# ROTATABLE MAGNETIC KEY COMBINATION ELEMENT

## FIELD OF THE INVENTION

The present invention relates to keys and locking apparatus generally, and more particularly to a key with a rotatable magnetic key combination element.

## BACKGROUND OF THE INVENTION

There are many magnetically actuated locks in the prior art. In general, the key that is used to actuate the lock has fixed magnets on the key blade or key shaft. These fixed magnets cooperate with magnetic elements located in the lock to bring the magnetic elements to a shear line, which is the unlocked position. For example, in prior art magnetic cylinder locks, the magnetic elements in the key are fixed whereas the magnetic elements in the plug of the cylinder lock are movable.

## SUMMARY OF THE INVENTION

The present invention seeks to provide a novel key device with a rotatable magnetic key combination element, as described in detail below. Unlike the prior art, the magnetic key combination element of the key can rotate, whereas the magnetic elements in the plug of the cylinder lock do not rotate.

There is thus provided in accordance with a non-limiting embodiment of the present invention a key device including a generally elongate shaft portion, and at least one magnetic key combination element disposed in the shaft portion which is rotatable about a rotation axis, wherein said at least one magnetic key combination element has an operative mode in which it rotates and aligns with a magnetic plug element such that said at least one magnetic key combination element magnetically interacts with said magnetic plug element and brings said magnetic plug element to a shear line of a cylinder lock, and wherein said rotation axis is not parallel to said elongate shaft portion.

In accordance with a non-limiting embodiment of the present invention a magnetization direction of the at least one magnetic key combination element is not collinear with the rotation axis (e.g., it is perpendicular or parallel to the rotation axis).

In accordance with a non-limiting embodiment of the present invention the at least one magnetic key combination element includes a diametral magnetic key combination element which has north-polarity and south-polarity magnetic portions. The rotation axis may be perpendicular to, coplanar with or parallel to, the elongate shaft portion.

The at least one magnetic key combination element may or may not be movable linearly along the rotational axis.

The at least one magnetic key combination element can protrude from at least one side of the key device.

There is thus provided in accordance with a non-limiting embodiment of the present invention lock and key combination including a key device including a generally elongate shaft portion, and at least one magnetic key combination element disposed in the

shaft portion, which is rotatable about a rotation axis, wherein said rotation axis is not parallel to said elongate shaft portion, and a cylinder lock including a cylinder lock housing in which a plug is mounted for rotation along a shear line, the plug including a keyway and being operatively ~~coupled~~ couplable to a cam, wherein the plug includes at least one magnetic plug element, and wherein after insertion of the key device into the keyway, the at least one magnetic key combination element rotates and aligns with the at least one magnetic plug element such that the at least one magnetic key combination element magnetically interacts with the at least one magnetic plug element against a force of a biasing device and brings the at least one magnetic plug element to the shear line.

In accordance with a non-limiting embodiment of the present invention the at least one magnetic plug element does not enter the keyway.

## BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be understood and appreciated more fully from the following detailed description, taken in conjunction with the drawings in which:

Fig. 1 is a simplified planar illustration of a key device with a rotatable magnetic key combination element, constructed and operative in accordance with a non-limiting embodiment of the present invention;

Figs. 1A-1C are simplified sectional illustrations of the rotatable magnetic key combination element of Fig. 1, taken along lines 1A-1A in Fig. 1;

Figs. 2A-2C are simplified side edge views of the key device, in which the magnetic key combination element can protrude from one side of the key device (Fig. 2A), or in which the magnetic key combination element can protrude from both sides of the key device or in which there are two such magnetic key combination elements and each one can protrude from one side of the key device (Fig. 2B), or in which the magnetic key combination element can be flush or below the key combination surfaces of the key device (Fig. 2C);

Figs. 3A and 3B are sectional illustrations respectively before and after insertion of the key device of Fig. 1 into a cylinder lock, wherein in Fig. 3B the key device moves a magnetic plug element in the plug of the cylinder lock to an unlocked position in which the magnetic plug element is at the shear line;

Fig. 4 is a simplified planar illustration of a key device with a rotatable magnetic key combination element, constructed and operative in accordance with another non-limiting embodiment of the present invention;

Fig. 4A is a simplified sectional illustration of the rotatable magnetic key combination element of Fig. 4, taken along lines 4A-4A in Fig. 4;

# CLAIMS

What is claimed is:

1. A key device comprising:

a generally elongate shaft portion; and

at least one magnetic key combination element disposed in said shaft portion which is rotatable about a rotation axis, wherein said at least one magnetic key combination element has an operative mode in which it rotates and aligns with a magnetic plug element such that said at least one magnetic key combination element magnetically interacts with said magnetic plug element and brings said magnetic plug element to a shear line of a cylinder lock, and wherein said rotation axis is not parallel to said elongate shaft portion.

2. The key device according to claim 1, wherein a magnetization direction of said at least one magnetic key combination element is not collinear with said rotation axis.

3. The key device according to claim 1, wherein a magnetization direction of said at least one magnetic key combination element is perpendicular to said rotation axis.

4. The key device according to claim 1, wherein said at least one magnetic key combination element comprises at least one diametral magnetic key combination element which has north-polarity and south-polarity magnetic portions.

5. The key device according to claim 1, wherein said rotation axis is perpendicular to a first key combination surface and a second key combination surface of said elongate shaft portion~~is not parallel to said elongate shaft portion~~.

~~6. The key device according to claim 1, wherein said rotation axis is coplanar with or parallel to said elongate shaft portion.~~

~~7~~6. The key device according to claim 1, wherein said at least one magnetic key combination element is not movable linearly along said rotational axis.

~~8~~7. The key device according to claim 1, wherein said at least one magnetic key combination element is movable linearly along said rotational axis.

~~9~~8. The key device according to claim 1, wherein said at least one magnetic key combination element can protrude from at least one side of said key device.

~~10~~9. A lock and key combination comprising:

a key device comprising a generally elongate shaft portion, and at least one magnetic key combination element disposed in said shaft portion, which is rotatable about a rotation axis, wherein said rotation axis is not parallel to said elongate shaft portion; and

a cylinder lock comprising a cylinder lock housing in which a plug is mounted for rotation along a shear line, said plug comprising a keyway and being operatively ~~coupled~~ couplable to a cam;

wherein said plug comprises at least one magnetic plug element, and wherein after insertion of said key device into said keyway, said at least one magnetic key combination element rotates and aligns with said at least one magnetic plug element such that said at least one magnetic key combination element magnetically interacts with said at least one magnetic plug element against a force of a biasing device and brings said at least one magnetic plug element to said shear line.

~~11~~10. The lock and key combination according to claim ~~8~~9, wherein said at least one magnetic plug element does not enter said keyway.