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(54) Revolving cylinder and radial piston type safety lock unit with relative key.

(57) The new lock comprises a body (12), a revolving cylindrical core (16) inside the body, a first series of pistons (28) driven by springs into appropriate radial housings in the core and one or two further series of pistons (34), without springs, free to slide into respective radial housings in the core and cooperating with notches provided on the inner wall of the body.

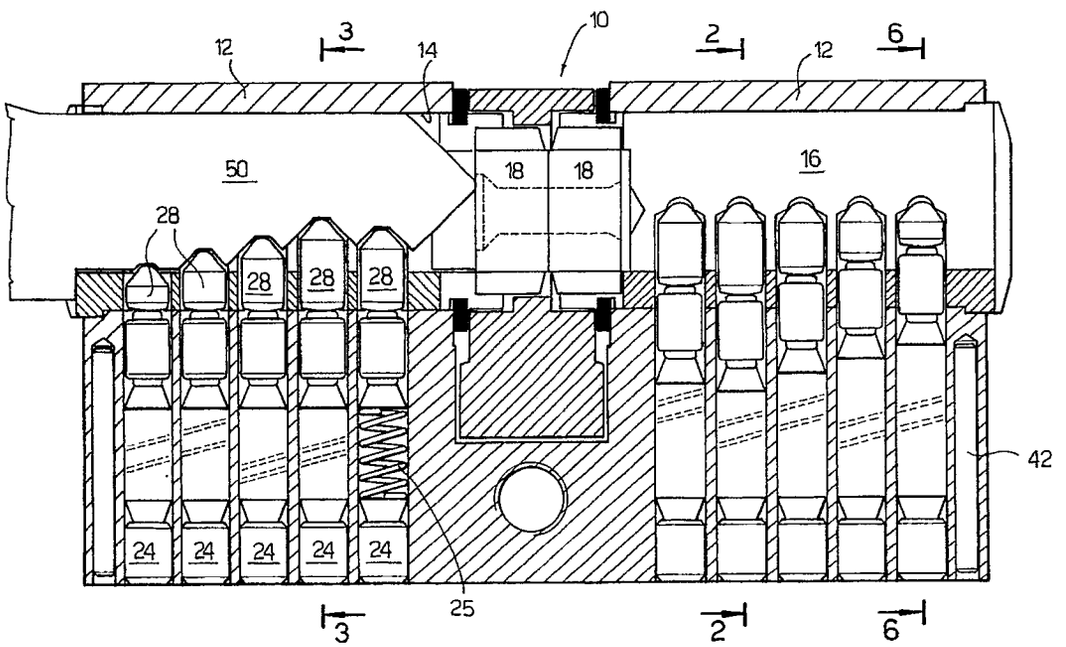

FIG. 1

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"REVOLVING CYLINDER AND RADIAL PISTON TYPE SAFETY LOCK UNIT WITH RELATIVE KEY"

The present invention relates to the field of cylinder safety locks. Such locks comprise a cylinder or core revolving around its own axis inside a cylindrical chamber made in a body of the lock. Integral with the cylinder is a sprocket wheel or another means for operating a closing latch, which is moved between the opened and closed position by means of the rotation of the cylinder. This in turn is determined by a key inserted into an appropriate chamber in the cylinder.

Various solutions have been studied to give ever-increasing safety to this type of lock.

At present locks are known and available on the market which have locking pistons arranged in a series with coplanar axes, sliding into seats cut in the body and in the cylinder. These pistons are driven by springs in an extended position in which they extend partially into the chamber for the key formed within the cylinder.

A piston or so-called neutral block corresponds to each locking piston, which is also called the end piston. The two pistons are usually in contact with each other and arranged along a radial axis which is the same as the cylinder axis. The neutral pistons are of the same length while the end pistons are of different lengths. When no key is inserted into the chamber, that is in the rest position, the neutral pistons extend between the body and the cylinder by the action of the respective springs, locking the cylinder against rotation, and the end pistons project into the chamber.

The particular extension and arrangement of the end pistons makes up one of the characteristics of the lock (numeration). A flat key provided with a particular profile on one longitudinal side is provided for operating the lock; the profile comprises areas of greater and lesser depth according to the numeration, which are connected by sloping ramps.

