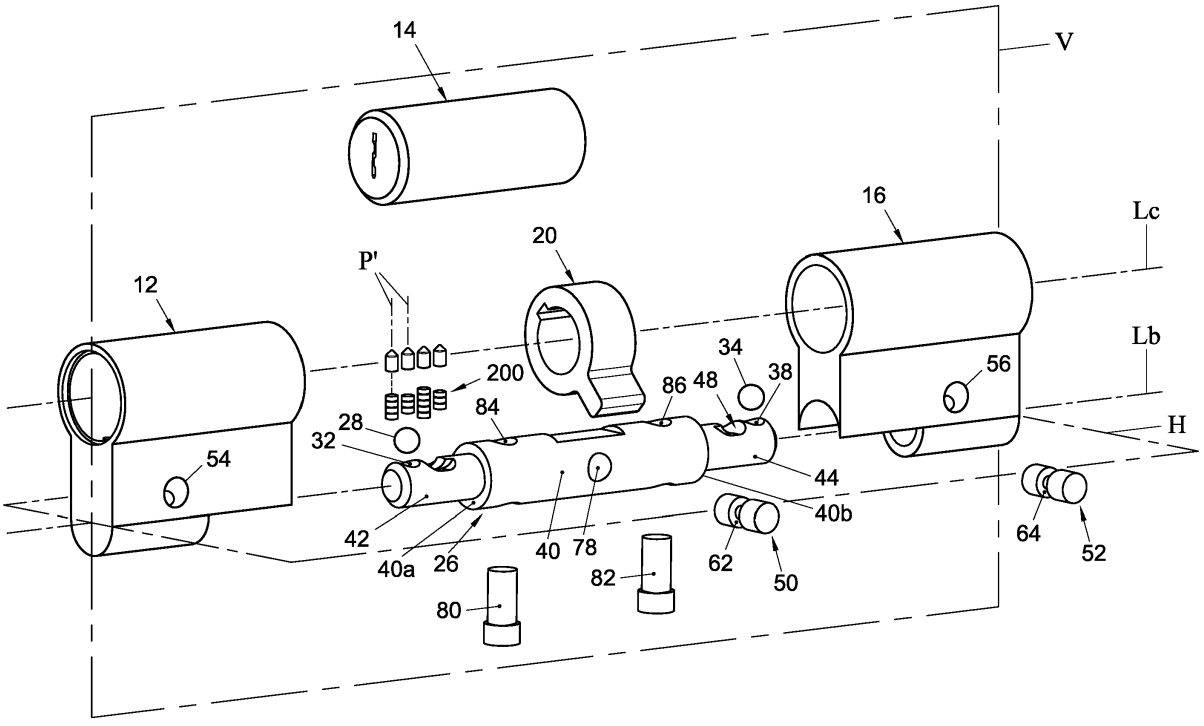

FIG. 2

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Description

FIELD

[0001] The invention relates to a cylinder lock with drill protection. The invention further relates to a lock pin and to a cylinder lock provided with such a lock pin.

BACKGROUND

[0002] From EP-1 209 305 A1 a cylinder lock is known which comprises:

- a first lock housing having a substantially constant circumferential contour extending in an axial direction, while in the lock housing a first lock cylinder is included;
- a second lock housing having a substantially constant circumferential contour extending in an axial direction, in which either a second lock cylinder is included or an operating knob assembly, the circumferential contour of the second lock housing corresponding to the circumferential contour of the first lock housing, and the circumferential contours of the two lock housings being in line with each other;
- a carrier which is provided with a carrier cam and which is included between the first and the second lock housing, wherein the carrier is rotatable relative to the first and the second lock housing and is positionable in a first position in which the carrier cam is in a recess between the first and the second lock housing and in which moreover the carrier cam, viewed in axial direction of the lock, is within the circumferential contours, wherein the carrier through rotation is positionable in a second position in which the carrier cam, viewed in axial direction, extends outside the circumferential contours;
- a bridge, which connects the first lock housing with the second lock housing; and
- a drill protection which is included at least in the first lock housing near an axial end of the first lock housing, which axial end is remote from the second lock housing.

[0003] In the cylinder lock known from EP-1 209 305 each lock housing is provided at the underside with a downwardly open, rectangular slot in which the bridge is receivable. The drill protection is formed by a loose part which in that publication is designated with the reference numeral 11. A drill protection is especially important for protection of the lock against burglars who with a drill try to drill through the bottom area of the lock, so that the connection of the bridge with the lock housing is damaged and the lock housing can thereupon be pulled from the bridge with force.

[0004] A second way of unauthorized keyless opening of a lock involves so-called lock picking. This has even become a sport, for which also clubs exist and tools are sold. A description of a lock picking tool is given, for example, in US-5 956 984 B1.

SUMMARY OF THE INVENTION

[0005] A drawback of the drill protection known from EP '305 is that assembling the drill protection together with the bridge and the lock housing is hard because three loose parts need to be put together simultaneously. Also the part forming the drill protection is a special part having a special shape. Such a part is costly to manufacture, in particular also because the material should be hardened and so is difficult to machine.

[0006] The invention contemplates a cylinder lock having the above-described properties without the just-described drawbacks. More particularly, the invention contemplates a cylinder lock whose drill protection can be implemented more inexpensively and the assembly of which is simpler.

[0007] To this end, the invention provides a cylinder lock according to claim 1. More particularly, the lock described in the background section is characterized according to the invention in that

- the drill protection is implemented as a ball from hardened steel, while the bridge near an axial end thereof that is in a bridge bore in the first lock housing is provided with a chamber in which the ball is received.

[0008] Balls of hardened steel are a standard commercially available commodity. They are produced in large numbers for ball bearings and for that reason are available at a relatively low price. As the bridge is provided with a chamber for taking up the ball, assembling a lock is simpler than in the case of the prior art lock with drill protection. This is because first the balls are placed in the chambers in the bridge. Thereupon, the axial end parts of the bridge can be moved into the two lock housings. After this, only the bridge needs to be fixed with respect to the lock housings, which will be described in more detail hereinafter with reference to an exemplary embodiment.

[0009] The present invention further contemplates providing a solution that makes lock picking more difficult to the point where opening a lock takes so much time that it is not a viable option anymore for a burglar to undertake burglary by lock picking.

[0010] Towards solving the lock picking problem, the invention provides a lock pin according to claim 11. More particularly, this concerns a lock pin comprising:

- a shank;
- a head which is broadened with respect to the shank and which forms a second lock pin end;
- at least one loose ring which extends around the shank with play;
- a retaining ring which is fixedly connected with the shank and forms a first lock pin end.

[0011] The new lock pin is applicable in the above-described lock with the new drill protection, but is also applicable in conventional cylinder locks without drill protection. The lock pin is applicable in any cylinder lock that comprises:

- a lock housing;
- a lock cylinder which is included in the lock housing and in an unlocked condition is rotatable relative to the lock housing around a central axis;
- at least one lock pin having a first lock pin end and a second lock pin end, wherein each lock pin is included in the lock housing and is provided with an axis which extends perpendicular to the central axis;
- at least one lock pin spring which engages a first lock pin end of a lock pin associated with that lock pin spring, which lock pin spring pushes the associated lock pin in the direction of the lock cylinder;
- at least one cylinder pin having a first cylinder pin end and a second cylinder pin end, wherein each cylinder pin is included in the lock cylinder and is provided with an axis which extends perpendicular to the central axis, wherein the first cylinder pin end abuts against the second lock pin end of the lock pin associated with the cylinder pin, wherein the at least one cylinder pin in use is engaged by a key, whereby the cylinder pin is moved, against spring action, away from the central axis (Lc) of the lock cylinder, such that the first cylinder pin end and the second lock pin end of each cylinder pin and lock pin are moved to a position in which they are flush with the cylindrical surface of the lock cylinder, so that the lock cylinder is rotatable in the lock housing.

