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(54) **Lock and key blade**

(57) The present invention relates to a rotary lock cylinder comprising

- a) a cylinder housing for hosting a cylinder core,
- b) a cylinder core mounted in said cylinder housing and being able to rotate in said cylinder housing to provide a shear line between said cylinder core and said cylinder housing, wherein said cylinder core has two sets of pin channels, referred to as the third set of pin channels and the fourth set of pin channels,
- c) a first set of locking pins guided in said third pin channels,
- d) a second set of locking pins guided in said fourth pin channels,

- e) a key channel extending in a longitudinal direction of said cylinder core for insertion of a key blade, which co-operates with said first set of locking pins and said second set of locking pins in said cylinder core,
- f) a longitudinal side bar accommodated in an aperture in said cylinder core which side bar co-acts with said second set of locking pins so that positioning of said second set of locking pins with a correct shaped key blade allows said side bar to clear the shear line, characterized in that said first set of locking pins and said second set of locking pins are arranged in an acute angle.

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Description

FIELD OF THE INVENTION

[0001] The present invention relates generally to a lock and key system of the rotary cylinder type. More particularly, the lock cylinder is of the kind comprising a cylinder housing, a cylinder core rotationally mounted in the housing to provide a shear line between the housing and the core, wherein said cylinder core has a set of pin channels guiding a set of locking pins, a key slot extending into the core parallel to the rotational axis thereof for insertion of a key blade, which cooperates with the set of locking pins in the cylinder core, and a longitudinal side bar accommodated in an aperture in the cylinder core which side bar co-acts with a second set of locking pins so that positioning of the second set of locking pins with a correct shaped key blade allows said side bar to clear the shear line. The present invention also concerns a key blade, a locking pin and a side bar.

BACKGROUND OF THE INVENTION

[0002] The lock and key system of the rotary cylinder type has been known for many years, and various forms thereof have been described, such as a lock known from e.g. US 3,499,302 (to be incorporated herein by reference) (and a corresponding U.S. Pat. No. 30198--Oliver et al), the known lock including a row of cylindrical locking pins having chisel shaped lower end portions which co-operate with skew cuts in the upper edge of a key blade inserted into the key plug so as to correctly position each locking pin and to release the lock. Thus, to release the lock, each locking pin has to be positioned into a specific rotational and elevational position which allows the fence member to clear the shear line.

[0003] Another lock cylinder is known from US 4,756,177 (to be incorporated herein by reference) which is of the kind comprising a cylinder shell, a key plug rotationally mounted in the shell to provide a shear line between the shell and the key plug, a key slot extending into the key plug parallel to the rotational axis thereof for receiving a key blade, at least one locking tumbler including an elongated body portion guided in a complementary transverse cavity in the key plug, the elongated body portion being capable of rotational movement about its longitudinal axis, and a fence member blockingly associated with the locking tumbler and shaped so that rotational positioning of said locking tumbler with a properly shaped key blade allows the fence member to clear the shear line.

Summary of the invention

[0004] The object of the present invention is to further develop such a lock and key combination, comprising a new locking mechanism to be used instead of the known mechanism such as those discussed above.

[0005] The lock cylinder of the present invention obtain

a sufficiently high number of code combinations by using elevationally movable locking pins while at the same time providing a more simple solution; secure a very high resistance against picking methods and making key impressions for obtaining a false key; keep down the space requirements of the key blade and the key slot while maintaining a sufficiently high number of code combinations; enable leaving major portions of the key blade free for conventional key profile grooves and code patterns; permit the use of two different locking mechanisms, whereby the resistance against unauthorized manipulation will be high and the total number of code combinations virtually unlimited; avoid the use of several different key ways in a lock system by replacing such different key ways with a new locking mechanism.

[0006] To achieve these aims, the lock cylinder according to the invention is characterized in that in addition to the first set of locking pins, a second set of locking pins are arranged inside the cylinder core in an acute angle to the first set of locking pins when looking at the lock cylinder from the key slot side. The acute angle is formed between two imaginary lines x and y as illustrated in figure 2. Typically, the acute angle (α) is from 5° to 45°, such as 10° to 30°, typically 12° to 18°, e.g. about 15°.

[0007] Thus, in a broad aspect, the present invention relates to a rotary lock cylinder comprising

- a) a cylinder housing for hosting a cylinder core,
- b) a cylinder core mounted in said cylinder housing and being able to rotate in said cylinder housing to provide a shear line between said cylinder core and said cylinder housing, wherein said cylinder core has two sets of pin channels, referred to as the third set of pin channels and the fourth set of pin channels,
- c) a first set of locking pins guided in said third pin channels,
- d) a second set of locking pins guided in said fourth pin channels,
- e) a key channel extending in a longitudinal direction of said cylinder core for insertion of a key blade, which cooperates with said first set of locking pins and said second set of locking pins in said cylinder core,
- f) a longitudinal side bar accommodated in an aperture in said cylinder core which side bar co-acts with said second set of locking pins so that positioning of said second set of locking pins with a correct shaped key blade allows said side bar to clear the shear line, characterized in that said first set of locking pins and said second set of locking pins are arranged in an acute angle.

[0008] In another aspect the present invention relates to a key blade for use in combination with a lock cylinder as defined above or as in any one of embodiments 1-23 from list of embodiments, comprising an elongated, optionally wave-like, longitudinally extending code pattern at the upper edge for urging the first set of locking pins

upwards to a position where the shear line is clear and another elongated wave-like longitudinally extending code pattern at the lower edge for urging the second set of locking pins upwards in the fourth set of pin channels so that positioning of said second set of locking pins with a correct shaped key blade allows a longitudinal side bar accommodated in an aperture in said cylinder core to co-act with said second set of locking pins and clear the shear line.

[0009] In a further aspect the present invention relates to a locking pin member for use in the set of the second locking pins in combination with a lock cylinder as defined above or as in any one of embodiments 1-23 from list of embodiments, comprising an end portion, a first cylinder portion, a second cylinder portion, a third cylinder portion, and a top portion, wherein the first cylinder portion has a reduced diameter compared to the second cylinder portion, and the third cylinder portion has a reduced diameter compared to the second cylinder portion, wherein the end portion is urged by a correct shaped key, thereby allowing movement of the locking pin member to a position where the side bar co-acts with the locking pin member.

[0010] In a still further aspect the present invention relates to a side bar for use in an aperture in the cylinder core being a part of the lock cylinder as defined above or as in any one of embodiments 1-23 from list of embodiments, comprising a longitudinal portion having channels at each end of the longitudinal portion for positioning of spring means and cam portions for engaging with the second set of locking pins.

[0011] Further suitable features of the lock according to the invention are stated in the claims as well as in the list of embodiments herein below.

[0012] Moreover, the invention concerns specific parts of the lock, i.e. a locking tumbler and a fence member.

DESCRIPTION OF THE INVENTION

[0013] In one aspect the present invention relates to a rotary lock cylinder comprising

- a) a cylinder housing for hosting a cylinder core,
- b) a cylinder core mounted in said cylinder housing and being able to rotate in said cylinder housing to provide a shear line between said cylinder core and said cylinder housing, wherein said cylinder core has two sets of pin channels, referred to as the third set of pin channels and the fourth set of pin channels,
- c) a first set of locking pins guided in said third pin channels,
- d) a second set of locking pins guided in said fourth pin channels,
- e) a key channel extending in a longitudinal direction of said cylinder core for insertion of a key blade, which cooperates with said first set of locking pins and said second set of locking pins in said cylinder core,

f) a longitudinal side bar accommodated in an aperture in said cylinder core which side bar co-acts with said second set of locking pins so that positioning of said second set of locking pins with a correct shaped key blade allows said side bar to clear the shear line, characterized in that said first set of locking pins and said second set of locking pins are arranged in an acute angle.

[0014] In a second aspect the present invention relates to a lock cylinder comprising

- a) a cylinder housing for hosting a cylinder core wherein said cylinder housing has a first set of pin channels, and optionally, a second set of pin channels,
- b) a cylinder core mounted in said cylinder housing and being able to rotate in said cylinder housing to provide a shear line between said cylinder core and said cylinder housing, wherein said cylinder core has a third set of pin channels and a fourth set of pin channels,
- c) a first set of locking pins guided in said third pin channels,
- d) a second set of locking pins guided in said fourth pin channels,
- e) optionally, a stop bar means guided in a stop bar aperture in said cylinder core located above said fourth pin channels and blocking the second set of locking pins from leaving the cylinder core when a suitably shaped key blade is inserted into the key slot,
- f) a key channel extending in a longitudinal direction of said cylinder core for insertion of a key blade, which cooperates with said first set of locking pins and said second set of locking pins in said cylinder core,
- g) a longitudinal side bar accommodated in an aperture in said cylinder core which side bar co-acts with said second set of locking pins so that positioning of said second set of locking pins with a correct shaped key blade allows said side bar to clear the shear line, characterized in that said first set of locking pins and said second set of locking pins are arranged in an acute angle.

[0015] Such acute angle as described herein is formed between an imaginary line through the center of the first set of locking pins and another imaginary line through the center of the second set of locking pins, when the lock cylinder is viewed in cross section from the front or back of the lock cylinder, e.g. the front, as shown in figure 2.

[0016] In one embodiment the acute angle is from 1° to 89°, such as 5° to 45°, preferably 10° to 30°, and typically 12° to 18°, e.g. about 15°. In a further embodiment the acute angle is the angle formed between the imaginary lines x and y as illustrated in figure 2.

[0017] The first and optionally second set of pin channels of the cylinder housing are typically cylindrical in shape and are formed so as to contain and guide the various parts of the lock cylinder, such as upper pins, spheres, and spring means, e.g. metal springs. The reference to the term "pins" in pin channels is not intended to mean that for instance the locking pins are guided in these channels, however, in a preferred embodiment the cylinder housing has locking means having a thread so as to enable changing of the various parts contained in the pin channels, such as the set of locking pins.

[0018] The cylinder core has two sets of pin channels and in order to separate the terms and distinguish between the channels of the core and the housing of the cylinder such pin channels are herein referred to as the third and fourth set of pin channels even though said core only has two separate sets of channels for guiding the locking pins. This does not exclude the situation wherein a further pin channel is present in said cylinder core and wherein a further locking pin is present in said channel.