When the key with the numeration corresponding to that of the lock is inserted into the appropriate chamber, it presses the end pistons radially toward the outside for a precise length, determined by the profile of the key and the height of the pistons, in such a way as to push the neutral pistons back into the body, while the end pistons are held back in the cylinder. In other words, in this condition the contact surface between the neutral blocks and the end pistons belongs to the cylindrical contact surface between the body and the cylinder. It is then possible to rotate the cylinder in the body to effect opening and closing. Any other key profile would push the end pistons for a shorter or longer length than necessary, so that the neutral and/or the end pistons would extend between the body and the cylinder and lock the rotation of the latter.

A drawback with this type of lock is the limited number of possible combinations.

In order to increase the number of possible combinations locks have been produced with several series of spring driven pistons, the various series being distanced from each other at an angle.

The corresponding keys have indentations of different depths on different faces which oppose the series of pistons.

The drawback with these locks lies in the fact that, since each pair of pistons of each series comprises the driven spring as well as the end piston and the neutral piston, the lock is inevitably of a large radial size and is relatively expensive to produce.

The aim of this application is to realize a lock with a high degree of safety, which permits a large number of numerations and still has relatively moderate size and reasonable production costs.

These aims have been achieved with a lock according to claim 1.

The lock comprises a body, a revolving cylinder in an appropriate seat in the body, a series of pairs of pistons spring driven into notches in the cylinder and body, and at least one or preferably two series of additional pistons, free to slide radially in additional housings made in the cylinder, or collaborating with particular shapings in the body wall.

The new lock has a high degree of safety, allows a large number of combinations and can be produced with reduced overall dimensions and at a moderate cost.

An example of the lock according to the invention preferred at present will be described below with reference to the appended drawings, in which:

- Figure 1 is a longitudinal section taken along a double lock, the left part illustrated in the locked condition and the left part illustrated in the free condition with the key inserted;
- Figure 2 is a section taken along 2.2 in figure 1 (lock locked with no key inserted);
- Figure 3 is a section taken along 3.3 in figure 1 (lock unlocked with its proper key);
- Figure 4 is a section similar to figure 3 but the lock is illustrated with the cylinder rotated through 90°;
- Figure 5 is a section similar to figure 4, enlarged and cut off; the lock is illustrated with a key which is not its

own inserted and in a locked condition rotated through 90°;

Figure 6 shows a section taken along 6.6 in figure 1;

Figure 7 is a side view of a key for use with the lock in the previous figure;

Figure 8 is a section taken along 8.8 in figure 7.

With reference to the figures, number 10 shows the lock as a whole. It comprises a body 12, which forms an inner cylindrical slot 14, which receives a cylinder or drum 16 in a revolving manner. It should be noted that in the double lock illustrated in figure 1 and operable from its two ends, there are two consecutive bodies 12 with aligned seats 14 and revolving cylinders 16; a sprocket wheel 18 for operating the latch 20 is respectively integral with the rotation with each cylinder and sliding axially on it. The elements of the right-hand part of the lock are a mirror image of those of the left-hand part in figure 1 and have the same reference numbers; the left part of the lock will be described below, and it should be understood that what is said about it holds good for the right part also.

The body 12 has an elongated part provided with holes or housings 22, usually arranged with their axes coplanar. Consecutively to each hole 22, the cylinder 16 has a hole 23; each hole receives a cap 24, a spring 25, a neutral piston 26 and an end piston 28.

Usually in the various holes 22, on a par with other elements, the axial dimensions (lengths) of the end pistons 28 are different from each other and different in different locks, thus making up a first type of numeration.

In the cylinder, each hole 23 is in communication with a chamber 30 for the key, substantially extending on an axial plane along the length of the whole cylinder.

According to the invention, additional holes or auxiliary housings 32 are foreseen, arranged at an angle with respect to the holes 23 and in communication with the chamber 30. In particular, in the example illustrated there are two series of holes 32; each series comprises holes 32 which have coplanar axes and lie on a plane at an angle with respect to the plane defined by the axes of the holes 23. Considering a plane at right angles to the axis of the cylinder, and passing through the axis of a hole 23, the axes of two holes 32 are coplanar to the axis of the hole 23 and at an angle of usually 90° to it. However, it is possible to have the axes of the holes 32 arranged at angles other than 90°, or to have a number other than two of holes 32 on a plane at right angles to the axis of the cylinder.