[0012] The invention further relates to such a cylinder lock provided with lock pins according to the invention. In the practical tests, it has been found that the new lock pin forms a highly effective protection against lock picking. The rings arranged on the shank with play make it virtually impossible to maneuver all lock pins with the aid of the lock picking technique into a position in which the lock cylinder can be rotated. This prolongs the time that is needed to open the lock by lock picking to the point where this technique is no longer a viable option for burglars to gain unauthorized access to a building or area.

[0013] The invention will hereinafter be further clarified on the basis of a number of embodiments, with reference to examples of such embodiments represented in the drawings.

BRIEF DESCRIPTION OF THE FIGURES

[0014]

Fig. 1 shows a perspective of an example of a lock in which different embodiments are embodied;
Fig. 2 shows a similar perspective to Figure 1, in exploded view;
Fig. 3 shows a similar perspective to Figure 1, with omission of the left-hand lock housing;
Fig. 4 shows a front view of the example of Figure 1;
Fig. 5 shows a partial sectional view taken along line V-V of Figure 4;
Fig. 6 shows a perspective of the bridge of the example of Figure 1;
Fig. 7 shows a top plan view of the bridge represented in Figure 6;
Fig. 8 shows a perspective of an alternative embodiment of the bridge;
Fig. 9 shows a top plan view of the bridge represented in Figure 8;
Fig. 10 shows a side view of an example of a lock pin; and
Fig. 11 shows a sectional view taken along line XI-XI of Figure 10.

DETAILED DESCRIPTION

[0015] Figures 1-5 show an example of a cylinder lock in which various embodiments as described in the subclaims are embodied. It is noted that the embodiments can also be applied independently of each other and that the invention is not limited to the examples shown in the figures. Hereinafter, various embodiments will be described, reference being made to the figures with the help of reference numerals. The reference numerals are used herein for clarification but have no limiting effect. An embodiment may also be implemented in a different manner than represented in the example that is shown in the figures.

[0016] In the most general terms, the invention provides a cylinder lock 10 comprising a first lock housing 12 having a substantially constant circumferential contour extending in an axial direction, with a lock cylinder 14 included in the lock housing 12. Further, the cylinder lock 10 comprises a second lock housing 16 having a substantially constant circumferential contour extending in an axial direction, in which either a second lock cylinder (not shown) is included or an operating knob assembly. A description of an example of such an operating knob assembly is given in Netherlands patent application NL-2012477. The circumferential contour of the second lock housing 16 corresponds to the circumferential contour of the first lock housing 12 and the circumferential contours of the two lock housings 12, 16 extend in line with each other. The cylinder lock 10 is further provided with a carrier 20 which is provided with a carrier cam 22 and which is included between the first and the second lock housing 12, 16. The carrier 20 is rotatable relative to the first and the second lock housing 12, 16 and is positionable in a first position in which the carrier cam 22 is in a recess 24 between the first and the second lock housing 12, 16. In that first position, moreover, the carrier cam 22, viewed in axial direction of the lock 10, is within the circumferential contours of the two lock housings 12, 16. Through rotation, the carrier 20 is positionable in a second position

in which the carrier cam 22, viewed in axial direction, extends outside the circumferential contours. The cylinder lock 10 is further provided with a bridge 26, which connects the first lock housing 12 with the second lock housing 16. To prevent sabotage whereby the connection between the bridge 26 and the lock housing 12 is broken by drilling, the cylinder lock 10 is provided with a drill protection which is included at least in the first lock housing 12 near an axial end 12a of the first lock housing 12, this axial end 12a being remote from the second lock housing 16. In themselves, all of the above-mentioned general features are known from the earlier-mentioned European patent application EP-1 209 305 A1.

[0017] The cylinder lock 10 is characterized in that the drill protection is implemented as a ball 28 from hardened steel, while the bridge 26, near an axial end thereof that is in a bridge bore 30 in the first lock housing 12, is provided with a chamber 32 in which the ball 28 is received.

[0018] Such a drill protection is simple to assemble and can be implemented inexpensively because hard steel balls are obtainable at low cost price and assembly is simple.

[0019] In an embodiment, of which an example is shown in the figures, also the second lock housing 16 may be provided with a drill protection. This drill protection can also be implemented as a ball 34 from hardened steel, while the bridge 26, near an axial end thereof that is in a bridge bore 36 in the second lock housing 16, is provided with a chamber 38 in which the ball 34 is received.

[0020] In an embodiment, of which a first example is shown in Figures 1-7 and of which a second example is shown in Figures 8-9, the bridge 26 can comprise a substantially cylindrical central part 40 of a first diameter. The central part 40 has a first and a second axial end 40a, 40b. With the first axial end 40a, a first, substantially cylindrical end part 42 may be connected. With the second axial end 40b, a second, substantially cylindrical end part 44 may be connected. In the example shown, the end parts 42, 44 and the central part 40 are implemented as a single, integral component. The substantially cylindrical central part 40 and the two end parts 42, 44 may be positioned coaxially with respect to each other and therefore have a common axis Lb. A first plane V which includes the axis Lb extends in use in a vertical direction. A second plane H which includes the axis Lb extends in use in a horizontal direction.

[0021] In an embodiment, of which an example is shown in Figures 1-5, the central part 40 may be provided, on opposite sides of the center thereof, with a bore 84, 86. One bore 84 may be associated with a threaded bore 88 in the first lock housing 12. The other bore 86 may be associated with a threaded bore (not shown) in the second lock housing 16. The cylinder lock 10 in this embodiment may be provided with two bolts 80, 82. A first 80 of the two bolts 80, 82, in the assembled condition of the cylinder lock 10, extends through one bore 84 and is fastened in the threaded bore 88 in the first lock housing 12.The other 82 of the two bolts 80, 82, in assembled condition of the cylinder lock 10, extends through the other bore 86 and is fastened in the threaded bore in the second lock housing 16.

[0022] With such bolts 80, 82 the bridge 26 and the lock housings 12, 16 can be connected with each other in a simple manner. Assembly and disassembly are thus feasible with a small number of operations.

[0023] In an embodiment, of which an example is shown in Figures 2-9, each end part 42, 44 can have a cylindrical surface or superficies. In the cylindrical surface of each end part 42, 44 a recess 46, 48 may then be provided, having a, viewed in a direction perpendicular to the first plane V, substantially circular segment-shaped contour. Further, with each recess 46, 48 a substantially cylindrical cross pin 50, 52 may be associated, as well as a cross bore 54, 56 in the lock housing 12, 16 associated with the respective end part 42, 44.

[0024] The cross pins 50, 52 take care of a very strong connection between the bridge 26 and the lock housings 12, 16. Certainly when the cross pins 50, 52 are also made of hardened steel, it is virtually impossible to sabotage the cylinder lock 10 by means of a drill. The drill protection provided with balls 28, 34, and the cross pins 50, 52 provide a particularly secure cylinder lock 10 that meets the highest security class standard.