[0019] In one embodiment the lock cylinder the cylinder housing has the first set of pin channels, but not the second set of pin channels. When the cylinder housing does not have the second set of pin channels the locking pins of the cylinder core are contained inside the core and are urged downwards by spring means. Typically, the cylinder core has a stop bar means guided in a stop bar aperture in said cylinder core located above said fourth set of pin channels and blocking the second set of locking pins from leaving the cylinder core when a suitably shaped key blade is inserted into the key slot. As stated the stop bar is not mandatory for the functioning of the lock cylinder, however provides a system of easy changing of the locking pins or spring means when this is considered necessary, for instance because of attempt of breaking an entrance, or because the spring means are not functioning properly.

[0020] In a further embodiment the first set of pin channels is guiding a set of upper pins which are urged downwards by a set of spring means. The upper pins push the first set of locking pins in the third pin channels and keep them contained in the cylinder core when the a proper key blade is inserted in the key slot. The first set of pin channels of the cylinder housing may be blocked at the end leaving it difficult to exchange or change any of the parts comprised in the first set of pin channels. Such blocking may be permanent by a stopper, such as plugs or fillings, or alternatively the cylinder housing as produced with a first set of pin channels that only extend partly through the cylinder housing. Typically, the first set of pin channels extend all the way through the cylinder housing, and further comprises a set of locking means at the end of the first set of pin channels, thereby blocking the spring means and upper pins from leaving the cylinder housing. Preferably, when such the set of locking means are present, the set of locking means is selected from stoppers with a thread. This is apparently not very common in the industry of producing lock cylinders, however,

in the present invention such thread in the locking means creates a easy exchange system where any part contained in the lock cylinder may be changed or exchanged as needed.

[0021] In a further embodiment the first set of locking pins are of equal length or of different length. Typically, the first set of locking pins is of different length. In a further embodiment, the first set of locking pins is of different length wherein the first locking pin is the shortest. In another embodiment, the first set of locking pins is of different length wherein the last locking pin is the shortest. Preferably, the first set of locking pins consists of a row of 4-8, such as 5-7, e.g. 6, locking pins. In another embodiment an additional set of locking pins are present, which locking pins form another acute angle with the first set of locking pins. Such additional set of locking pins are also referred to as the third set of locking pins, which third set of locking pins are guided in a further set of pin channels in the cylinder core and wherein a second longitudinal side bar is accommodated in a second aperture in said cylinder core which side bar co-acts with said third set of locking pins so that positioning of said third set of locking pins with a correct shaped key blade allows said side bar to clear the shear line. In this embodiment the additional set of locking pins typically consists of a row of 1-5, such as 2-3, e.g. 3 locking pins, and correspondingly the second set of locking pins will also typically consist of a row of 1-5, such as 2-3, e.g. 3 locking pins. In this respect the acute angle formed may be the same as the acute angle formed between the first set of locking pins and the second set of locking pins, or the angle may be different and such angle or angles are in further embodiments selected from 1° to 89°, such as 5° to 45°, preferably 10° to 30°, and typically 12° to 18°, e.g. about 15°.

[0022] In a further embodiment the cylinder housing has a second set of pin channels. Thus, the cylinder housing have two sets of channels for guiding the necessary parts of such lock cylinder, such as parts selected from any one of locking means, springs means, upper pin means, or spheres. The second set of pin channels have a similar function as the first set of pin channels, and creates the possibility of changing or exchanging the various parts comprised in the pin channels as with the first set of pin channels as described above. In an embodiment the second set of pin channels is guiding a set of spheres which are urged downwards by a set of spring means. Typically, there are 1, 2 or three spheres present, and preferred is two spheres in each channel of the second set of pin channels. As with the set of first pin channels the second set of pin channels of the cylinder housing may be blocked at the end leaving it difficult to exchange or change any of the parts comprised in the second set of pin channels. Such blocking may be permanent by a stopper, such as plugs or fillings, or alternatively the cylinder housing as produced with a second set of pin channels that only extend partly through the cylinder housing. Typically, the second set of pin channels extend

all the way through the cylinder housing, and further comprises a set of locking means at the end of the second set of pin channels, thereby blocking the spring means and spheres from leaving the cylinder housing. Preferably, when such the set of locking means are present, the set of locking means is selected from stoppers with a thread. As explained above this is apparently not very common in the industry of producing lock cylinders, and further in the present invention, such thread in the locking means of the second pin channels creates a easy exchange system where any part contained in the lock cylinder may be changed or exchanged as needed.

[0023] Typically, when the cylinder housing only has the first set of pin channels, but not the second set of pin channels, the second set of locking pins guided in said fourth set of pin channels (of the cylinder core) is urged downwards by a set of spring means, such as metal springs. In this situation each of the locking pins have a slot in the top part extending partly through the inner of the locking pin so as to maintain a spring in position, wherein each spring urges the locking pin downwards.

[0024] In a further embodiment the second set of locking pins are of equal length or of different length. Typically, the second set of locking pins is of different length. In a further embodiment, the second set of locking pins is of different length wherein the first locking pin is the shortest. In another embodiment, the second set of locking pins is of different length wherein the last locking pin is the shortest. Preferably, the second set of locking pins consists of a row of 3-8, such as 4-6, e.g. 5, locking pins.

[0025] In a further aspect the present invention relates to a key blade for use in combination with a lock cylinder having

- a) a cylinder housing for hosting a cylinder core wherein said cylinder housing has a first set of pin channels, and optionally, a second set of pin channels,
- b) a cylinder core mounted in said cylinder housing and being able to rotate in said cylinder housing to provide a shear line between said cylinder core and said cylinder housing, wherein said cylinder core has a third set of pin channels and a fourth set of pin channels,
- c) a first set of locking pins guided in said third pin channels,
- d) a second set of locking pins guided in said fourth pin channels,
- e) optionally, a stop bar means guided in a stop bar aperture in said cylinder core located above said fourth pin channels and blocking the second set of locking pins from leaving the cylinder core when a suitably shaped key blade is inserted into the key slot,
- f) a key channel extending in a longitudinal direction of said cylinder core for insertion of a key blade, which cooperates with said first set of locking pins and said second set of locking pins in said cylinder

core,

g) a longitudinal side bar accommodated in an aperture in said cylinder core which side bar co-acts with said second set of locking pins so that positioning of said second set of locking pins with a correct shaped key blade allows said side bar to clear the shear line, wherein the first set of locking pins and the second set of locking pins are arranged in an acute angle,

comprising an elongated, optionally wave-like, longitudinally extending code pattern at the upper edge for urging the first set of locking pins upwards to a position where the shear line is clear and another elongated wave-like longitudinally extending code pattern at the lower edge for urging the second set of locking pins upwards in the fourth set of pin channels so that positioning of said second set of locking pins with a correct shaped key blade allows a longitudinal side bar accommodated in an aperture in said cylinder core to co-act with said second set of locking pins and clear the shear line.

[0026] It should be understood that any one of the above features as explained above in relation to the lock cylinder also applies to the key blade of the present invention, and that each of these features may constitute embodiments of the key blade of the invention either individually or in combination, for instance as defined in the set of claims.

[0027] In a further aspect the present invention relates to a locking pin member for use in the set of the second locking pins in combination with a lock cylinder having

- a) a cylinder housing for hosting a cylinder core wherein said cylinder housing has a first set of pin channels, and optionally, a second set of pin channels,
- b) a cylinder core mounted in said cylinder housing and being able to rotate in said cylinder housing to provide a shear line between said cylinder core and said cylinder housing, wherein said cylinder core has a third set of pin channels and a fourth set of pin channels,
- c) a first set of locking pins guided in said third pin channels,
- d) a second set of locking pins guided in said fourth pin channels,
- e) optionally, a stop bar means guided in a stop bar aperture in said cylinder core located above said fourth pin channels and blocking the second set of locking pins from leaving the cylinder core when a suitably shaped key blade is inserted into the key slot,
- f) a key channel extending in a longitudinal direction of said cylinder core for insertion of a key blade, which cooperates with said first set of locking pins and said second set of locking pins in said cylinder core,

g) a longitudinal side bar accommodated in an aperture in said cylinder core which side bar co-acts with said second set of locking pins so that positioning of said second set of locking pins with a correct shaped key blade allows said side bar to clear the shear line, wherein the first set of locking pins and the second set of locking pins are arranged in an acute angle,

comprising an end portion, a first cylinder portion, a second cylinder portion, a third cylinder portion, and a top portion, wherein the first cylinder portion has a reduced diameter compared to the second cylinder portion, and the third cylinder portion has a reduced diameter compared to the second cylinder portion, wherein the end portion is urged by a correct shaped key, thereby allowing movement of the locking pin member to a position where the side bar co-acts with the locking pin member.

[0028] In an embodiment of the locking pin member the end portion is conical, blunt or shaped as a half sphere. Preferably, the end portion is shaped as a half sphere.

[0029] In another embodiment of the locking pin member the top portion is conical shaped. Preferably, the top portion is substantially flat at the top, thereby being able to be in contact with a sphere means.

[0030] In a further embodiment of the locking pin member the top portion has a hole extending through the top and the third cylinder portion and optionally through the second cylinder portion thereby being able to hold a spring means in position. This is particularly suitable when there is no second set of pin channels present and the fourth pin channel of the cylinder core is blocked at the end towards the outer of the cylinder core.

[0031] It should be understood that any one of the above features as explained above in relation to the lock cylinder also applies to the locking pin member of the present invention, and that each of these features may constitute embodiments of the locking pin member of the invention either individually or in combination, for instance as defined in the set of claims.

[0032] In a further aspect the present invention relates to a side bar for use in an aperture in the cylinder core being a part of the lock cylinder having

a) a cylinder housing for hosting a cylinder core wherein said cylinder housing has a first set of pin channels, and optionally, a second set of pin channels,

b) a cylinder core mounted in said cylinder housing and being able to rotate in said cylinder housing to provide a shear line between said cylinder core and said cylinder housing, wherein said cylinder core has a third set of pin channels and a fourth set of pin channels,

c) a first set of locking pins guided in said third pin channels,

d) a second set of locking pins guided in said fourth pin channels,

e) optionally, a stop bar means guided in a stop bar aperture in said cylinder core located above said fourth pin channels and blocking the second set of locking pins from leaving the cylinder core when a suitably shaped key blade is inserted into the key slot,

f) a key channel extending in a longitudinal direction of said cylinder core for insertion of a key blade, which cooperates with said first set of locking pins and said second set of locking pins in said cylinder core,

g) a longitudinal side bar accommodated in an aperture in said cylinder core which side bar co-acts with said second set of locking pins so that positioning of said second set of locking pins with a correct shaped key blade allows said side bar to clear the shear line, wherein the first set of locking pins and the second set of locking pins are arranged in an acute angle,

comprising a longitudinal portion having channels at each end of the longitudinal portion for positioning of spring means and cam portions for engaging with the second set of locking pins.