An auxiliary or secondary piston 34 is housed in a sliding way in each hole 32. Each secondary piston 34 preferably has a head 34' widened at its outer end, having a rounded outer surface collaborating with a widened part 32' of the hole 32. The secondary pistons can be foreseen in different sizes, so as to project into the chamber 30 in a different way.

The body 12 has notches or grooves 36 in its inner wall, in a position corresponding to the position of the holes 32, when the hole 23 is aligned with the housing 22. The walls of the notches 36 have a sloping shape, usually without sharp rises, to ease the sliding of the heads 34' when they enter and leave the notches.

Each neutral piston 26 has an end part 26' with a diameter suitable for entering the widened part 32' of the hole 32 (in the figures the diameter of 26' is smaller than the diameter 26; it could however also be equal or bigger, as long as it is correlated to the diameter of 32').

The lock can be completed with hardened steel pins 40 and 42 in the cylinder and in the body, in one of their zones near the outside, as is already known, to make any break-in with a drill difficult if not impossible. A key for the lock described is shown with number 50 and illustrated in figures 7 and 8. It comprises a shank 52, usually grooved longitudinally in a way already known (in this case the chamber 30 has a corresponding shape). Then on one side it has a succession of points and indentations, which make up a first numeration 54 corresponding to the arrangement of the end pistons 28, and two successions of notches respectively 56 and 58 on two opposite sides, making up two further numerations, which can be varied in each lock and its relative key.

There follows a description of the working of the invention.

When the chamber 30 is free, the hole 23 is aligned with the housing 22, the spring 25 presses the neutral piston 26, and this in turn presses the end piston 28. The piston 26 is located in an intermediate position between the housing 22 and the hole 23 (or between the body 12 and the cylinder 16) so as to lock any rotation of the cylinder 16 with respect to the body 12.

When the proper key for the lock is inserted into the chamber 30, the numeration 54 pushes the series of pistons 28 against the action of the spring 25, until the contact interface between 26 and 28 is on the ideal prolongation of the interface between 16 and 12 (figure 3). In this situation, neither the neutral pistons 26 nor the end pistons 28 impede the rotation of the cylinder. As the cylinder begins to rotate, the widened heads 34' of the auxiliary pistons 34 collaborate with the surface of the notches 36 and are pushed towards the inside for the length along the holes 32, for the amount allowed by the depth of the indentations 56 on the

key.

It will be noted that, if all the indentations 56 and 58 have the arrangement and depth foreseen for the numeration of the lock, there will be no hindrance to the rotation of the cylinder, and, since the point of the key will have the corresponding sprocket wheel 18 axially moved into the working position, the rotation of the cylinder will determine the rotation of the sprocket wheel, which will determine the sliding of the latch (in a way already known and therefore not illustrated).

When an unsuitable key or other object is inserted into the lock, at least one of the following cases takes place:

a) the outline 54 is wrong: at least one of the units comprising a neutral piston and the relative end piston does not have its interface aligned with the rotation surface of the cylinder and impedes the rotation of the cylinder in the body,

b) at least one of the indentations 56 or 58 is not deep enough: the head 34' of the respective auxiliary piston 34 remains projecting into the notch 36 and impedes the rotation of the cylinder,

c) at least one of the indentations 56 or 58 is too deep (figure 5):
the cylinder is able to rotate through an angle equal to the angle between the axis of the hole 32 of the said auxiliary piston and the axis of the hole 23; when the hole 32 comes into alignment with the housing 22, the neutral spring driven piston 26 enters the part 32' and locks rotation (also locking the improper key inside the lock).

Claims

1. A lock unit comprising:
- a body (12) having a slot (14);
- a cylinder (16) received into the said slot in a revolving manner around its own axis and connected to a sprocket wheel (18) for operating a latch or the like;
- a series of housings (22) in the said body in communication with the said slot;
- a series of holes (23) in the said cylinder, corresponding to the said housings and in communication with a chamber (30) for the key in the said cylinder;
- a neutral piston (26) and an end piston (28) received in each housing, being elastically driven to extend into the said housing and the said hole;

characterized in that it further comprises:
- additional holes (32) in the said cylinder, in communication between the said chamber and the outer surface of the said cylinder;
- at least one auxiliary piston (34) received in a sliding way in one of the said holes;
- notches (36) in the wall of the said body which delimit the said slot, the said notches being arranged in such a way as to collaborate with the said auxiliary pistons;
- each said neutral piston having an end part (26') with dimensions suitable for entering one of the said additional holes (32).