[0025] In an embodiment, of which two examples are shown in Figures 1-9, in each recess 46, 48 in the surface of the end part 42, 44 a central ridge 58, 60 may be provided which is on the side of the recess 46, 48 proximal to the central part 40. The substantially cylindrical cross pin 50, 52 may then be provided with a central groove 62, 64 in which in assembled condition of the cylinder lock 10 the central ridge 58, 60 is received.

[0026] This central ridge 58, 60 prevents the cross pin 50, 52 possibly falling out of the lock housing 12, 16 when the bridge 26 has taken up its final position in the lock housings 12, 16.

[0027] Assembly proceeds as follows: first, an end part 42, 44 is slipped partly into the bridge bore 30, 36 of the lock housing 12, 16 associated with the end part 42, 44. Thereupon the cross pin 50, 52 is slipped into cross bore 54, 56. After this, the end parts 42, 44 are slipped deeper into the bridge bores 30, 36, so that the central ridge 58, 60 is received in the central groove 62, 64 of the corresponding cross pin 50, 52. Finally, with the aid of the bolts 80, 82, the bridge 26 and the lock housings 12, 16 are connected with each other. When a burglar tries to break the lock housing 12 loose from the bridge 26 with brute force, he must break not only the bolt 80 but also the cross pin 50. Since the cross pin 50 may be made of hardened, high-grade material, this is virtually impossible and the attempts of the burglar will fail.

[0028] In an embodiment, of which an example is shown in Figures 1-9, each end part 42, 44 can include an above-mentioned chamber 32, 38 for receiving an above-mentioned ball 28, 34. By including the chamber 32, 38 in an end part 42, 44, the ball 28, 34 in an assem-

bled condition of the cylinder lock 10 is always confined in the chamber 32, 38 because the access opening of the chamber 32, 38 is closed off by the associated lock housing 12, 16.

[0029] In an embodiment, of which an example is shown in Figures 8 and 9, the chamber 32, 38 in an end part 42, 44 may be situated under the recess 46, 48 in the cylindrical surface of the end part 42, 44.

[0030] In such an implementation, the room that the ball 28, 34 has in the chamber 32, 38 is somewhat smaller, so that the possibilities of movement of the ball 28, 34 are somewhat more limited. This makes the chances of successfully executing a drill attack even slimmer.

[0031] Instead of, or in addition to, the bolts 80, 82, in an embodiment of the cylinder lock 10 each end pin 42, 44 may be provided with a circumferential groove 66, 68 which is associated with a clip. An example of this embodiment is shown in Figures 8 and 9. Each lock housing may then be provided with a clip groove in which the clip is receivable. In an assembled condition, the clip may be received in the clip groove in the lock housing 12, 16 and engages a circumferential groove 66, 68 of the associated end pin 42, 44 which is received in the respective lock housing 12, 16. The clips and clip grooves are not shown in the drawings. Use of such clips and clip grooves, however, is for instance known from WO2006/042753 A1 and for an example of the clips and clip grooves, reference is made to that publication.

[0032] In an exemplary embodiment, of which an example is shown in Figures 1-9, the central part 40 may be provided with a central bore 78 which extends perpendicular to the first plane V and which is threaded.

[0033] With the aid of this central bore, the cylinder lock can be fixed in a door (not shown) by means of a bolt which engages the central bore 78.

[0034] The invention further provides a new lock pin 200 which is suitable and intended for use in a cylinder lock 10 and which is intended in particular to prevent the unauthorized opening of a cylinder lock 10 by lock picking, or at least to make this as difficult as possible.

[0035] An example of a lock pin 200 is shown in detail in Figures 10 and 11. Also in Figures 2 and 5, the example of the lock pin 200 of Figures 10 and 11 is shown. It is to be noted that the new bridge 26 with the new drill protection can also be applied in a cylinder lock 10 that is provided with conventional lock pins. Further, it is to be noted that the new lock pins 200 can also be applied in cylinder locks that are not provided with the new bridge 26 with the new drill protection according to the present invention.

[0036] The new anti-lockpicking lock pin 200, of which, as mentioned, an example is shown in Figures 10 and 11, has in the most general terms a shank 206 and head 208 which is broadened with respect to the shank 206 and which forms a second lock pin end 204. Further, the lock pin 200 is provided with at least one loose ring 210, 210', 210" which extends around the shank 206 with play. Further, the new lock pin 200 has a retaining ring 212 which is fixedly connected with the shank 206 and which forms a first lock pin end 202.

[0037] The loose rings 210, 210', 210" make lock picking virtually impossible, presumably because the fixing of such a ring 210, 210', 210" during lock picking does not yet lead to the axial fixation of the shank 206 and the head 208, connected thereto, of the lock pin 200. In any case, it appears from practical tests that the new lock pin 200 makes lock picking virtually impossible.

[0038] In the example of Figure 2 there are shown, viewed from left to right, lock pins 200 with, respectively, two, one, three, and one loose ring or rings 210, 210', 210".

[0039] In an embodiment, of which an example is shown in Figures 10 and 11, the shank 206 may be provided, near the first lock pin end 202, with a reduced cylindrical part 206' whose length Lj substantially corresponds to the height H1 of the retaining ring 212. In the first end 202, a central axial central bore 214 may be provided. The retaining ring 212 may be provided with a central bore 216 in which the reduced cylindrical part 206' is fittingly received. An end of the central bore 216 of the retaining ring 212 that is remote from the head 208 may be provided with a chamfer 218. After the loose rings 210, 210', 210" have been placed on the shank 206, and the retaining ring 212 has been placed on the reduced part 206' of the shank 206, the free end of the reduced cylindrical part 206' can be widened by plastic deformation, so that the widened part 220 thereof is received in the chamfer 218.

[0040] Thus, in a simple and efficient manner, an undetachable connection between the shank 206 and the retaining ring 212 is effected, whereby the loose rings are also placed undetachably, but with play, on the shank 206.

[0041] In an embodiment, of which an example is shown in the figures, lock pin 200, depending on the desired length, may be provided with one to six loose rings 210, 210', 210", while the length Ls of the non-reduced part of the shank 206 is somewhat greater than the sum of the heights H2 of the loose rings 210, 210', 210" placed on the shank 206, so that the loose rings 210, 210', 210" are arranged on the shank 206 with some play.

[0042] The presence of play is important to obtain the desired effect, viz., efficiently preventing lock picking.

[0043] As stated, the new lock pins 200 can be applied to any cylinder lock 10, as long as such cylinder lock 10 comprises a lock housing 12 in which a lock cylinder 14 is included, which lock cylinder 14 in an unlocked condition is rotatable relative to the lock housing 12 about a central axis Lc. Further, the cylinder lock should have at least one lock pin 200 with a first lock pin end 202 and a second lock pin end 204. Each lock pin 200 is then included in the lock housing 12 and is provided with an axis P extending perpendicular to the central axis Lc. The axis P of the lock pin 200 does not need to intersect the central axis Lc, crossing axes P and Lc are also possible. Further, the cylinder lock 10 should have at least one lock

pin spring 90 which engages a first lock pin end 202 of a lock pin 200 associated with that lock pin spring 90. The lock pin spring 90 pushes the associated lock pin 200 in the direction of the lock cylinder 14. The cylinder lock further features at least one cylinder pin 92 having a first cylinder pin end 94 and a second cylinder pin end 96. Each cylinder pin 92 is included in the lock cylinder 14 and is provided with an axis P' extending perpendicular to the central axis Lc. Just as already mentioned hereinbefore, the axes P' and Lc can cross or intersect each other. The first cylinder pin end 94 abuts against the second lock pin end 204 of the lock pin 200 associated with the cylinder pin 92. The at least one cylinder pin 92 is engaged in use by a key (not shown) whereby the cylinder pin 92 is moved, against spring action, away from the central axis Lc of the lock cylinder 14, such that the first cylinder pin end 94 and the second lock pin end 204 of each cylinder pin 92 and lock pin 200 are moved to a position in which these ends 94, 204 are flush with the cylindrical surface or superficies of the lock cylinder 14, so that the lock cylinder 14 is rotatable in the lock housing 12.