[0033] The invention will now be described more fully with reference to the appended drawings illustrating a preferred embodiment of the new lock and key combination.

FIG. 1 illustrates a lock according to the invention to be used in combination with the key blade illustrated in a perspective view as well as shown in FIG 3, a part of the lock being broken away to show the inside thereof;

FIG. 2 illustrates a lock according to the invention seen from the front with the key slot side holding a key in position, and the acute angle α which is formed between the imaginary line (x) of the third set of pin channels and the imaginary line (y) of the fourth set of pin channels;

FIG. 3 is a side view of a key blade as well as an end view of the key blade, together with a locking pin in position;

FIG. 4 is a perspective view of a side bar and the locking pin in position;

FIG. 5 is a cross section illustrating the locking pin in the position where the cylinder is locked and there is no key inserted in the key slot;

FIG. 6 is a transverse section of the cylinder core along lines A—A, B—B, C—C, and D—D, illustrated as SECTION A-A, SECTION B-B, SECTION C-C, and SECTION D-D, respectively;

FIG. 7 illustrates a lock according to the invention, wherein the cylinder housing has a second set of pin channels, to be used in combination with the key blade illustrated in a perspective view as well as

shown in FIG 8, a part of the lock being broken away to show the inside thereof;

FIG. 8 illustrates a lock according to the invention, wherein the cylinder housing has a second set of pin channels, seen from the front with the key slot side holding a key in position, and the acute angle α (α) which is formed between the imaginary line (x) of the third set of pin channels and the imaginary line (y) of the fourth set of pin channels.

FIG. 9 illustrates a transverse section of the cylinder core along lines A—A and B—B illustrated as SECTION A-A and SECTION B-B, respectively, wherein two sets of pin channels are arranged on both sides of the third set of pin channels, so as to form acute angles on both sides.

[0034] An embodiment of the lock cylinder of present invention is illustrated in figure 1, wherein a cylinder housing (10) is hosting a cylinder core (12). The cylinder housing (10) has a first set of pin channels (34), and the normal number of such channels is six as shown in figure 1, thus the individual channels may be referred to as (34a, 34b, 34c, 34d, 34e, 34f). Depending on the size of the lock cylinder such number of channels may be from 4 to 10, such as 5-7, typically 6, which fits into most standard locks in Scandinavia and even throughout Europe. The cylinder housing (10) may have a second set of pin channels (not shown) for receiving a set of locking pins (22), second pins, such as upper pins (not shown), spheres (not shown) and springs (not shown), such locking pins being guided in the fourth set of pin channels of the cylinder core (12). The cylinder core (12) is mounted in said cylinder housing (10) and being able to rotate in said cylinder housing (10) to provide a shear line (14) between said cylinder core (12) and said cylinder housing (10). The cylinder core (12) has two sets of pin channels, herein referred to as the third set of pin channels (46) (the individual pin channels may be referred to as (46a, 46b, 46c, 46d, 46e, 46f)) and the fourth set of pin channels (40).

[0035] The third set of pin channels (46) of the cylinder core (12) comprises a first set of locking pins (26) (the individual locking pins may be referred to as (26a, 26b, 26c, 26d, 26e, 26f)) guided in the third set of pin channels (46). The first set of pin channels (34) of the cylinder housing is guiding a set of upper pins (28, wherein the individual upper pins may be referred to as 28a, 28b, 28c, 28d, 28e, 28f), a set of springs (30, wherein the individual top pins may be referred to as 30a, 30b, 30c, 30d, 30e, 30f)), and a set of locking means (32, wherein the individual locking means may be referred to as 32a, 32b, 32c, 32d, 32e, 32f)), (such locking means may typically be screws or plugs, which secure the line of springs (30) and upper pins (28) and locking pins (26) in the first (34) and third pin channels (46)). The upper pins (28) are urged downwards by the springs (30). The locking means (32) typically as screw means are an advantage since it creates the possibility of easy assembling of the lock cyl-

inder as well as easy changing/exchanging of the individual parts contained in the channels of the lock cylinder. However, such locking means (32) may also simply be plugs blocking and securing the parts contained in the channels, without providing the possibility of changing/assembly.

The fourth set of pin channels (40) of the cylinder core (12) comprises a second set of locking pins (22) (the individual locking pins may be referred to as (22a, 22b, 22c, 22d, 22e)) guided in the fourth set of pin channels (40). The normal number of such pin channels (40) is five as shown in figure 1, thus the individual channels may be referred to as 40a, 40b, 40c, 40d, 40e. Depending on the size of the lock cylinder such number of channels may be from 4 to 10, such as 4-7, typically 5, which fits into most standard locks in Scandinavia and even throughout Europe. The second set of locking pins (22) have a hole in the top portion wherein a set of springs (24, wherein the individual springs may be referred to as 24a, 24b, 24c, 24d, 24e) are inserted to provide a flexible movement of the locking pins (22) in the fourth set of pin channels (40) when a suitable key is inserted in the key slot of the lock cylinder. The second set of locking pins (22) is urged downwards by the springs (24). To keep the set of springs (24) and locking pins (22) in position in the cylinder core (12) a stop bar (36) is located above said forth set of pin channels and blocking the second set of locking pins (22) from leaving the cylinder core (12) when a suitably shaped key (20) is inserted in the key slot (42). The stop bar (36) is guided in a stop bar aperture (38) in said cylinder core (12) and the stop bar (36) is typically conically shaped to fit into the conically shaped aperture (38), thereby effectively securing the set of springs and locking pins in the core (12) while at the same time providing an easy way of assembling and/or changing such pins and springs should it be considered necessary. Of course the set of springs (24) and locking pins (22) may also be held in position in the cylinder core (12) by simply blocking the set of channels (40) without leaving open the possibility of changing the inner parts, such as locking pins (22) and springs (24). The set of locking pins (22) may be of the same or different lengths, preferably the individual locking pins (22a-22e) have different length.

[0036] The cylinder core (12) has a key channel extending in a longitudinal direction of said cylinder core (12) for insertion of the key (20), which cooperates with said first set of locking pins (26) and said second set of locking pins (22) in said cylinder core (12). The sets of locking pins (22 and 26) are illustrated wherein the set of pin (22) and set of pins (26) are displaced from one another so as to make room for the channels and the various parts contained in the channels. In principle such set of locking pins may also be located in parallel so that 22a and 26a up to 22e and 26e are located directly opposite each other, and in this respect only five sets of pins are contemplated, however six or higher may also be an option.

[0037] In the side of the cylinder core (12) is provided a longitudinal side bar (16) accommodated in an aperture (44) in said cylinder core (12) which side bar (16) co-acts with said second set of locking pins (22) so that positioning of said second set of locking pins (22) with a correct shaped key (20) allows said side bar (16) to clear the shear line (14). A correct shaped key is a key having the desired code so as to fit into and un-locking the lock cylinder. The side bar (16) is shown with two springs (18a, 18b) located at each end of the side bar (16) which are urging the side bar (16) towards the outer of the cylinder core and at the same time keeping the side bar flexible so that when the set of locking pins (22) are engaged with a set of cam portions of the side bar (16) (such cam portions are shown in more detail in figure 4) then the side bar can be moved into a position where the shear line (14) is cleared.

[0038] Also illustrated in figure 1 are bore slots (48, 50) containing hard metals, alloys or the like, e.g. comprising tungsten, serving as drill protection from for instance burglars. Such bore slots are not important for the functioning of the lock cylinder, and are merely shown to illustrate such details that will normally be present in a commercial version of the present lock cylinder.

[0039] Important in the lock cylinder of the present invention and as illustrated in figure 1 and in more detail in figure 2, are the two sets of locking pins (22 and 26) located in the cylinder core (12) and arranged so that an imaginary central line (x) of the locking pins (22) and an imaginary central line (y) of the locking pins (26) form an acute angle alpha (α). The acute angle (α) is formed between the imaginary central lines (x and y) when looking at a cross section of the cylinder core (12) from the key slot (42) side as illustrated in figure 2. The acute angle (α) may be from 1° to 89°, although in order to manufacture a reliable lock cylinder the acute angle is typically from 5° to 45°, such as 10° to 30°, typically 12° to 18°, e.g. about 15°. Wherein the term "about" means +/- 2°, typically +/- 1°.

[0040] To clear the shear line (14) between the cylinder housing (10) and the cylinder core (12), a key blade (20) with a properly cut upper edge (not shown, however this is well-known to the skilled person how to shape such upper edge of a key) and a properly cut lower edge (see figure 3 with different side codes (52, 54, 56)) has to be inserted into the key slot (42), so that each first locking pin (26) is elevated into a position where the upper end surface thereof coincides with the shear line (14) and each second locking pin (22) is elevated into a position where the cam portions (see figure 4) of the side bar (16) engages with each locking pin (22; 22a-22e) and allows the side bar (16) to move freely to a position where the shear line (14) is clear.

[0041] As illustrated more in detail in figure 2 (when looking at a cross section of the lock cylinder, from the key slot (42) side), wherein the cylinder housing (10) is seen from front where the key (20) is positioned in the key slot (42) in the core (12), there is an acute angle

alpha (α) which is formed between an imaginary central line (x) extending through the first set of locking pins (26), the upper pins (28), the springs (30), and the locking means (32) and another imaginary central line (y) extending through the second set of locking pins (22) and the springs (24). The present invention should not be limited to this particular shown embodiment of figure 2, as various other options are apparent to the skilled person when reading the present description and claims and drawings.

[0042] In figure 3 a key (20) is shown with examples of code lines (52, 54, 56) in the lower edge, where a single locking pin (22) is illustrated in one position (52) and it is clear to the skilled person how the remaining locking pins (22) may be positioned when the key is inserted in the key slot.