2. A unit according to claim 1, characterized in that the said auxiliary holes (32) are arranged at an angle with respect to the axis of the said hole for the end piston.

3. A unit according to claim 1, characterized in that the axis of each said additional or auxiliary hole (32) is coplanar with the axis of one of the said housings (22).

4. A unit according to claim 1, characterized in that it comprises a number of auxiliary pistons of different lengths.

5. A unit according to claim 1, characterized in that each piston has a rounded head (34') and each notch has rounded or sloping surfaces.

6. A unit according to claim 1, characterized in that it comprises a key (50) having a first series of indentations of various depths, making up a first numeration (54) and corresponding to the series of end pistons (28), and at least one second series of indentations (56, 58) of various depths making up a second numeration and corresponding to a series of auxiliary pistons (34).

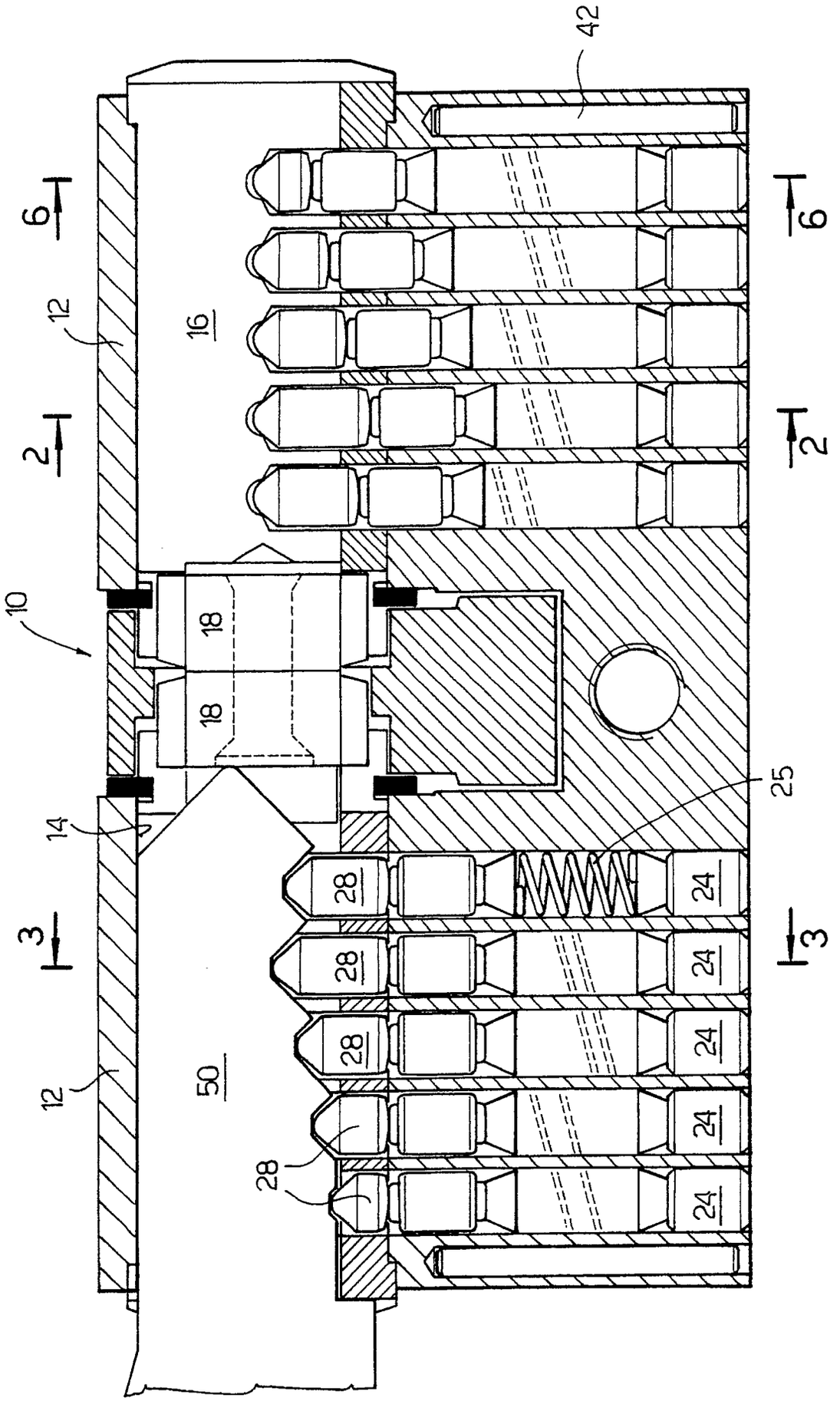

FIG. 1