[0044] The invention further provides such a cylinder lock 10 provided with the lock pin 200 according to the invention.

[0045] The various embodiments described above can be applied independently of each other and be combined with each other in different ways. The reference numerals in the detailed description and the claims do not limit the description of the embodiments and the claims and serve for clarification only.

Claims

1. A cylinder lock (10) comprising:

• a first lock housing (12) having a substantially constant circumferential contour extending in an axial direction, while in the lock housing a first lock cylinder (14) is included;
• a second lock housing (16) having a substantially constant circumferential contour extending in an axial direction, in which either a second lock cylinder (18) is included or an operating knob assembly, the circumferential contour of the second lock housing (16) corresponding to the circumferential contour of the first lock housing (12), and the circumferential contours of the two lock housings (12, 16) being in line with each other;
• a carrier (20) which is provided with a carrier cam (22) and which is included between the first and the second lock housing (12, 16), wherein the carrier (20) is rotatable relative to the first and the second lock housing (12, 16) and is positionable in a first position in which the carrier cam (22) is in a recess (24) between the first and the second lock housing (12, 16) and in which moreover the carrier cam, viewed in axial direction of the lock (10), is within the circumferential contours, wherein the carrier (20) through rotation is positionable in a second position in which the carrier cam (22), viewed in axial direction, extends outside the circumferential contours;
• a bridge (26), which connects the first lock housing (12) with the second lock housing (16);
• a drill protection which is included at least in the first lock housing (12) near an axial end (12a) of the first lock housing (12), which axial end (12a) is remote from the second lock housing (16);

characterized in that

• the drill protection is implemented as a ball (28) from hardened steel, while the bridge (26), near an axial end thereof that is in a bridge bore (30) in the first lock housing (12), is provided with a chamber (32) in which the ball (28) is received.

2. The cylinder lock according to claim 1, wherein also the second lock housing (16) is provided with a drill protection, wherein the drill protection in the second lock housing (16) is implemented as a ball (34) from hardened steel, while the bridge (26), near an axial end thereof that is in a bridge bore (36) in the second lock housing (16), is provided with a chamber (38) in which the ball (34) is received.

3. The cylinder lock according to claim 1 or 2, wherein the bridge (26) comprises a substantially cylindrical central part (40) having a first diameter, wherein the central part (40) has a first and a second axial end (40a, 40b), wherein with the first axial end (40a) a first, substantially cylindrical end part (42) is connected, wherein with the second axial end (40b) a second, substantially cylindrical end part (44) is connected, wherein the substantially cylindrical central part (40) and the two end parts (42, 44) are coaxial with respect to each other and have a common axis (Lb), wherein a first plane (V), in which the axis (Lb) extends, extends in use in a vertical direction and wherein a second plane (H), in which the axis (Lb) extends, extends in use in a horizontal direction.

4. The cylinder lock according to claim 3, wherein the central part (40), on opposite sides of the center thereof, is provided with a bore (84, 86), wherein one bore (84) is associated with a threaded bore (88) in the first lock housing (12) and wherein the other bore (86) is associated with a threaded bore in the second lock housing (16), wherein the cylinder lock (10) is provided with two bolts (80, 82), wherein a first (80) of the two bolts (80, 82) extends through one bore (84) and is fastened in the threaded bore (88) in the first lock housing (12), wherein the other (82) of the

two bolts (80, 82) extends through the other bore (86) and is fastened in the threaded bore in the second lock housing (16).

5. The cylinder lock according to claim 3 or 4, wherein each end part (42, 44) has a cylindrical surface, wherein in the cylindrical surface of each end part (42, 44) a recess (46, 48) is provided having a, seen in a direction perpendicular to the first plane (V), substantially circular segment-shaped contour, wherein with each recess (46, 48) a substantially cylindrical cross pin (50, 52) is associated as well as a cross bore (54, 56) in the lock housing (12, 16) associated with the respective end part (42, 44).

6. The cylinder lock according to claim 5, wherein in each recess (46, 48) in the surface of the end part (42, 44) a central ridge (58, 60) is provided which is on the side of the recess (46, 48) proximal to the central part (40), wherein the substantially cylindrical cross pin (50, 52) is provided with a central groove (62, 64) in which in assembled condition of the cylinder lock (10) the central ridge (58, 60) is received.

7. The cylinder lock according to any one of claims 3-6 in combination with claim 2, wherein each end part (42, 44) includes a said chamber (32, 38) for receiving a said ball (28, 34).

8. The cylinder lock according to claim 5 or 6, wherein each end part (42, 44) includes a said chamber (32, 38) for receiving a said ball (28, 34), wherein the chamber (32, 38) in a said end part (42, 44) is under the recess (46, 48) in the cylindrical surface of said end part (42, 44).

9. The cylinder lock according to any one of claims 3-8, wherein each end part (42, 44) is provided with a circumferential groove (66, 68) which is associated with a clip, wherein each lock housing is provided with a clip groove in which the clip is receivable, and wherein in an assembled condition the clip is received in the clip groove in the lock housing (12, 16) and engages the circumferential groove (66, 68) in the end part (42, 44) which is received in the lock housing (12, 16).

10. The cylinder lock according to any one of claims 3-9, wherein the central part (40) is provided with a central bore (78) which extends perpendicular to the first plane (V) and which is threaded.

11. A lock pin (200) suitable and intended for a cylinder lock (10), the cylinder lock comprising:

- a lock housing (12);
- a lock cylinder (14) which is included in the lock housing (12) and in an unlocked condition is rotatable relative to the lock housing (12) around a central axis (Lc);
- at least one lock pin (200) having a first lock pin end (202) and a second lock pin end (204), wherein each lock pin (200) is included in the lock housing (12) and is provided with an axis (P) which extends perpendicular to the central axis (Lc);
- at least one lock pin spring (90) which engages a first lock pin end (202) of a lock pin (200) associated with that lock pin spring (90), which lock pin spring (90) pushes the associated lock pin (200) in the direction of the lock cylinder (14);
- at least one cylinder pin (92) having a first cylinder pin end (94) and a second cylinder pin end (96), wherein each cylinder pin (92) is included in the lock cylinder (14) and is provided with an axis (P') which extends perpendicular to the central axis (Lc), wherein the first cylinder pin end (94) abuts against the second lock pin end (204) of the lock pin (200) associated with the cylinder pin (92), wherein the at least one cylinder pin in use is engaged by a key, whereby the cylinder pin (92) is moved, against spring action, away from the central axis (Lc) of the lock cylinder (14), such that the first cylinder pin end (94) and the second lock pin end (204) of each cylinder pin (92) and lock pin (200) are moved to a position in which they are flush with the cylindrical surface of the lock cylinder (14), so that the lock cylinder (14) is rotatable in the lock housing (12);

characterized in that at least one lock pin (200) comprises:

- a shank (206);
- a head (208) which is broadened with respect to the shank (206) and which forms the second lock pin end (204);
- at least one loose ring (210, 210', 210") which extends around the shank (206) with play;
- a retaining ring (212) which is fixedly connected with the shank (206) and forms the first lock pin end (202).