[0043] In figure 4 a side bar (16) is illustrated with channels (60) for positioning of the set of springs (18a and 18b as shown in figure 1), and wherein cam portions (62, 64) will engage with the set of locking pins (22), here shown as one locking pin engaging with two cam portions. Also illustrated is a particular embodiment of one second locking pin (22) with a round end portion (70), here shaped as a half sphere, a first cylinder portion (72) and a second cylinder portion (74), wherein the first cylinder portion (72) has a reduced diameter compared to the second cylinder portion (74), a third cylinder portion (76), wherein the third cylinder portion (76) has a reduced diameter compared to the second cylinder portion (74). On top of the first locking pin (22) is a top cylinder portion (78) which may be flat on the top so as to engage with a sphere (this embodiment is not shown, but is preferred when no stop bar (36) and stop bar aperture (38) is present and the second set of pin channels in the cylinder housing (10) is present and said channels are for guiding the set of sphere(s) and optional upper pins and springs for urging the sphere(s) downward to the set of locking pin (22)); or the top cylinder portion (78) may have a hole extending through the top (78), the third cylinder portion (76) and optionally the second cylinder portion (74) to hold a spring in position as shown in figure 1 and in more detail in figure 5.

[0044] Figure 5 is a cross section illustrating the locking pin (22) in the position where the cylinder is locked and there is no key inserted in the key slot (42). A bore slot (80) is shown for containing hard alloys or the like. The set of locking pins (22) are in a resting position (no key inserted) in the fourth pin channel (40) and a set of springs (24) are urging the set of locking pins (22) downwards. As shown here the spring (24) extends through a hole in the center of the locking pin (22) and is blocked at the other end by the stop bar (not shown) to be in position in the stop bar aperture (38). When a suitable key is inserted in the key slot the lower side code will push the locking pin (22) to a position where the side bar (16) in the side bar aperture (44) will engage with the locking pin (22) so that rotation of the cylinder core (12) is possible.

[0045] In figure 6 is illustrated a transverse section of

the cylinder core (12) along lines A—A, B—B, C—C, and D—D. This figure is intended to show various sections, illustrated as SECTION A-A, SECTION B-B, SECTION C-C, and SECTION D-D, of the cylinder core (12), however, should in no way be limiting the invention and its full potential as described herein and in the figures 1-5. Section A-A is a transverse section showing the cylinder core (12) with the third set of pin channels (46). Section B-B shows the cylinder core (12) with the bore (80) for drill-protection in the same level as the fourth set of pin channels (40). As shown the stop bar aperture (38) extends through the core (12) thus making it easy to change or assemble any one of the spring parts (24) or locking pin parts (22) of the lock cylinder. The side bar aperture (44) extends only partly through the core (12) as shown in sections A-A to C-C, where section D-D shows the end part of the core (12) with screw holes/slots (90, 92) for securing the core part (12) in the lock cylinder according to known means with a key system of the rotary cylinder type.

[0046] Another embodiment of the lock cylinder of present invention is illustrated in figure 7, wherein a cylinder housing (10) is hosting a cylinder core (12). The cylinder housing (10) has a first set of pin channels (34) (as also illustrated in figure 1). The cylinder housing (10) has a second set of pin channels (not shown) for receiving a set of locking pins (22), two sets of spheres (herein referred to as 94 and 96) and a set of springs (98), such locking pins being guided in the fourth set of pin channels of the cylinder core (12). In this embodiment the set of locking pins (22) have a top cylinder portion (78) (as shown in figure 4) which is flat on the top so as to engage with the first sphere (94). The first set of spheres (94) and the second set of spheres (96) creates a system wherein the cylinder core (12) can rotate with reduced friction, for instance compared to a situation where a set of upper pins are pushing the set of locking pins (22). A set of springs (98) is urging the spheres (96) downwards, and on top a set of locking means (100) is blocking the parts contained in the second set of channels from leaving the cylinder housing. Such locking means (100) are typically screw means as they are an advantage creating the possibility of easy assembling of the lock cylinder as well as easy changing/exchanging of the individual parts contained in the channels of the lock cylinder. However, such locking means (100) may also simply be plugs blocking and securing the parts contained in the channels, without providing the possibility of changing/assembly. The remaining parts of the lock cylinder are as described in connection with figure 1.

[0047] In figure 8 the lock cylinder as illustrated in figure 7 (when looking at a cross section of the lock cylinder, from the key slot (42) side) is shown in order to further elucidate the positioning of the set of locking pins (22), the first set of spheres (94), the second set of spheres (96), the springs (98) and finally the locking means (100) holding all parts in a suitable position. The remaining parts of the lock cylinder are as described in connection

with figure 2. The present invention should not be limited to this particular shown embodiment of figure 8, as various other options are apparent to the skilled person when reading the present description and claims and drawings.

[0048] FIG. 9 illustrates a transverse section of the cylinder core (12) along lines A—A and B—B illustrated as SECTION A-A and SECTION B-B, respectively, wherein two sets of pin channels (110a and 110b) are arranged on both sides of the third set of pin channels (46). The pin channels (110a and 110b) are made, such as drilled, so that the set of locking pins (22) may be inserted with the top cylinder portion (78) (as shown in figure 4) first. This alternative way of inserting the locking pins (22) avoids the need for a stop bar (36) (as shown in figure 1). Thus, this solution illustrates that the locking pins (22) may be arranged on either side of the pin channels (46) and in particular that the locking pins (22) may be present simultaneously in the cylinder core (12). When two sets of locking pins (22) are present an acute angle as illustrated and described in connection with figure 2 will be formed on both sides, and this also means that the number of lock channels may be from 4 to 10, such as 4-7, typically 5 or 6, wherein 3 is located on each side of the third set of pin channels (46), or 3 on one side and 2 on the other. The acute angle (shown in figure 2 as angle α) on both sides may be the same or different, wherein each of the angles (α) may be from 1° to 89°, typically from 5° to 45°, such as 10° to 30°, typically 12° to 18°, e.g. about 15°. The key (as shown in figure 3) will of course have code lines in the lower edge part on both sides, in order to work in this embodiment. The side bar apertures (44a and 44b) are illustrated and basically works as described herein, e.g. in relation to figure 5. The remaining parts of the lock cylinder are as described in connection with the other figures.

[0049] The above embodiments as well as the embodiments to be described hereunder should be seen as referring to any one of the aspects described herein as well as any one of the embodiments described herein unless it is specified that an embodiment relates to a certain aspect or aspects of the present invention.

List of embodiments

[0050]

1. A rotary lock cylinder comprising

- a) a cylinder housing for hosting a cylinder core,
- b) a cylinder core mounted in said cylinder housing and being able to rotate in said cylinder housing to provide a shear line between said cylinder core and said cylinder housing, wherein said cylinder core has two sets of pin channels, referred to as the third set of pin channels and the fourth set of pin channels,
- c) a first set of locking pins guided in said third pin channels,

- d) a second set of locking pins guided in said fourth pin channels,
- e) a key channel extending in a longitudinal direction of said cylinder core for insertion of a key blade, which cooperates with said first set of locking pins and said second set of locking pins in said cylinder core,
- f) a longitudinal side bar accommodated in an aperture in said cylinder core which side bar co-acts with said second set of locking pins so that positioning of said second set of locking pins with a correct shaped key blade allows said side bar to clear the shear line, characterized in that said first set of locking pins and said second set of locking pins are arranged in an acute angle.

2. A lock cylinder comprising

- a) a cylinder housing for hosting a cylinder core wherein said cylinder housing has a first set of pin channels, and optionally, a second set of pin channels,
- b) a cylinder core mounted in said cylinder housing and being able to rotate in said cylinder housing to provide a shear line between said cylinder core and said cylinder housing, wherein said cylinder core has a third set of pin channels and a fourth set of pin channels,
- c) a first set of locking pins guided in said third pin channels,
- d) a second set of locking pins guided in said fourth pin channels,
- e) optionally, a stop bar means guided in a stop bar aperture in said cylinder core located above said fourth pin channels and blocking the second set of locking pins from leaving the cylinder core when a suitably shaped key blade is inserted into the key slot,
- f) a key channel extending in a longitudinal direction of said cylinder core for insertion of a key blade, which cooperates with said first set of locking pins and said second set of locking pins in said cylinder core,
- g) a longitudinal side bar accommodated in an aperture in said cylinder core which side bar co-acts with said second set of locking pins so that positioning of said second set of locking pins with a correct shaped key blade allows said side bar to clear the shear line, characterized in that said first set of locking pins and said second set of locking pins are arranged in an acute angle.

- 3. The lock cylinder of any one of embodiments 1-2 wherein said cylinder housing has the first set of pin channels, but not the second set of pin channels.
- 4. The lock cylinder of any one of embodiments 1-3 wherein said cylinder core has the stop bar means guided in the stop bar aperture in said cylinder core

located above said fourth set of pin channels and blocking the second set of locking pins from leaving the cylinder core when a suitably shaped key blade is inserted into the key slot.

- 5. The lock cylinder of any one of embodiments 1-2 wherein said cylinder housing has the second set of pin channels.
- 6. The lock cylinder of any one of embodiments 1-5 wherein the acute angle is α formed between the imaginary lines x and y as illustrated in figure 2.
- 7. The lock cylinder of any one of embodiments 1-6 wherein the acute angle (α) is from 5° to 45°, such as 10° to 30°, typically 12° to 18°, e.g. about 15°.
- 8. The lock cylinder of any one of embodiments 1-7 wherein the first set of pin channels is guiding a set of upper pins which are urged downwards by a set of spring means.
- 9. The lock cylinder of embodiment 8 wherein the cylinder housing further comprises a set of locking means at the end of the first set of pin channels, thereby blocking the spring means and upper pins from leaving the cylinder housing.
- 10. The lock cylinder of embodiment 9 wherein the set of locking means is selected from permanent stoppers, such as plugs or fillings.
- 11. The lock cylinder of embodiment 9 wherein the set of locking means is selected from stoppers with a thread.
- 12. The lock cylinder of any one of embodiments 1-11 wherein the first set of locking pins are of equal length.
- 13. The lock cylinder of any one of embodiments 1-11 wherein the first set of locking pins are of different length.
- 14. The lock cylinder of any one of embodiments 5-13 wherein the second set of pin channels is guiding a set of spheres which are urged downwards by a set of spring means.
- 15. The lock cylinder of any one of embodiments 5-14 wherein the cylinder housing further comprises a set of locking means at the end of the second set of pin channels, thereby blocking the spring means and spheres from leaving the cylinder housing.
- 16. The lock cylinder of embodiment 15 wherein the set of locking means is selected from permanent stoppers, such as plugs or fillings.
- 17. The lock cylinder of embodiment 15 wherein the set of locking means is selected from stoppers with a thread.
- 18. The lock cylinder of any one of embodiments 4 and 6-17 wherein the second set of locking pins guided in said fourth pin channels is in contact with a set of spheres urged downwards by a set of spring means.
- 19. The lock cylinder of any one of embodiments 1-18 wherein the second set of locking pins are of different length.
- 20. The lock cylinder of embodiment 19 wherein the

first locking pin at either end of the cylinder core is the shortest with increasing length of each of the locking pins.

