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### (54) Anti-bumping lock cylinder

(57) The present invention relates to a lock, and more particularly, to an anti-bumping lock cylinder. The anti-bumping lock cylinder comprises a lock cylinder barrel, a lock cylinder housing, columns of pin channels in rows in the lock cylinder barrel and the lock cylinder housing, which are arranged in communication with each other, lower pins in the pin channels of the lock cylinder barrel, cover pins at the top of the pin channels of the lock cylinder housing, springs, upper pins, and a key hole; and the lock cylinder is characterized in that an anti-bumping pin is provided in at least one column of each row of the pin channels of the lock cylinder barrel, the anti-bumping pin being suspended in the pin channel of the lock

cylinder barrel, the upper edge of the anti-bumping pin being lower than the plane of the lock cylinder barrel and the lower edge of the anti-bumping pin being higher than the bottom of the pin channel of lock cylinder barrel. A cylindrical thin pin is provided beneath each of the springs. When a bump key is bumped strongly, the bits of the bump key bump only the normal lower pins but not the anti-bumping pins. Further, due to the function of the cylindrical thin pin, it is even hard for the upper pins opposite to the anti-bumping pins to be ejected out of the pin channels of the lock cylinder barrel, which remain jammed between the upper and lower pin channels, so that the lock cylinder cannot be opened and security is ensured.

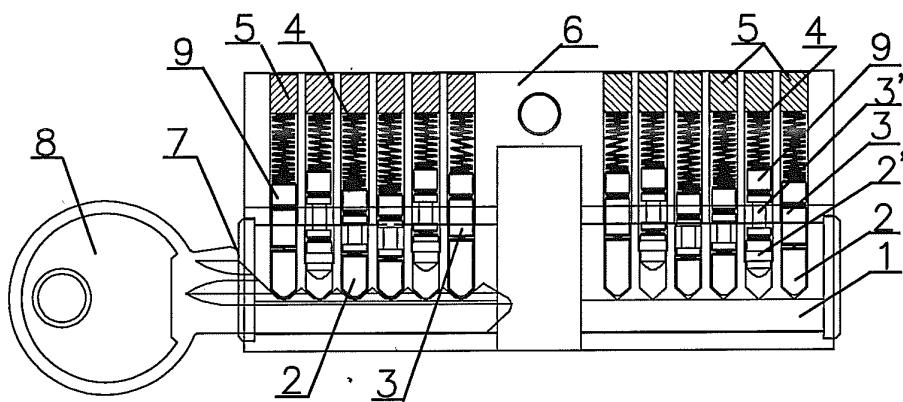


Fig. 1

**Description****TECHNICAL FIELD**

**[0001]** The present invention relates to a lock, more particularly, to a lock cylinder of a mechanical cylinder lock having a function of preventing unauthorized opening by a bump key, and especially to a lock cylinder of a mechanical cylinder lock having a function of preventing unauthorized opening through strong bumping of a bump key.

**BACKGROUND ART**

**[0002]** Now it is popular in the world to open a lock with a bump key or "999-key". Its principle lies in that bits of the key are made largest and after the bump key is inserted in a key hole, all the lower pins in a lock cylinder barrel can contact roots of the bits of the bump key. Then back portion of the bump key is bumped. Thus, due to the principle of acting force and reacting force, upper pins in the lock cylinder barrel are bumped out of pin channels in the lock cylinder barrel by the bump key. Rotating the lock cylinder can achieve the object of opening the mechanical cylinder lock. The key sometimes is called "passkey". To avoid any theft, peoples have paid attention to how to deal with the "passkey". Chinese Patent No. ZL97210117.9, entitled "A CYLINDER LOCK FOR PREVENTING BEING OPENED BY AN UNIVERSAL UNLOCKING TOOL", disclosed that "In the present invention, there provides a convex pin and an I-shaped pin as well as at least one cross pin. By means of a step formed by a projection in a middle portion of the cross pin, the lower pins cannot be ejected out of the lock cylinder barrel by an 'unlocking gun' under a torsion force. As a result, the lock can be prevented from being opened by various passkeys and 'unlocking guns'. " However, the lock cylinder of the mechanical cylinder lock according to this Chinese utility model requires modification of quite a lot of pins and is hard to install. Moreover, the most critical thing is that cylinder lock since all the lower pins in its lock cylinder barrel still touch the bottom of the lock cylinder when the cylinder lock according to this Chinese utility model is locked, this structure cannot resist bumping of a bump key. The cross pin of the lock can still be ejected out of the pin channel of the lock cylinder barrel under the acting force of the bump key which bumps the lock cylinder pins so that the mechanical cylinder lock is opened.