12. The lock pin according to claim 11, wherein the shank (206) near the first lock pin end (202) is provided with a reduced cylindrical part (206') whose length substantially corresponds to the height of the retaining ring (212), wherein in the first end (202) a central axial central bore (214) is provided, wherein the retaining ring (212) is provided with a central bore (216) in which the reduced cylindrical part (206') is fittingly received, wherein an end of the central bore (216) of the retaining ring (212) that is remote from the head (208) is provided with a chamfer (218), and wherein the free end of the reduced cylindrical part (206') is widened by plastic deformation, so that the widened part (220) thereof is received in the chamfer (218).

13. The lock pin according to claim 11 or 12, wherein the lock pin (200), depending on the desired length, is provided with one to six loose rings (210, 210', 210"), while the length of the non-reduced part (206") of the shank (206) is somewhat greater than the sum of the heights of the loose rings (210, 210', 210") placed on the shank, so that the loose rings (210, 210', 210") are arranged on the shank (206) with some play.

14. A cylinder lock (10) comprising:

- a lock housing (12);
- a lock cylinder (14) which is included in the lock housing (12) and in an unlocked condition is rotatable relative to the lock housing (12) around a central axis (Lc);
- at least one lock pin (200) according to claim 11 or 12;
- at least one lock pin spring (90) which engages a first lock pin end (202) of a lock pin (200) associated with that lock pin spring (90), which lock pin spring (90) pushes the associated lock pin (200) in the direction of the lock cylinder (14);
- at least one cylinder pin (92) having a first cylinder pin end (94) and a second cylinder pin end (96), wherein each cylinder pin (92) is included in the lock cylinder (14) and is provided with an axis (P') which extends perpendicular to the central axis (Lc), wherein the first cylinder pin end (94) abuts against the second lock pin end (204) of the lock pin (200) associated with the cylinder pin (92), wherein the at least one cylinder pin in use is engaged by a key, whereby the cylinder pin (92) is moved, against spring action, away from the central axis (Lc) of the lock cylinder (14), such that the first cylinder pin end (94) and the second lock pin end (204) of each cylinder pin (92) and lock pin (200) are moved to a position in which they are flush with the cylindrical surface of the lock cylinder (14), so that the lock cylinder (14) is rotatable in the lock housing (12).