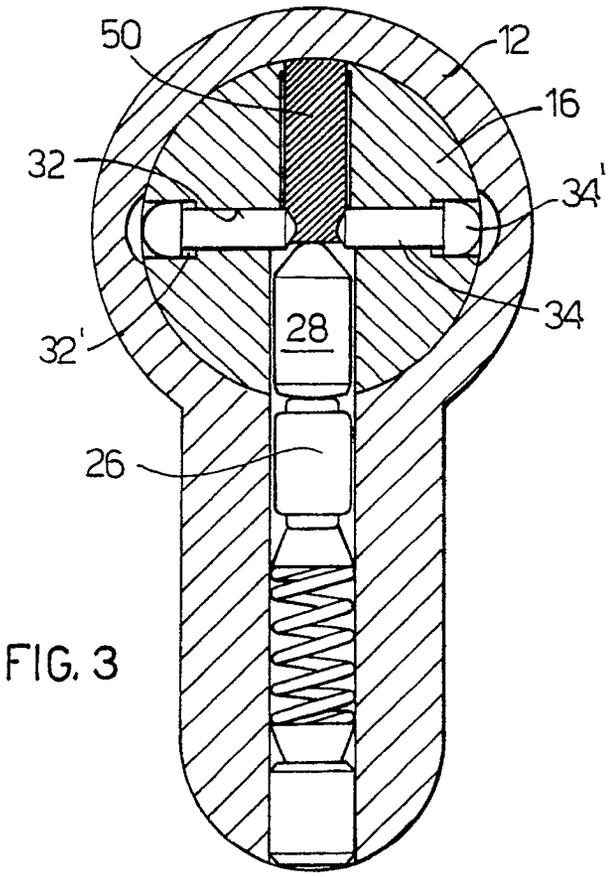

FIG. 3

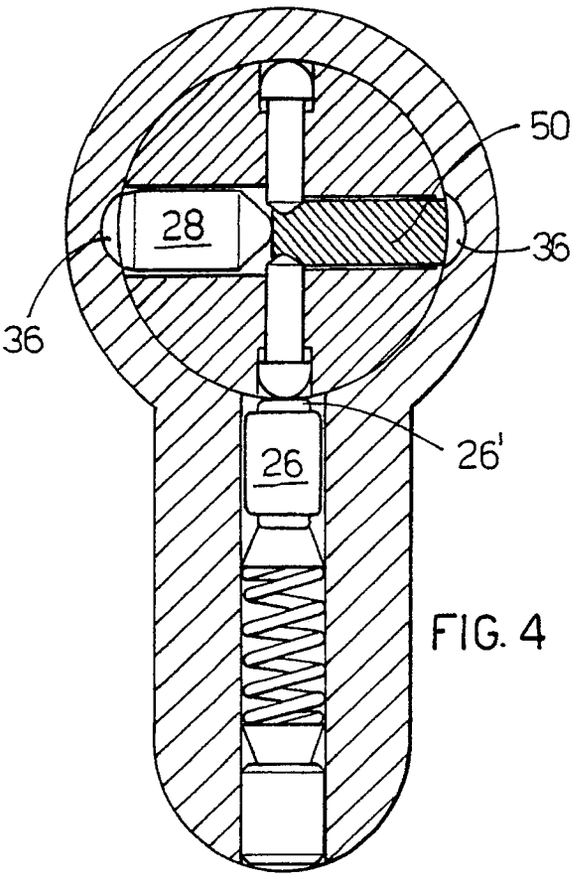

FIG. 4

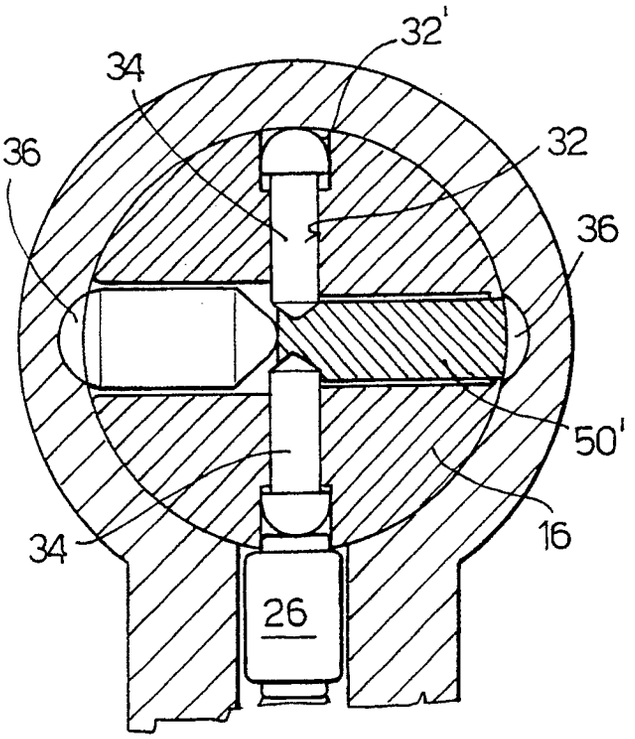

FIG. 5

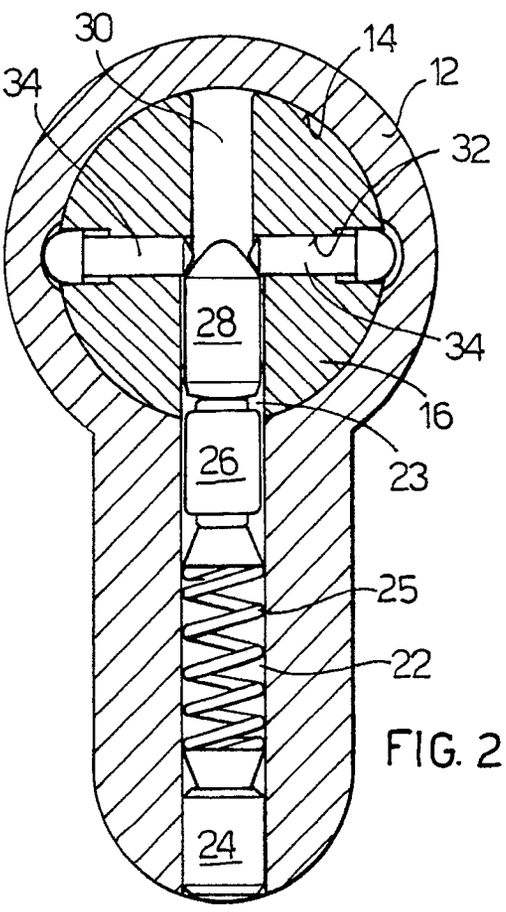

FIG. 2

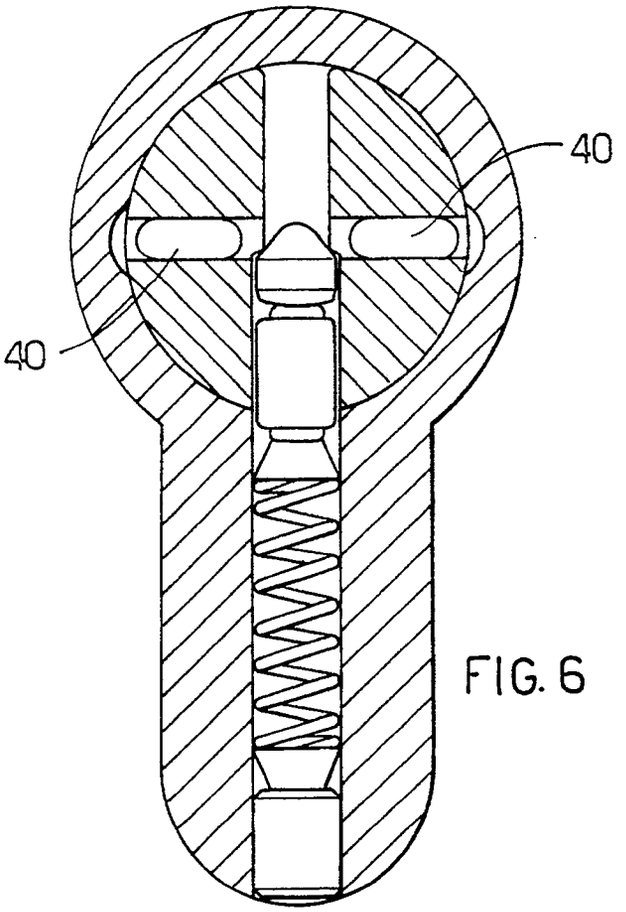

FIG. 6

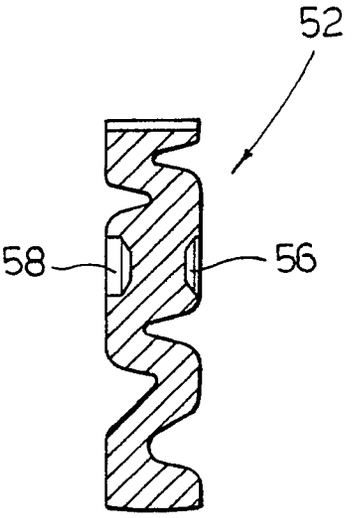

FIG. 8

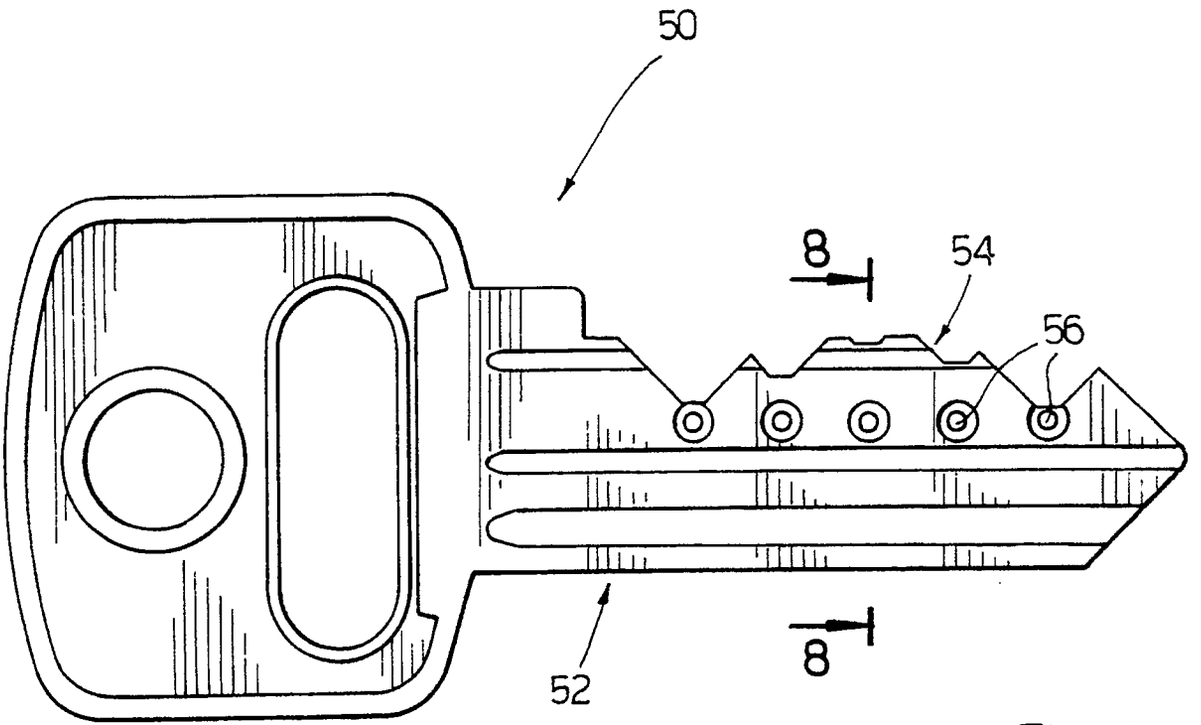

FIG. 7