**[0003]** Therefore, it remains to be a problem how to deal with unauthorized opening of mechanical cylinder locks by a bump key. The mission to prevent the mechanical cylinder lock from being unauthorized opened by the bump key has become the responsibility of the technicians and experts in the art.

**DISCLOSURE OF THE INVENTION**

**[0004]** An object of the present invention is to disclose a lock cylinder which is simple in structure, easy to manufacture, and has a function of preventing unauthorized opening through strong bumping of a bump key.

**[0005]** The technical proposal of the present invention is as follows:

10 An anti-bumping lock cylinder, comprising a lock cylinder barrel, a lock cylinder housing, columns of pin channels in rows in the lock cylinder barrel and the lock cylinder housing, which are arranged in communication with each other, lower pins in the pin channels of the lock cylinder barrel, cover pins at the top of the pin channels of the lock cylinder housing, springs beneath the cover pins, upper pins disposed in the pin channels of the lock cylinder housing when the lock cylinder is opened, and a key hole; characterized in that an anti-bumping pin is provided in at least one column of each row of the pin channels of the lock cylinder barrel, the anti-bumping pin being suspended in the pin channel of the lock cylinder barrel, the upper edge of the anti-bumping pin being lower than the plane of the lock cylinder barrel and the lower edge of the anti-bumping pin being higher than the bottom of the pin channel of lock cylinder barrel; and in that a cylindrical thin pin is provided beneath at least one of the springs in the pin channels of the lock cylinder housing.

**[0006]** Said anti-bumping pin in the pin channel of the lock cylinder barrel is  $\Phi$ -shaped, and said anti-bumping pin has a smaller diameter in its upper and lower portions than that in its middle cylindrical portion.

**[0007]** The shape and dimension of said pin channel of the lock cylinder barrel in which the  $\Phi$ -shaped anti-bumping pin is provided matches the shape and dimension of said anti-bumping pin.

**[0008]** The advantages of the invention are as follows:

45 At least one hole for disposing the  $\Phi$ -shaped anti-bumping pin is made in the pin channel of the lock cylinder barrel, so that the  $\Phi$ -shaped pin is suspended in the middle portion of the pin channel of the lock cylinder barrel, do not fall onto the bottom of the pin channel of the lock cylinder barrel, and thus do not fall onto the root of the bit of the bump key. It can keep a thief who intends to bump the pins up in order to open the lock out of the door using the principle of acting force and reacting force, so that it provides greater security and ensures an anti-bumping function.

55 **[0009]** In the pin channels of the lock cylinder housing, a cylindrical thin pin is interposed between each spring and upper pin. The cylindrical thin pin is capable of increasing the compression force of the spring and thus

the elastic force accumulated in the spring. Moreover, the cylindrical thin pin can increase the resistance force when bumping out the pins of the lock cylinder barrel by a bump key. Even if the bump key bumps the pins of the lock cylinder barrel strongly, the lock cylinder according to the present invention can prevent any unauthorized opening by the bump key, so that it considerably increases assurance coefficient of the lock cylinder of the cylinder lock and ensures security.

**[0010]** If the invention is combined with other technologies for anti-prizing, anti-drilling and anti-drawing functions (prior art), a 4-anti function of being anti-prizing, anti-drilling, anti-drawing and anti-bumping can be achieved so as to produce a mechanical cylinder lock having the 4-anti function. Therefore, the invention is applicable to all the mechanical lock cylinders.