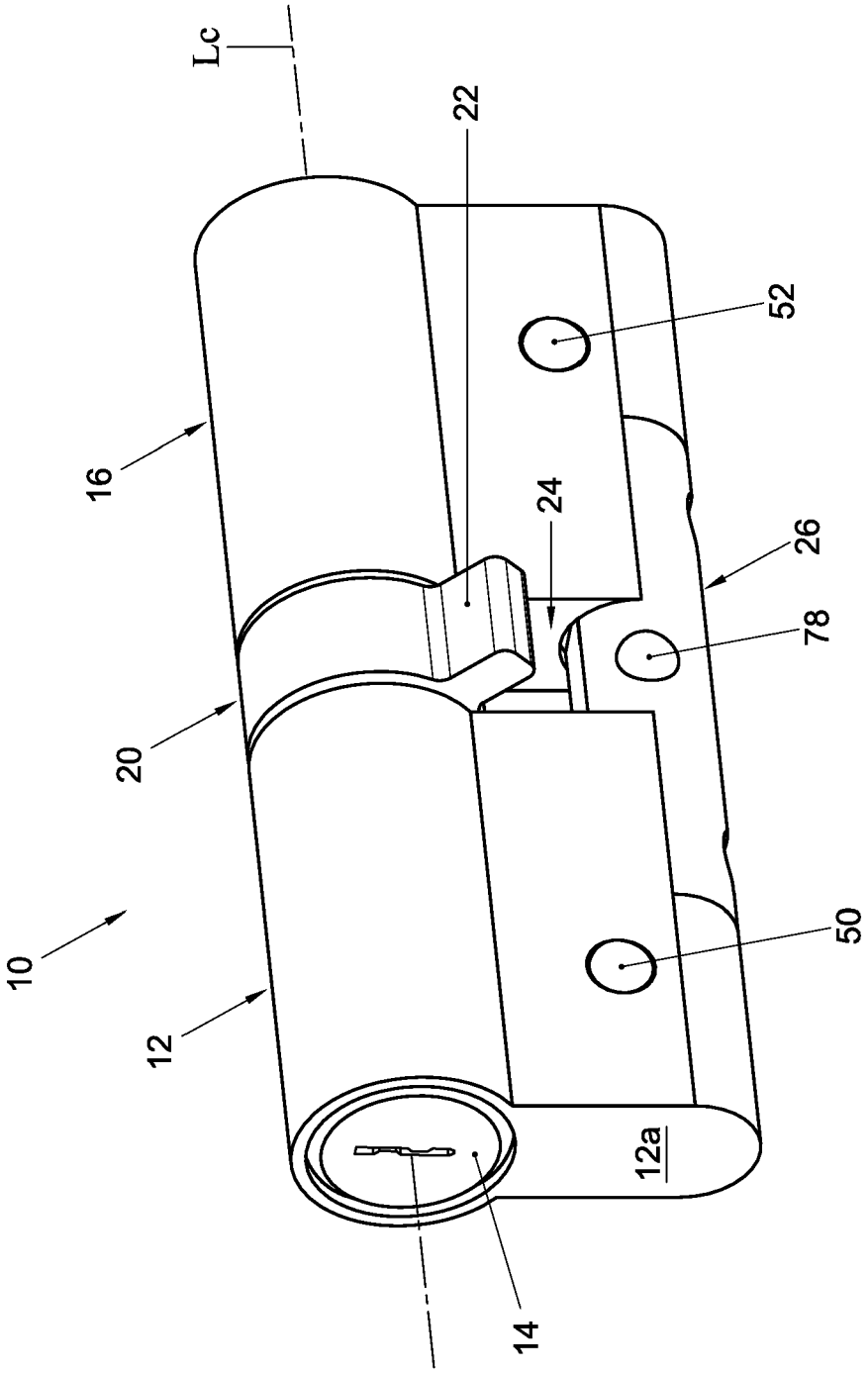

FIG. 1

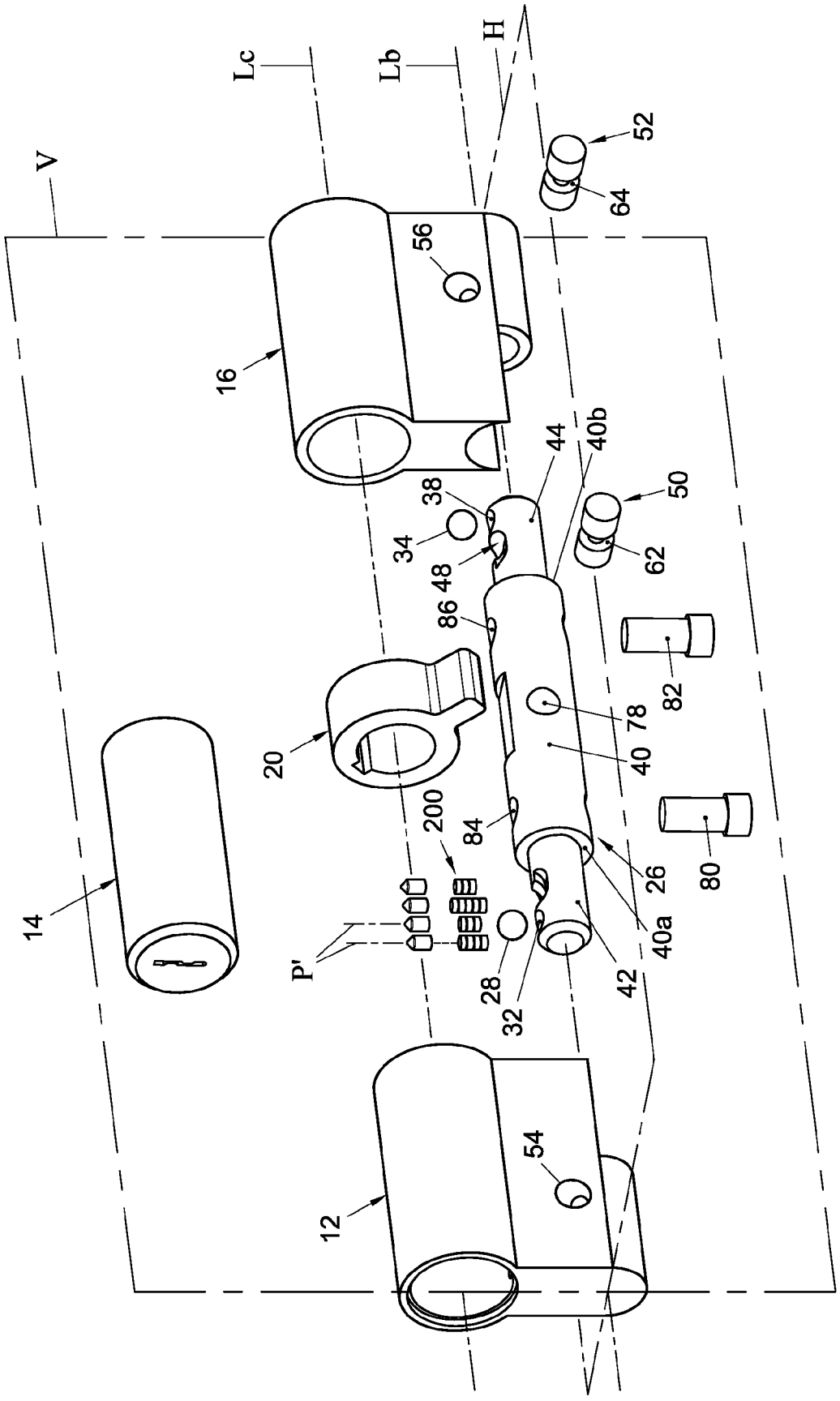
Lc
Lb
H
V
52
64
56
16
44
40b
50
38
34
48
62
86
82
78
40
20
200
84
26
80
14
40a
P'
28
32
42
54
12