21. The lock cylinder of any one of embodiments 1-18 wherein the second set of locking pins are of equal length.

22. The lock cylinder of any one of embodiments 1-21 wherein the first set of locking pins consists of 5-7, such as 6, locking pins.

23. The lock cylinder of any one of embodiments 1-22 wherein the second set of locking pins consists of 4-6, such as 5, locking pins.

24. A key blade for use in combination with a lock cylinder as defined in any one of embodiments 1-23, comprising an elongated, optionally wave-like, longitudinally extending code pattern at the upper edge for urging the first set of locking pins upwards to a position where the shear line is clear and another elongated wave-like longitudinally extending code pattern at the lower edge for urging the second set of locking pins upwards in the fourth set of pin channels so that positioning of said second set of locking pins with a correct shaped key blade allows a longitudinal side bar accommodated in an aperture in said cylinder core to co-act with said second set of locking pins and clear the shear line.

25. A locking pin member for use in the set of the second locking pins in combination with a lock cylinder as defined in any one of embodiments 1-23, comprising an end portion, a first cylinder portion, a second cylinder portion, a third cylinder portion, and a top portion, wherein the first cylinder portion has a reduced diameter compared to the second cylinder portion, and the third cylinder portion has a reduced diameter compared to the second cylinder portion, wherein the end portion is urged by a correct shaped key, thereby allowing movement of the locking pin member to a position where the side bar co-acts with the locking pin member.

26. The locking pin member of embodiment 25 wherein the end portion is conical, blunt or shaped as a half sphere.

27. The locking pin member of embodiment 25 or 26 wherein the top portion is conical shaped.

28. The locking pin member of embodiment 27 wherein the top portion is substantially flat at the top, thereby being able to be in contact with a sphere means.

29. The locking pin member of embodiment 27 wherein the top portion has a hole extending through the top, the third cylinder portion and optionally the second cylinder portion thereby being able to hold a spring means in position.

30. A side bar for use in an aperture in the cylinder core being a part of the lock cylinder as defined in any one of embodiment 1-23, comprising a longitudinal portion having channels at each end of the longitudinal portion for positioning of spring means and

cam portions for engaging with the second set of locking pins.

[0051] All references, including publications, patent applications and patents, cited herein are hereby incorporated by reference to the same extent as if each reference was individually and specifically indicated to be incorporated by reference and was set forth in its entirety herein.

[0052] All headings and sub-headings are used herein for convenience only and should not be construed as limiting the invention in any way.

[0053] Any combination of the above-described elements in all possible variations thereof is encompassed by the invention unless otherwise indicated herein or otherwise clearly contradicted by context.

[0054] Recitation of ranges of values herein are merely intended to serve as a shorthand method of referring individually to each separate value falling within the range, unless otherwise indicated herein, and each separate value is incorporated into the specification as if it were individually recited herein. Unless otherwise stated, all exact values provided herein are representative of corresponding approximate values (e.g., all exact exemplary values provided with respect to a particular factor or measurement can be considered to also provide a corresponding approximate measurement, modified by "about," where appropriate).

[0055] All methods described herein can be performed in any suitable order unless otherwise indicated herein or otherwise clearly contradicted by context.

[0056] The use of any and all examples, or exemplary language (e.g., "such as") provided herein, is intended merely to better illuminate the invention and does not pose a limitation on the scope of the invention unless otherwise indicated. No language in the specification should be construed as indicating any element is essential to the practice of the invention unless as much is explicitly stated.

[0057] The citation and incorporation of patent documents herein is done for convenience only and does not reflect any view of the validity, patentability and/or enforceability of such patent documents.

[0058] The description herein of any aspect or embodiment of the invention using terms such as "comprising", "having", "including" or "containing" with reference to an element or elements is intended to provide support for a similar aspect or embodiment of the invention that "consists of", "consists essentially of", or "substantially comprises" that particular element or elements, unless otherwise stated or clearly contradicted by context (e.g., a composition described herein as comprising a particular element should be understood as also describing a composition consisting of that element, unless otherwise stated or clearly contradicted by context).

[0059] This invention includes all modifications and equivalents of the subject matter recited in the aspects or claims presented herein to the maximum extent per-

mitted by applicable law.

[0060] The features disclosed in the foregoing description may, both separately and in any combination thereof, be material for realizing the invention in diverse forms thereof.

Claims

1. A rotary lock cylinder comprising

- a) a cylinder housing for hosting a cylinder core,
- b) a cylinder core mounted in said cylinder housing and being able to rotate in said cylinder housing to provide a shear line between said cylinder core and said cylinder housing, wherein said cylinder core has two sets of pin channels, referred to as the third set of pin channels and the fourth set of pin channels,
- c) a first set of locking pins guided in said third pin channels,
- d) a second set of locking pins guided in said fourth pin channels,
- e) optionally, a stop bar means guided in a stop bar aperture in said cylinder core located above said forth pin channels and blocking the second set of locking pins from leaving the cylinder core when a suitably shaped key blade is inserted into the key slot,
- f) a key channel extending in a longitudinal direction of said cylinder core for insertion of a key blade, which cooperates with said first set of locking pins and said second set of locking pins in said cylinder core,
- g) a longitudinal side bar accommodated in an aperture in said cylinder core which side bar co-acts with said second set of locking pins so that positioning of said second set of locking pins with a correct shaped key blade allows said side bar to clear the shear line, **characterized in that** said first set of locking pins and said second set of locking pins are arranged in an acute angle.

2. The lock cylinder of claim 1 wherein the cylinder housing has a first set of pin channels.

3. The lock cylinder of claim 1 wherein a third set of locking pins are guided in a further set of pin channels in the cylinder core and wherein a second longitudinal side bar is accommodated in a second aperture in said cylinder core which side bar co-acts with said third set of locking pins so that positioning of said third set of locking pins with a correct shaped key blade allows said side bar to clear the shear line.

4. The lock cylinder of any one of claims 1-3 wherein said cylinder core has the stop bar means guided in the stop bar aperture in said cylinder core located

above said fourth set of pin channels and blocking the second set of locking pins from leaving the cylinder core when a suitably shaped key blade is inserted into the key slot.

5. The lock cylinder of any one of claims 1-4 wherein the acute angle is alpha (α) formed between the imaginary lines x and y as illustrated in figure 2, and wherein the acute angle (α) is from 5° to 45°, such as 10° to 30°, typically 12° to 18°, e.g. about 15°.

6. The lock cylinder of any one of claims 1-5 wherein the second set of locking pins guided in said fourth pin channels is in contact with a set of spheres urged downwards by a set of spring means.

7. The lock cylinder of any one of claims 1-6 wherein the first set of locking pins consists of 5-7, such as 6, locking pins.

8. The lock cylinder of any one of claims 1-7 wherein the second set of locking pins consists of 4-6, such as 5, locking pins.

9. The lock cylinder of claim 3 wherein the first set of locking pins consists of 5-7 locking pins, the second set of locking pins consists of 2-4 locking pins, and the third set of locking pins consists of 2-4 locking pins.

10. A key blade for use in combination with a lock cylinder as defined in any one of claims 1-9, comprising an elongated, optionally wave-like, longitudinally extending code pattern at the upper edge for urging the first set of locking pins upwards to a position where the shear line is clear and another elongated wave-like longitudinally extending code pattern at the lower edge for urging the second set of locking pins upwards in the fourth set of pin channels so that positioning of said second set of locking pins with a correct shaped key blade allows a longitudinal side bar accommodated in an aperture in said cylinder core to co-act with said second set of locking pins and clear the shear line.

11. A locking pin member for use in the set of the second locking pins in combination with a lock cylinder as defined in any one of claims 1-9, comprising an end portion, a first cylinder portion, a second cylinder portion, a third cylinder portion, and a top portion, wherein the first cylinder portion has a reduced diameter compared to the second cylinder portion, and the third cylinder portion has a reduced diameter compared to the second cylinder portion, wherein the end portion is urged by a correct shaped key, thereby allowing movement of the locking pin member to a position where the side bar co-acts with the locking pin member.

12. The locking pin member of claim 11 wherein the end portion is conical, blunt or shaped as a half sphere, and wherein the top portion is conical shaped.
13. The locking pin member of claim 12 wherein the top portion is substantially flat at the top, thereby being able to be in contact with a sphere means. 5
14. The locking pin member of claim 12 wherein the top portion has a hole extending through the top, the third cylinder portion and optionally the second cylinder portion thereby being able to hold a spring means in position. 10
15. A side bar for use in an aperture in the cylinder core being a part of the lock cylinder as defined in any one of claims 1-9, comprising a longitudinal portion having channels at each end of the longitudinal portion for positioning of spring means and cam portions for engaging with the second set of locking pins. 15 20