#### BRIEF DESCRIPTION OF THE DRAWINGS

**[0011]**

Fig. 1 is a structural schematic view (front sectional view) of an embodiment of the present invention; Fig. 2 is a top view of Fig. 1; Fig. 3 is a structural schematic view (enlarged) of an anti-bumping pin according to the present invention; Fig. 4 is a schematic view of a cylinder of a prior mechanical cylinder lock after being locked. It shows the conditions of lower and upper pins in pin channels of a lock cylinder barrel. It can be seen in the figure that all the lower pins in the pin channels of the lock cylinder barrel at the left side of the lock cylinder have contacted roots of bump key bits, which indicates that the bump key can eject the upper pins out of the pin channels of the lock cylinder barrel using the principle of acting force and reacting force.

#### BEST MODE FOR CARRYING OUT THE INVENTION

**[0012]** The invention will be described in more detail with reference to the figures hereinafter.

**[0013]** An anti-bumping lock cylinder comprises a lock cylinder barrel or plug 1 (Fig. 1), a lock cylinder housing 6, twelve columns of pin channels in two rows in the lock cylinder barrel 1 and the lock cylinder housing 6, which are arranged in communication with each other, lower pins 2 in the pin channels of the lock cylinder barrel 1, cover pins 5 at the top of the pin channels of the lock cylinder housing 6, springs 4 beneath the cover pins 5, upper pins 3 disposed in the pin channels of the lock cylinder housing when the lock cylinder is opened, and a key hole 7; characterized in that an anti-bumping pin 2' is provided in each of two columns (the second and fifth column in both the left and right rows) of each row (each row having six columns) of the pin channels of the lock cylinder barrel 1, the anti-bumping pin 2' being suspended in the pin channel of the lock cylinder barrel 1, the upper edge of the anti-bumping pin 2' being lower

than the plane of the lock cylinder barrel and the lower edge of the anti-bumping pin 2' being higher than the bottom of the pin channel of the lock cylinder barrel; and in that a cylindrical thin pin 9 is provided beneath each of the springs 4 in the pin channels of the lock cylinder housing 6, the thin pins 9 being interposed between the springs and the lower pins.

**[0014]** Said anti-bumping pins 2' in the pin channel of the lock cylinder barrel 1 are Φ-shaped, and said anti-bumping pins have a smaller diameter in their upper and lower portions than that in their middle cylindrical portion (Fig. 3).

**[0015]** The shape and dimension of said pin channels of the lock cylinder barrel 1 in which the Φ-shaped anti-bumping pins 2' are provided matches the shape and dimension of the anti-bumping pins.

**[0016]** The principle of the invention is as follows:

When a bump key 8 is inserted into a key hole 7 (Fig. 1), all the lower pins 2 in the first, third, fourth and sixth holes of the pin channels of the lock cylinder barrel bear against the roots of the bits of the bump key 8. However, the lower pins 2 in the second and fifth holes are anti-bumping pins 2', and the two anti-bumping lower pins 2' do not fall onto the roots of the bits of the bump key 8. Thus, if the bump key 8 is bumped, the bits of the bump key 8 can only bump the lower pins in the first, third, fourth and sixth holes of the pin channels of the lock cylinder barrel, and their bumping forces also only act on the four lower pins mentioned above. With the principle of acting force and reacting force, the four lower pins mentioned above bump their opposite upper pins 3 out of the respective pin channels of the lock cylinder barrel. However, the lower pins in the second and fifth holes are the anti-bumping pins 2' and the bits of the bump key 8 can not bump them so that the upper pins 3 opposite to the two anti-bumping pins are still jammed in the pin channels of the lock cylinder barrel. Therefore, the whole lock cylinder still can not be opened so that it has an effect of preventing unauthorized opening by the bump key. It should be mentioned especially that since cylindrical thin pins 9 are interposed between the springs and the upper pins, the cylindrical thin pins are capable of increasing the compression force of the springs and thus the elastic force accumulated in the spring. Moreover, the cylindrical thin pins 9 can increase the resistance force when bumping out the pins of the lock cylinder barrel by a bump key. Even if the bump key bumps the pins of the lock cylinder barrel strongly, the strong vibration of the lower pins bumped by the bump key can not eject the upper pins into the pin channels of the lock cylinder housing 6. In addition, with the effect of the cylindrical thin pins 9 and the anti-bumping pins 2' in the pin channels, the vibration waves produced by the lower pins bumped by the bump key will be staggered. While some upper

pins are ejected up, some other upper pins have just been subject to the vibration waves; and when these upper pins are subject to the vibration waves, said some upper pins have already fallen back into the pin channels of the lock cylinder barrel, so that it will considerably reduce the possibility of opening the lock cylinder according to the invention without authorization. In this way, it considerably increases assurance coefficient of the lock cylinder of the cylinder lock and ensures security.