FIG. 2

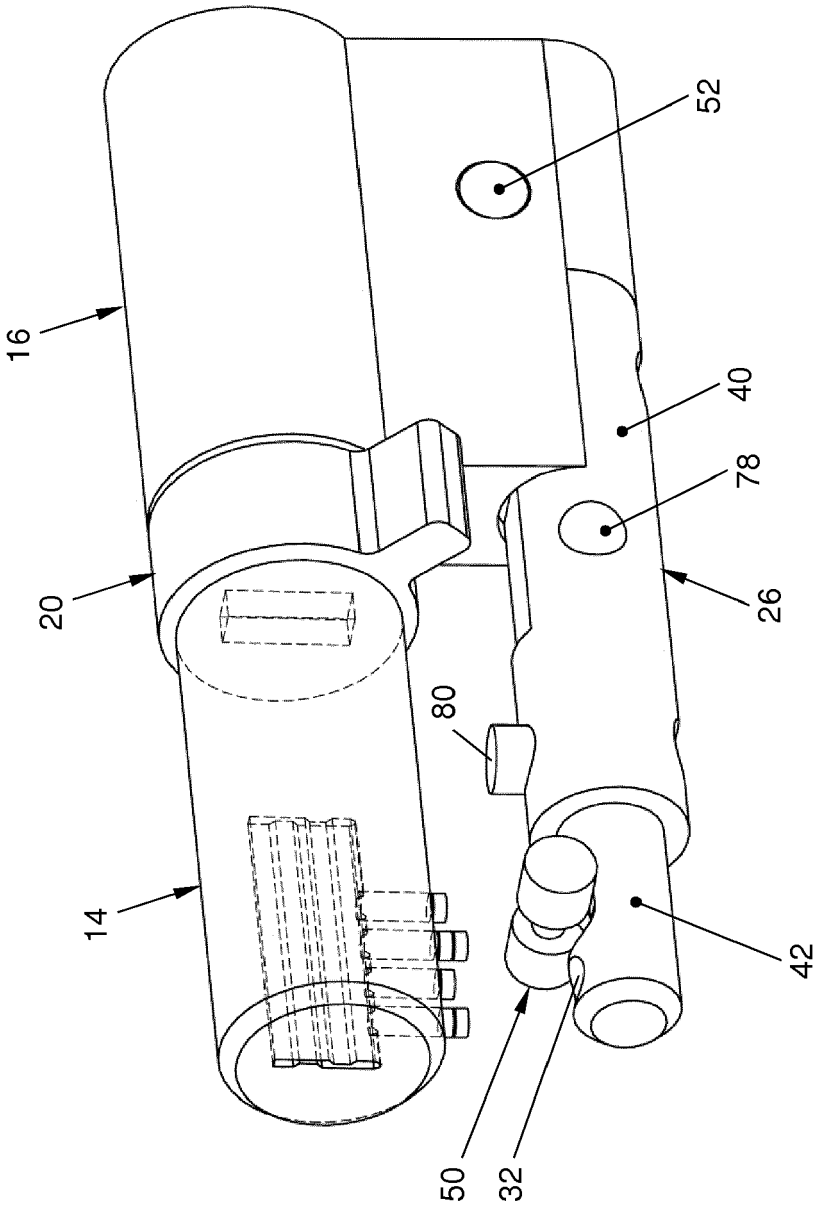

FIG. 3

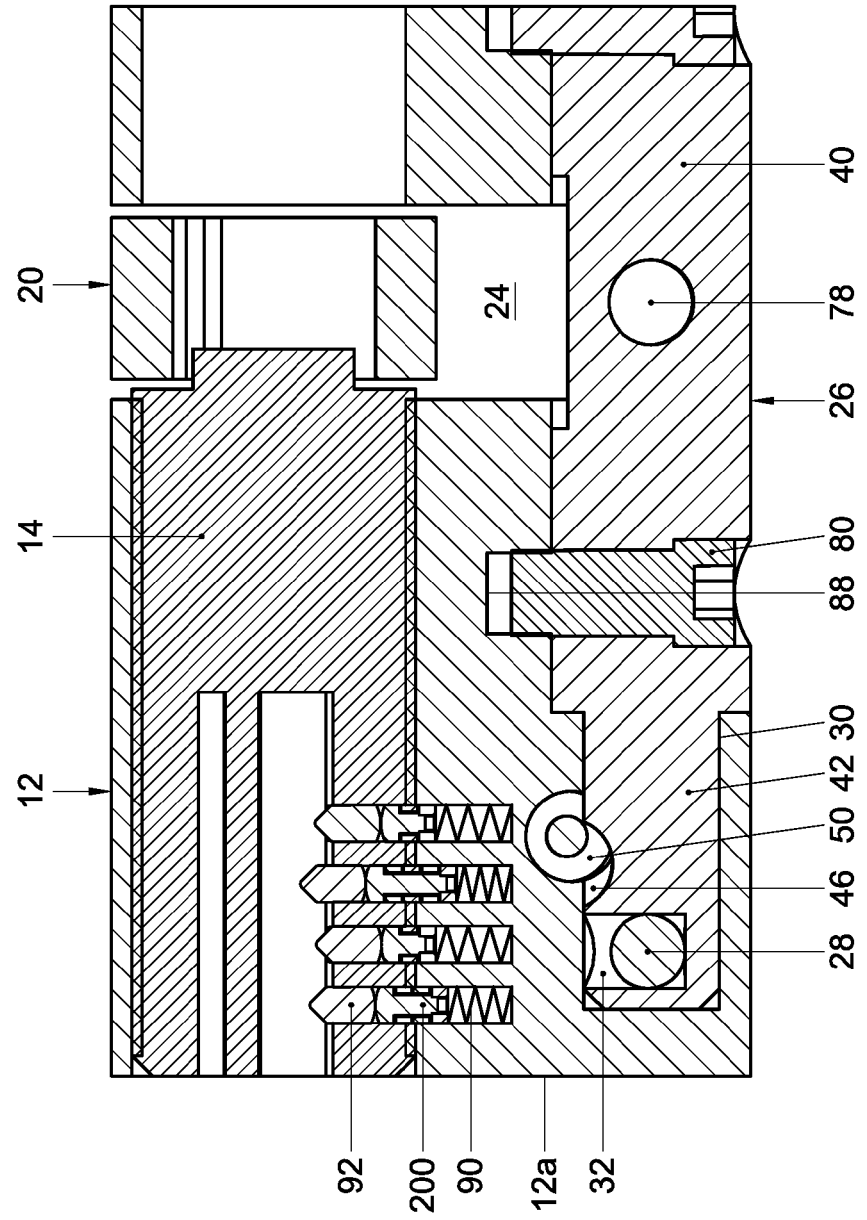
20
14
12
24
40
78
26
80
88
30
42
50
46
28
92
200
90
12a
32