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FIGURE 1

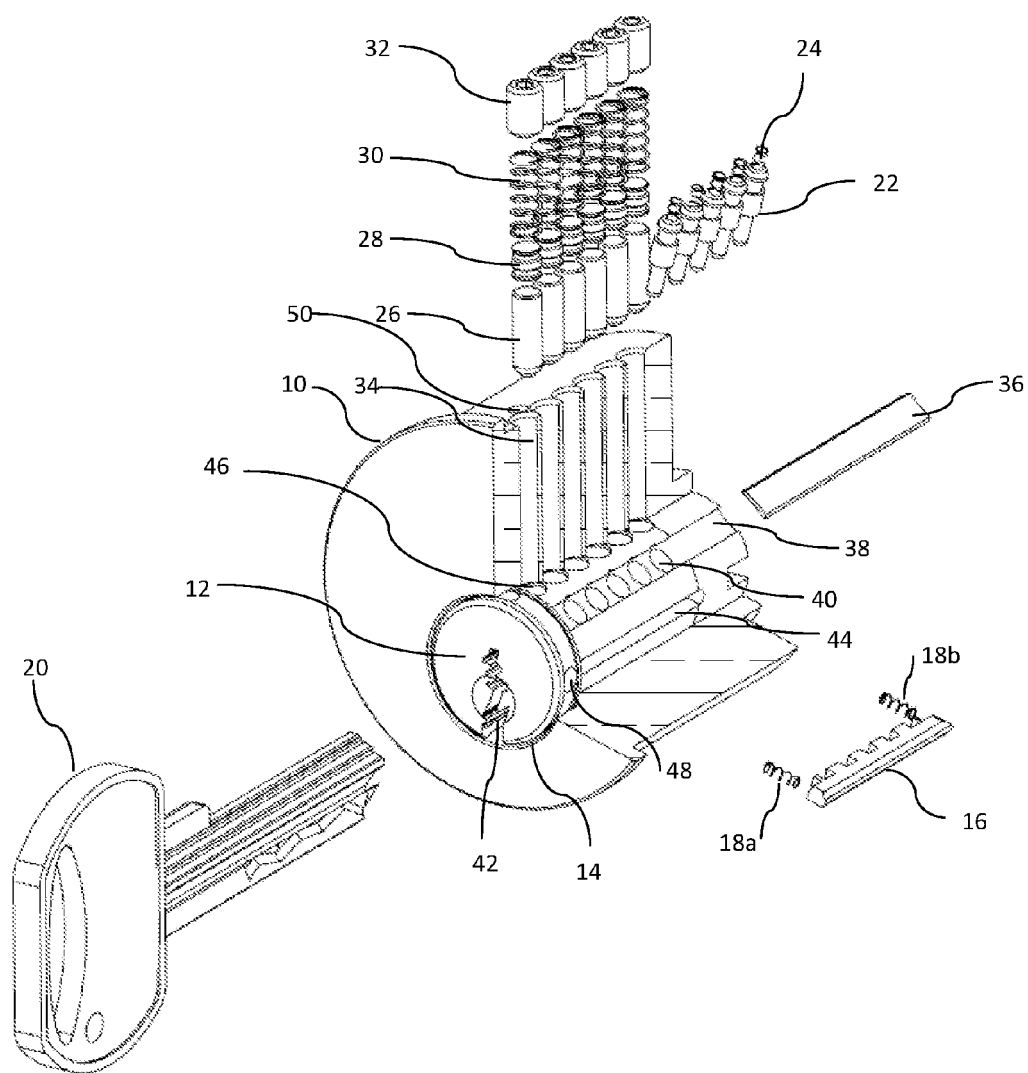


FIGURE 2

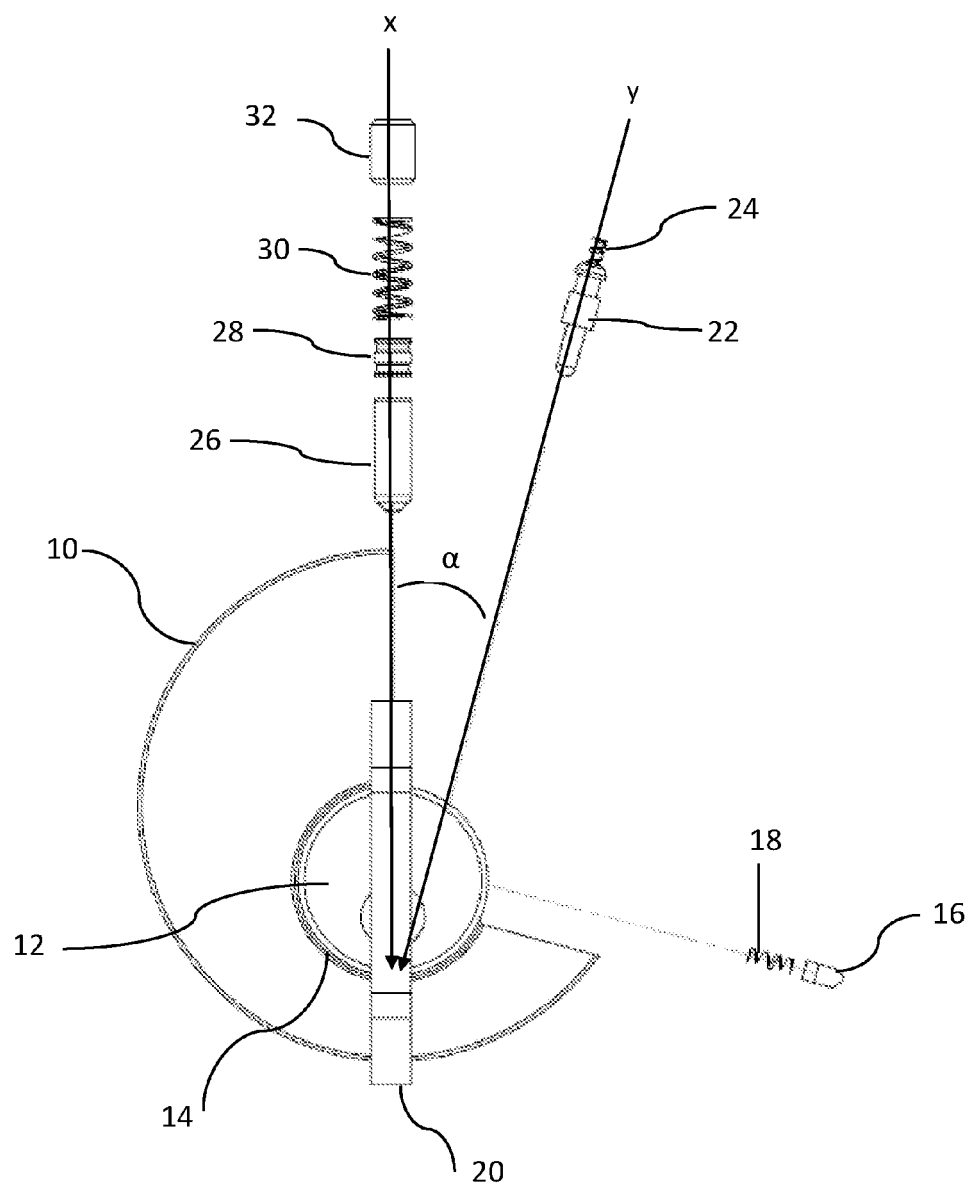


FIGURE 3

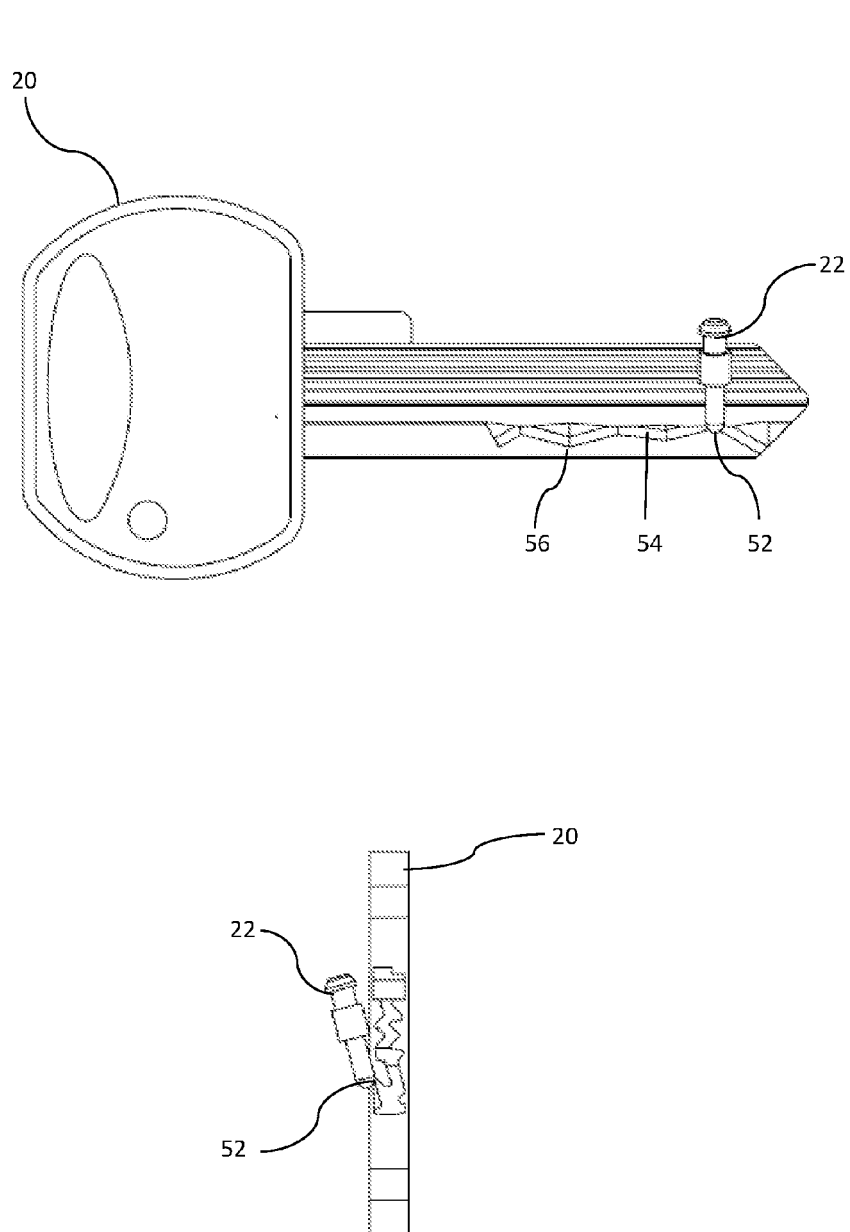


