

Magnetic Pin Tumbler Locking Mechanism: A Concept

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Abstract—This paper proposes a modification in the presently available conventional pin-tumbler locking mechanism. The conventional locks can be easily picked with the help of commonly available tools such as feelers, scrubbers and tension tools. The main objective of this paper is to enhance the security by incorporating magnets. The design is based on a basic phenomenon that the like poles when brought closer, repel each other. In the proposed model, the pins of the pin tumbler mechanism are replaced by magnetic pins and the key has flat cluster of magnetic and non-magnetic bars whose patterns are not visible. In the locked position, when the correct key is inserted in the lock, the combinations will match and the lock will be opened. The mechanism is designed such that if any wrong key is inserted, the magnets in the lock will readjust such that it will become even tougher to open the lock. Another very common problem associated with the conventional locks is that their patterns can be copied and the replica can be made very easily by any locksmith or even a layman. Since the combination used in the proposed design is not visible hence it cannot be copied.

Keywords: Lock, pin tumbler, key, magnetic

1. INTRODUCTION

This paper relates to advancement in the pin tumbler mechanism by incorporating magnets. The pins and key of conventional pin tumbler mechanism^{[4][2]} is replaced by magnetic pin and magnetic key. The aim of this paper is to enhance the security by reducing the chances of lock picking. The conventional pin tumbler lock can be easily picked up by lock picking tools (feelers, scrubbers, tension tools^[2] etc.) or by combination keys. The pin stacks of a conventional pin tumbler lock can be easily attacked and compromised regardless of how many pins are used in the lock. Even the replica of the key can also be produced easily. If the pattern of the key can be made non observable, so that the replica of the key cannot be made easily, there is a good chance that lock picking can be minimized. Keeping in mind that the lock is the most necessary device to secure money, important documents, expensive stuffs, etc. So there is a need to make this mechanism even better with improved security.

2. PRINCIPLE

The proposed mechanism is based on a well-known principle that “when like poles of magnets come close to each other, they tend to repel each other.”

3. DESIGN

Following elements of a conventional pin tumbler lock have been modified in the proposed design:

3.1 Key Pins

These are the bottom pins of the plug (inner cylinder) which engages with the key^{[1][2]}. In the proposed design, the key pins are replaced with magnetic and non-magnetic pins. The polarity of key pins are arranged in different ways to achieve a number of combinations.

3.2 Driver Pins

These are the upper pins of the plug (inner cylinder)^{[1][2]}. The driver pins along with the outer body are made of non-magnetic material.

3.3 Key

It is a flat cluster of magnetic and some non-magnetic bars as shown in fig.1. The polarity of magnetic bars arranged in key are same as that of the corresponding key pins arranged in the plug as shown in fig.3. If the corresponding key pin is of non-magnetic material then the bar of the key is also of a non-magnetic material. The non-magnetic bars incorporated just to increase the number of combinations.

The number of combinations will increase with the number of pins. For example, if n pins are used then the total number of combinations which can be made are 3^n .



Fig. 1: Key

4. WORKING

The mechanism works in a way that in the locked position, when the correct key is inserted in the lock, the combinations will match and the lock will be opened. The mechanism is designed such that if any wrong key is inserted, the magnets in the lock will readjust such that it will become even tougher to open the lock. The detailed working of the mechanism is discussed below:

1. The position of the pins when key is not inserted is shown in fig.2. In this position no force is acting on the key pins, therefore, the driver pins (upper pins) are positioned on the shear line and resist the rotation of plug (inner cylinder) and maintain the locking state.

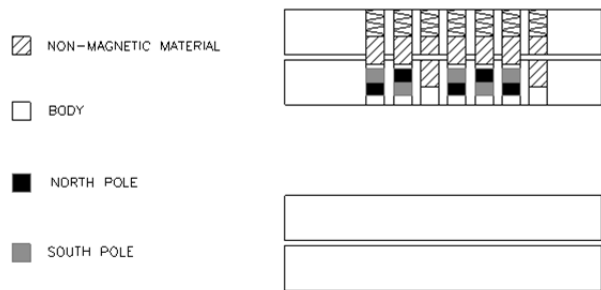


Fig. 2: Without Key

2. When the correct key is inserted, the same poles of key pin (lower pins) and bar tend to repel each other and force the driver pins (upper pins) against the spring. The length of driver pins is such that the repulsive force causes the movement of pins and make the gap (between key pin and driver pin) coincident with shear line. Thus rotation of key opens the lock as shown in fig. 3.

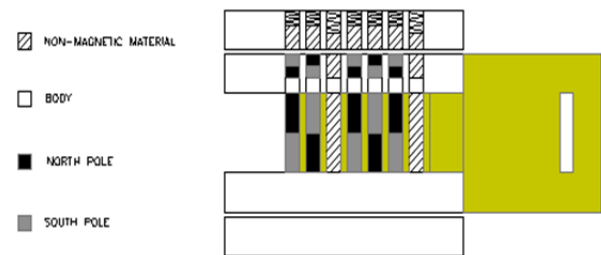


Fig. 3: Correct Key

3. When wrong key is inserted, the opposite poles of key pin (lower pins) and bar attract each other and thus the gap (between key pin and driver pin) is not aligned with the shear line as shown in fig. 3. So the lock is not opened with wrong key.

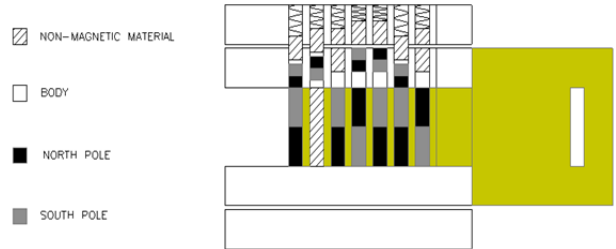


Fig. 4: Wrong Key

5. ADVANTAGES

Since the main purpose of lock is to provide security. So incorporating the magnets in the pin tumbler mechanism will result in the improvement of locking mechanism in following ways:

1. Lock picking using picking tools can be eliminated because thieves would not be able to move the pins by mechanical objects.
2. Security is improved because combination keys cannot be made easily.
3. It is difficult to produce the replica of key because pattern is non-observable.
4. Wearing is reduced because there is no mechanical contact between the key bars and key pins.

6. CONCLUSION

In current times the incidents of lock-picking are quite easy and common. There is a need to modify the locking mechanism so that incidents of lock-picking are reduced. The proposed mechanism effectively reduces the lock-picking and non-observable pattern of the key boosts the security standards of the pin-tumbler lock.

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