**[0017]** On the contrary, as shown in Fig. 4, when the bump key 8 is inserted in the key hole 7, the lower pins 2 in all the six pin channels of the lock cylinder barrel pins contact the roots of the bits of the bump key 8. In this way, when the bump key 8 is being bumped, the bits of the bump key 8 act on all the lower pins in the pin channels of the lock cylinder barrel. With the principle of acting force and reacting force, all the lower pins mentioned above bump the respective upper pins out of the respective pin channels of the lock cylinder barrel, so that the cylinder lock is opened.

**[0018]** The present invention is applicable to all the mechanical lock cylinders. The I-shaped upper pins 3 as shown in Figs. 1 and 4 are anti-prizing pins. The lock cylinder has an anti-prizing function. If the invention is combined with other technologies for other functions such as anti-drilling and anti-drawing functions (prior art), the lock cylinder of the mechanical cylinder lock cylinder may have a 4-anti function of being anti-prizing, anti-drilling, anti-drawing and anti-bumping.

**[0019]** In addition, the pin channels in the lock cylinder barrel 1 and the lock cylinder housing 6 which are arranged in communication with each other can be arranged as twelve columns in two rows, or a plurality of columns in one row. Among these pin channels, anti-bumping pins 2' are provided in pin channels of the lock cylinder barrel 1 and cylindrical thin pins 9 are provided beneath the springs 4 in the pin channels of the lock cylinder housing 6, both of which belong to the solution of the present invention.

## Claims

1. An anti-bumping lock cylinder, comprising a lock cylinder barrel (1), a lock cylinder housing (6), columns of pin channels in rows in the lock cylinder barrel and the lock cylinder housing, which are arranged in communication with each other, lower pins (2) in the pin channels of the lock cylinder barrel, cover pins (5) at the top of the pin channels of the lock cylinder housing, springs (4) beneath the cover pins, upper pins (3) disposed in the pin channels of the lock cylinder housing when the lock cylinder is opened, and a key hole (7); **characterized in that** an anti-bumping pin (2') is provided in at least one column of each row of the pin channels of the lock cylinder barrel,

the anti-bumping pin being suspended in the pin channel of the lock cylinder barrel (1), the upper edge of the anti-bumping pin (2') being lower than the plane of the lock cylinder barrel (1) and the lower edge of the anti-bumping pin (2') being higher than the bottom of the pin channel of lock cylinder barrel; and **in that** a cylindrical thin pin (9) is provided beneath at least one of the springs (4) in the pin channels of the lock cylinder housing.

2. The anti-bumping lock cylinder according to claim 1, **characterized in that** said anti-bumping pin (2') in the pin channel of the lock cylinder barrel is  $\Phi$ -shaped, and said anti-bumping pin has a smaller diameter in its upper and lower portions than that in its middle cylindrical portion.

3. The anti-bumping lock cylinder according to claim 1 or 2, **characterized in that** the shape and dimension of said pin channel of the lock cylinder barrel in which the  $\Phi$ -shaped anti-bumping pin (2') is provided matches the shape and dimension of said anti-bumping pin.

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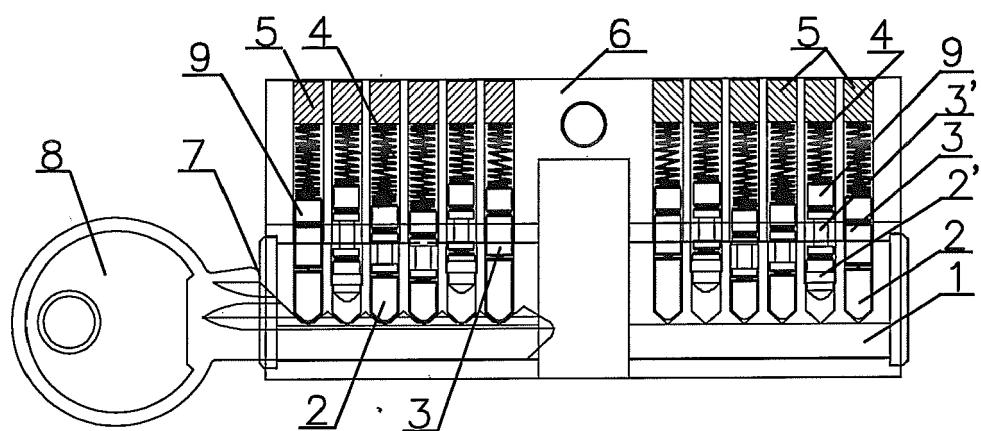