FIGURE 4

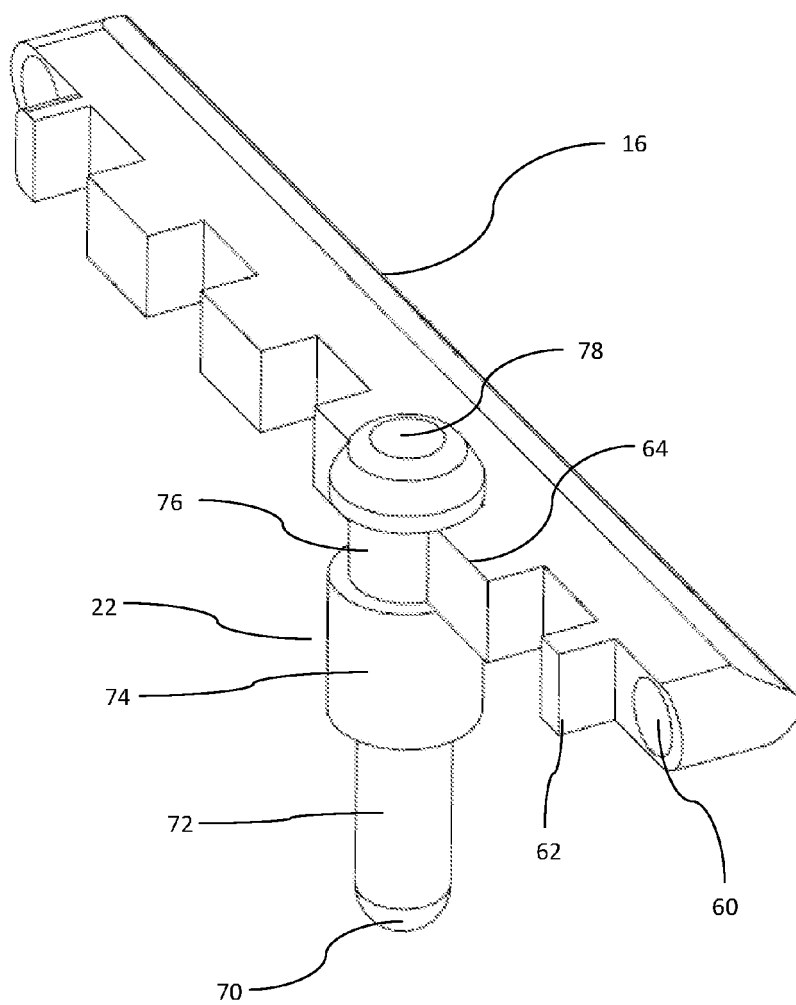


FIGURE 5

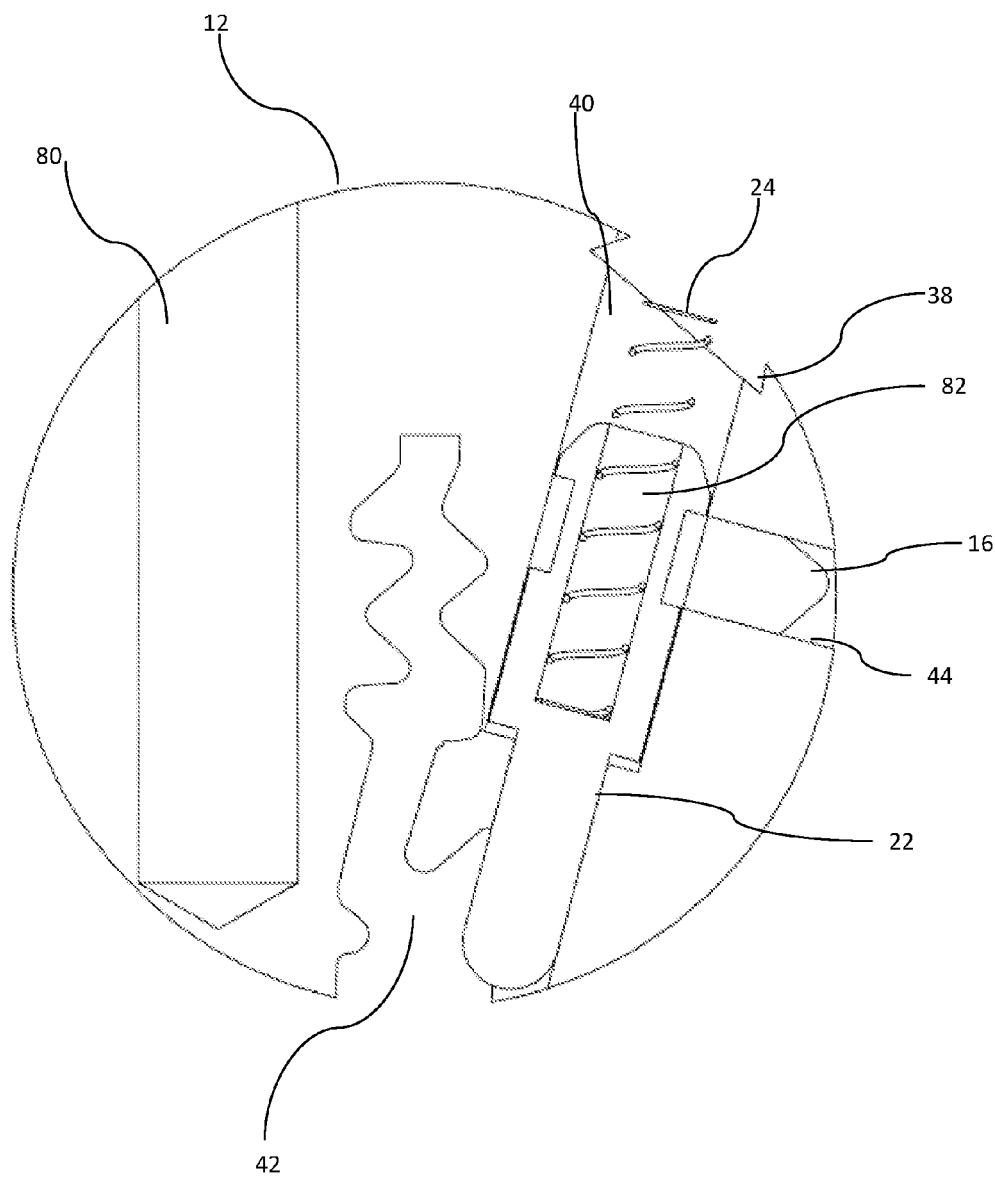


FIGURE 6

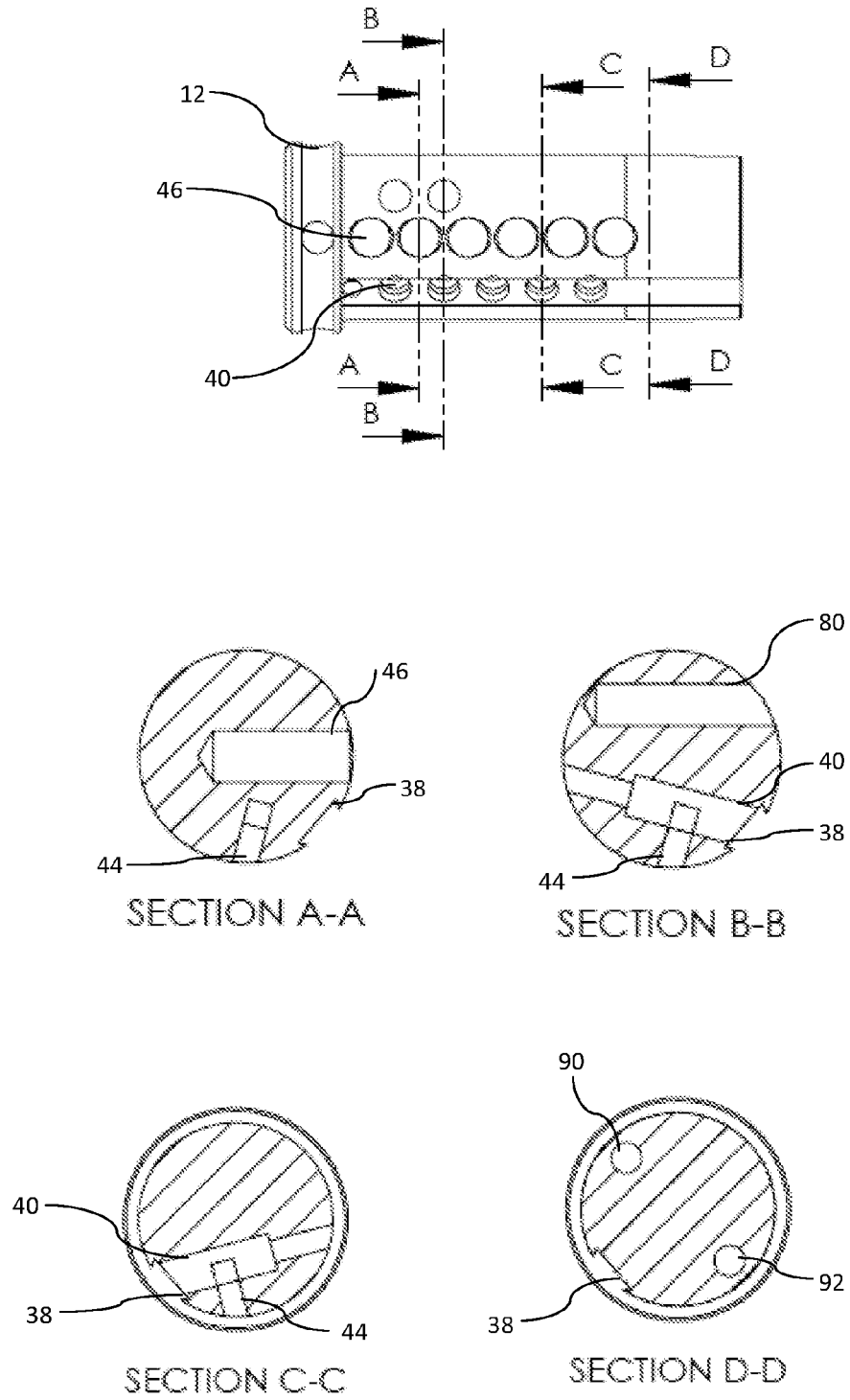


FIGURE 7

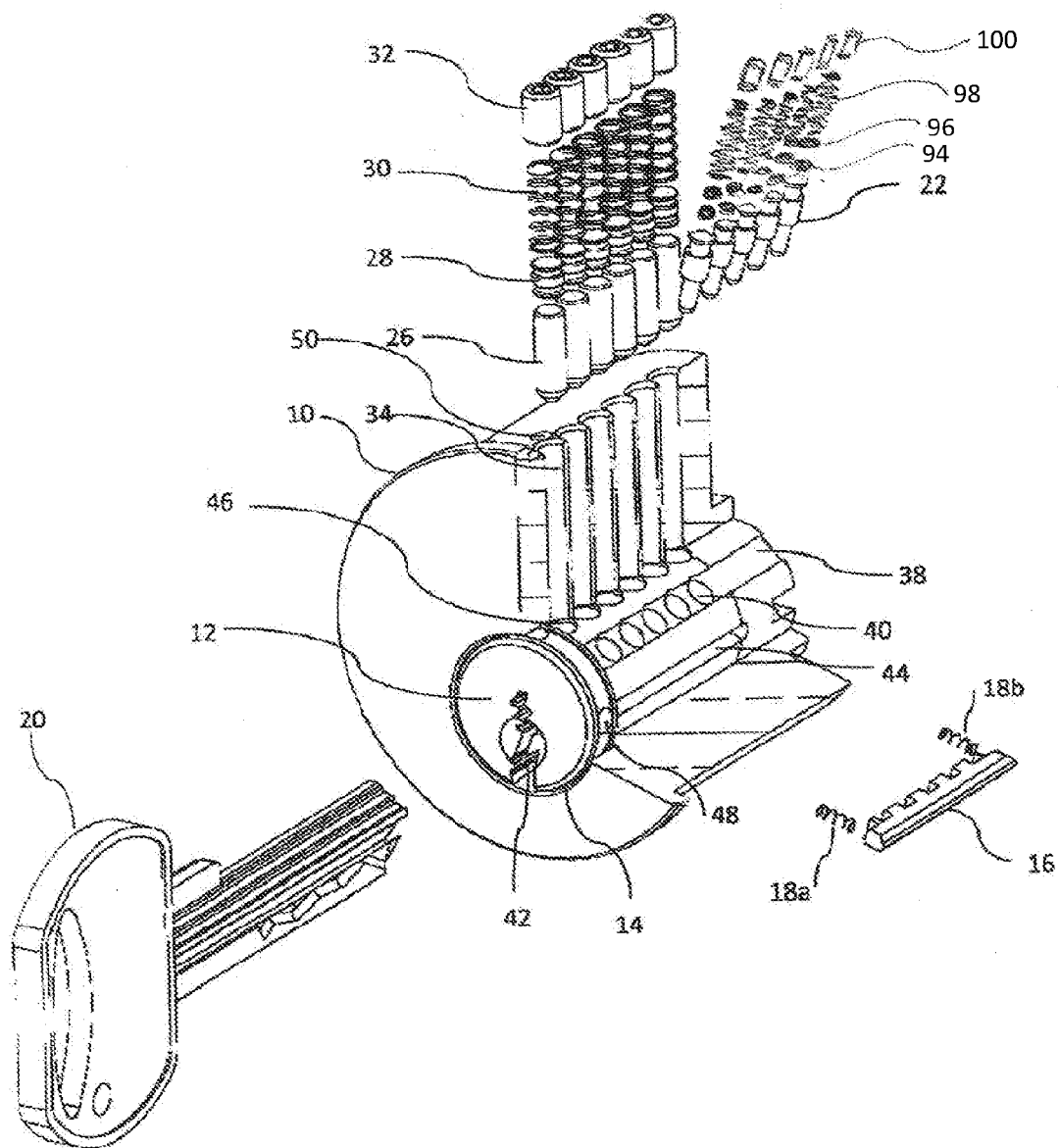