FIG. 5

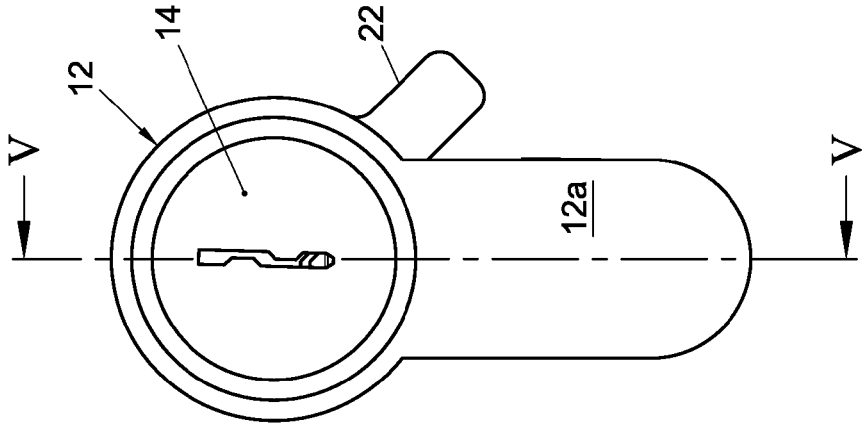
V
12
14
22
12a
V

FIG. 4

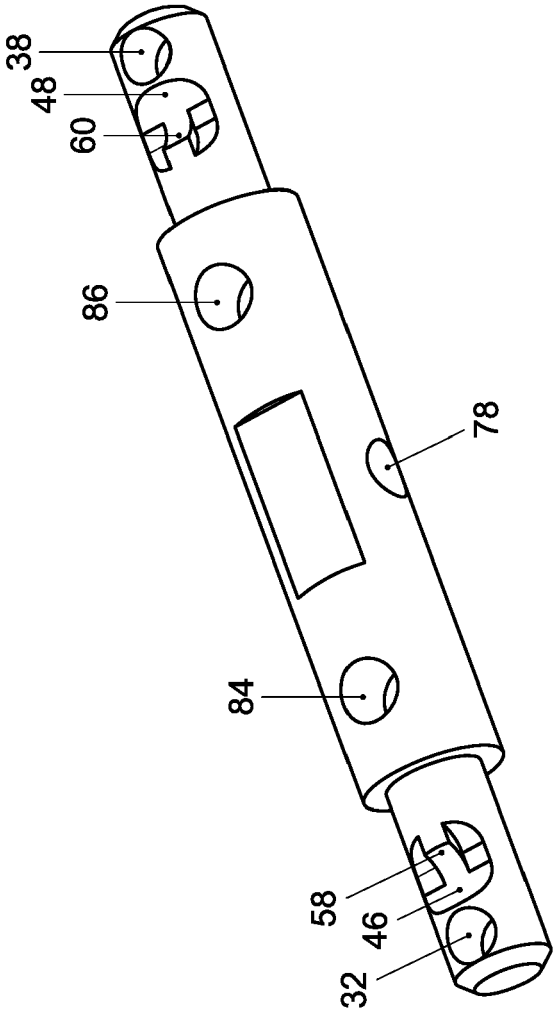

FIG. 6

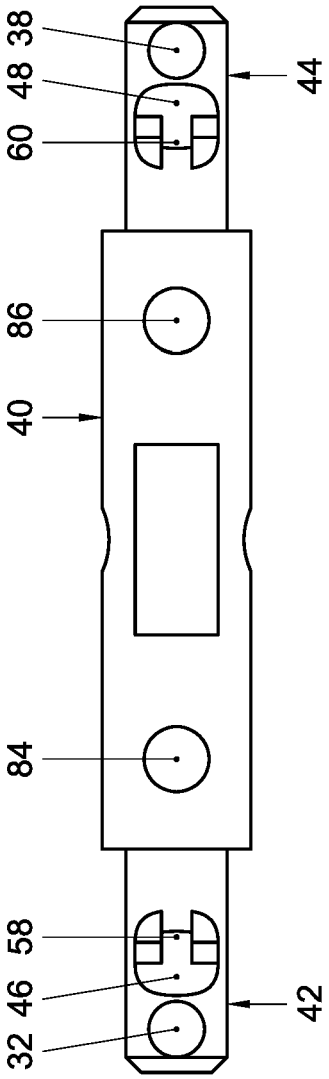

FIG. 7

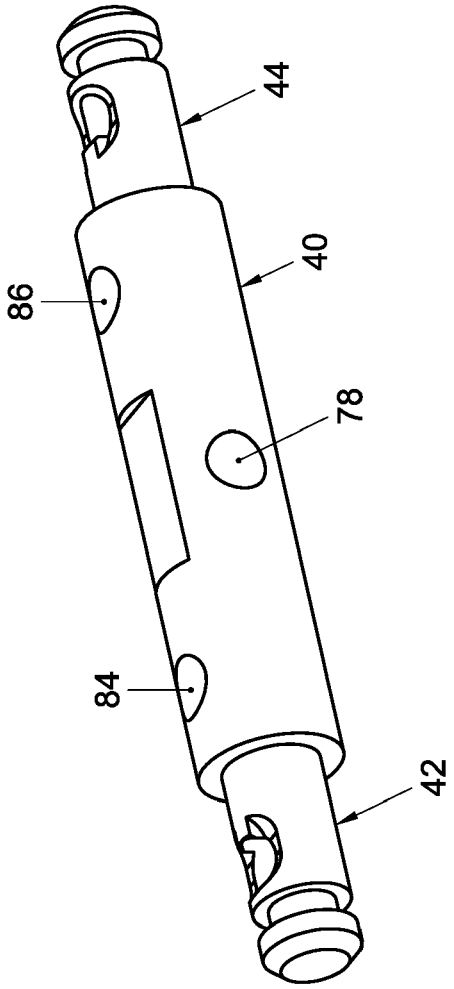

FIG. 8

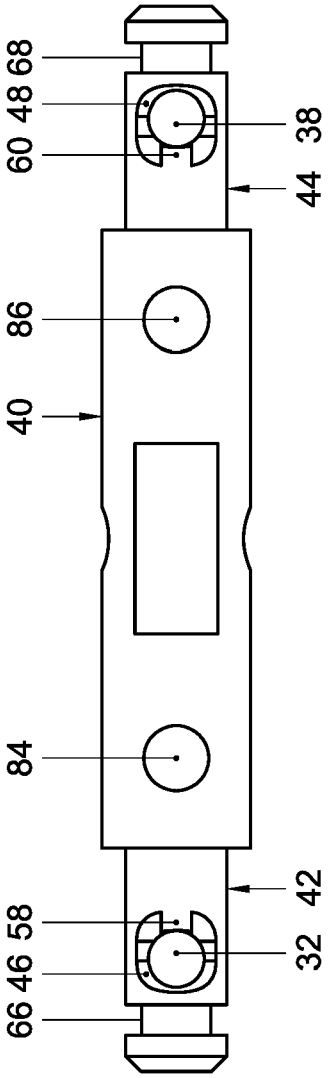

FIG. 9

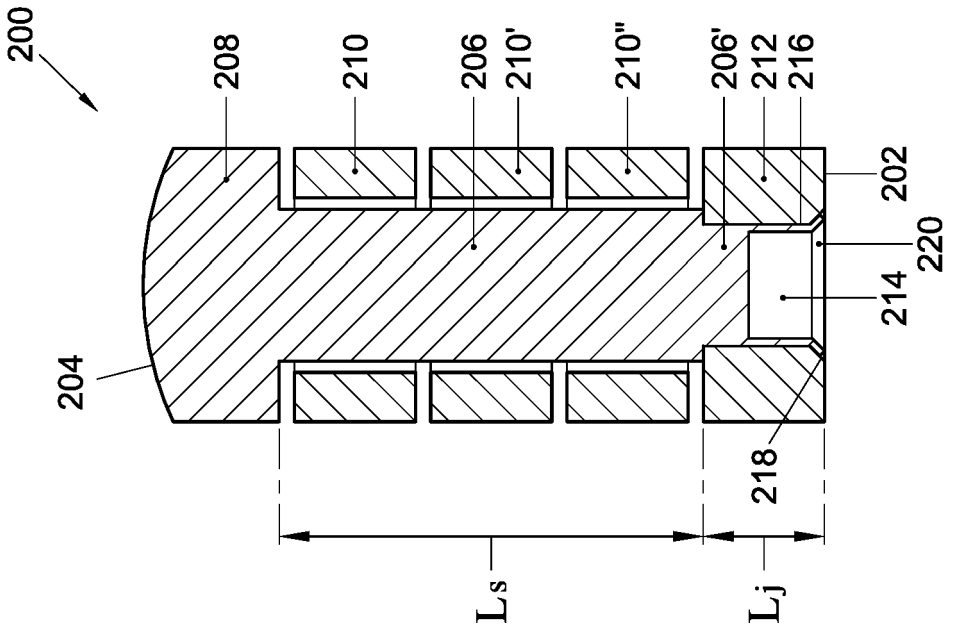
200
208
210
206
210'
210"
206'
212
216
202
220
214
204
218
L_s
L_j

FIG. 11

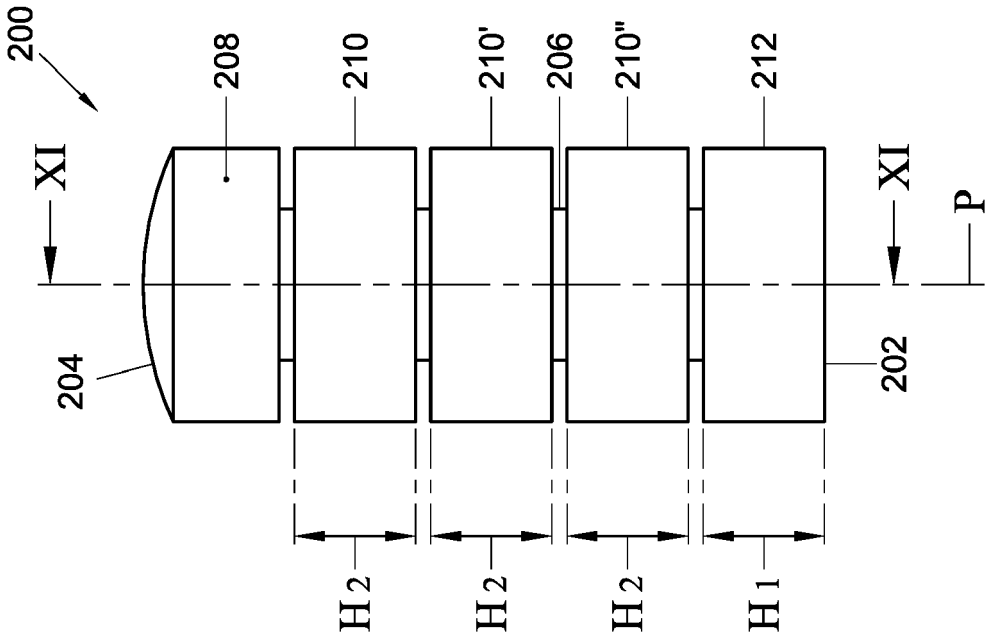
200
208
210
210'
206
210"
212
XI
XI
P
204
202
H_2
H_2
H_2
H_1

FIG. 10

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EUROPEAN SEARCH REPORT

Application Number
EP 15 19 1341

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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A	WO 2011/051703 A2 (AVOCET HARDWARE LTD [GB]; ROGERS JOHN [GB]; MIDDLEBROOK ANDREW [GB]; G) 5 May 2011 (2011-05-05) * figure 1 *	1-10	
A	DE 10 2004 051163 A1 (SCHLIESANLAGEN GMBH PFAFFENHAI [DE]) 27 April 2006 (2006-04-27) * figure 1a *	1-10	TECHNICAL FIELDS SEARCHED (IPC) E05B
X	DE 11 22 866 B (VOSS KG J) 25 January 1962 (1962-01-25) * the whole document *	11-14	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	17 May 2016	Cruyplant, Lieve

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
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T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

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Application Number
EP 15 19 1341

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

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LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 15 19 1341

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-10

A ball made of hardened steel in a chamber in the bridge between a first and second lock housing of a cylinder lock, for drill protection.

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2. claims: 11-14

A lock pin with a head, a shank, at least one loose ring around the shank and a retaining ring fixed to the shank, for making lock picking more difficult.

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 15 19 1341

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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17-05-2016

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REFERENCES CITED IN THE DESCRIPTION

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- WO 2006042753 A1 **[0031]**