Fig. 1

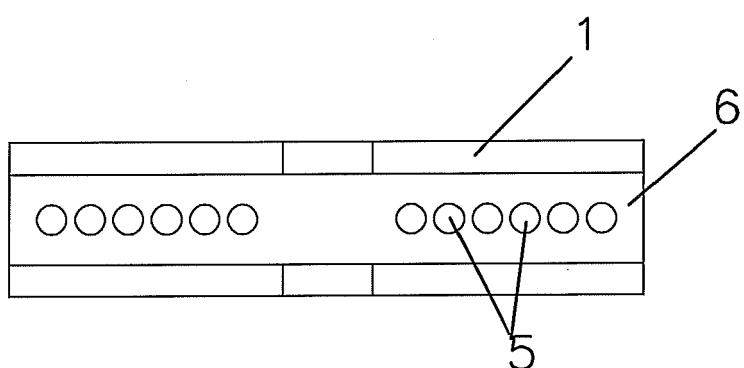


Fig. 2

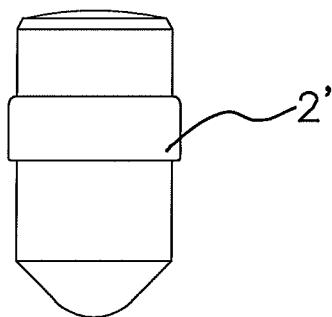


Fig. 3

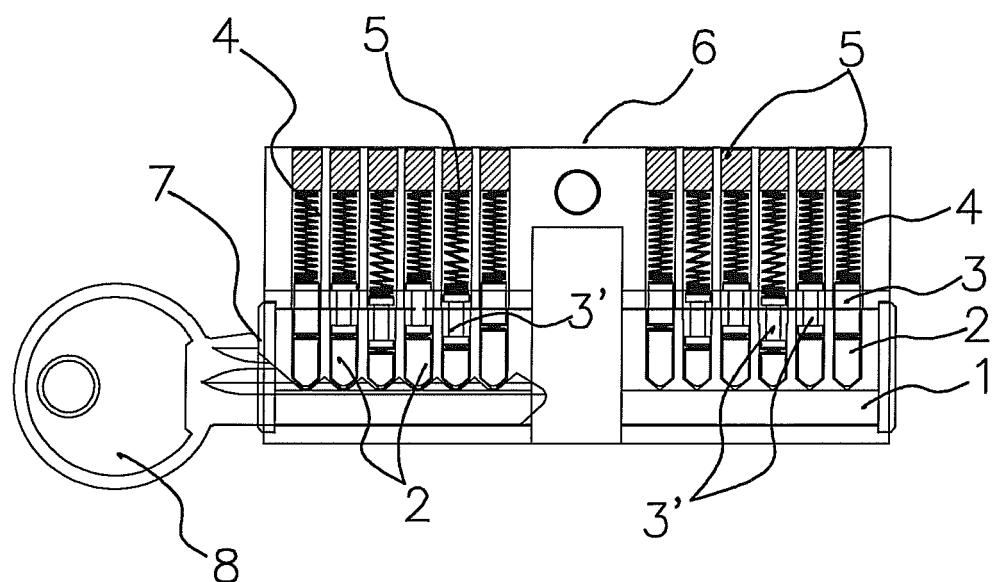


Fig. 4



## EUROPEAN SEARCH REPORT

Application Number  
EP 09 15 1281

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The present search report has been drawn up for all claims			
1	Place of search The Hague	Date of completion of the search 25 May 2009	Examiner Westin, Kenneth
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