FIGURE 8

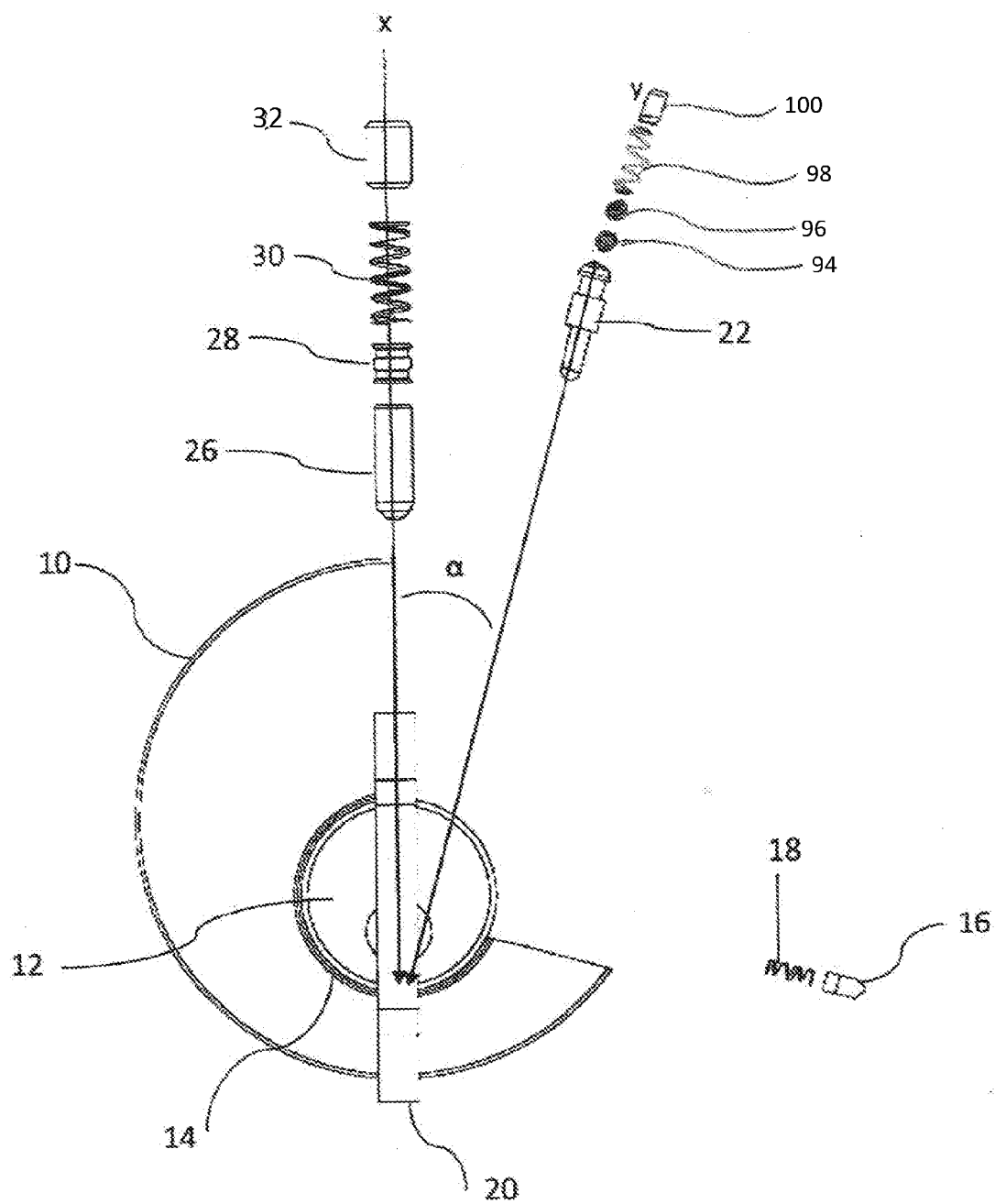
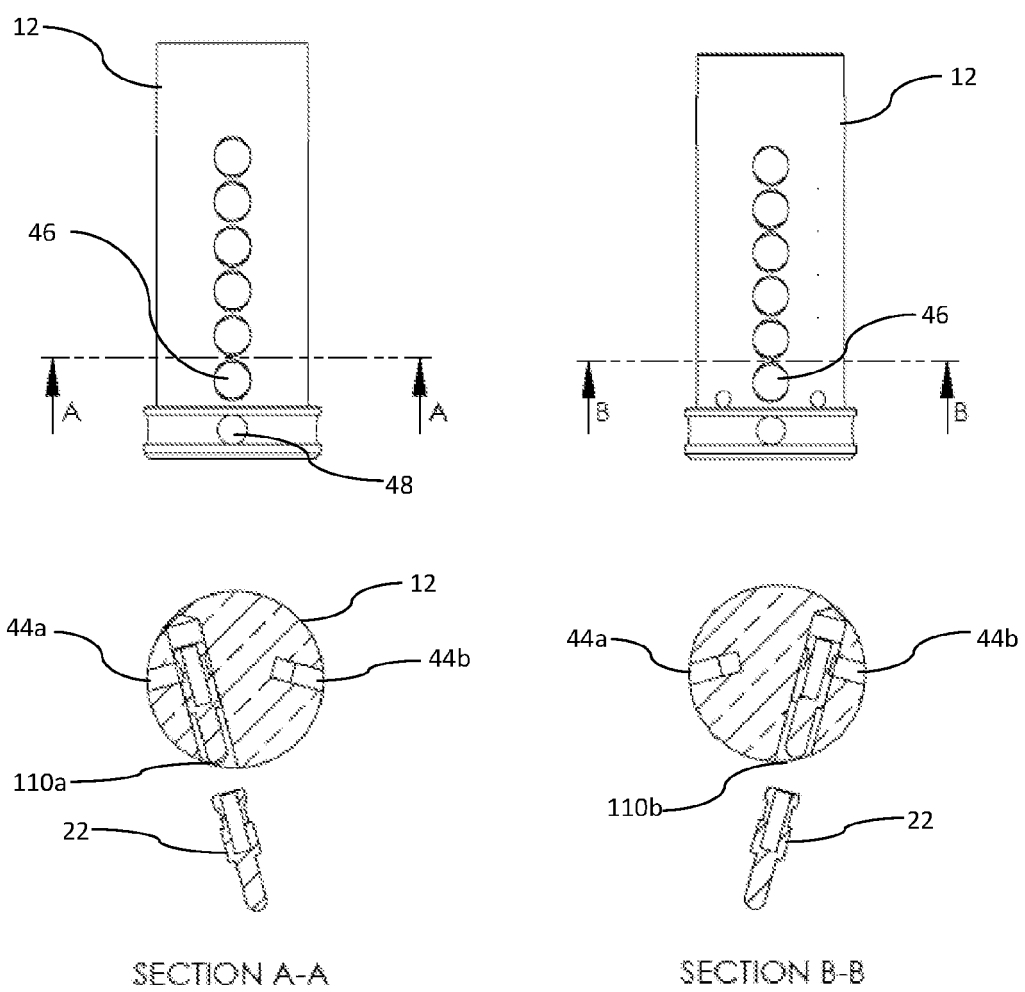


FIGURE 9



REFERENCES CITED IN THE DESCRIPTION

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