Physical Security (from Introduction to Computer Security, M.T. Goodrich, R. Tamassia, Pearson, 2011, ISBN 10-0-321-70201-8, Chapter 8, p. 379-434)

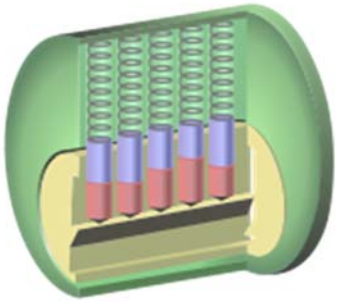
8.1. Physical Protection and Attacks

Physical security assumes physical measures to protect valuables, information, or access to a restricted resource.

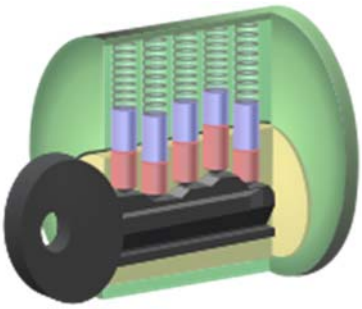
8.1.1. Locks and Safes

Tumbler locks (from https://en.wikipedia.org/wiki/Pin_tumbler_lock)

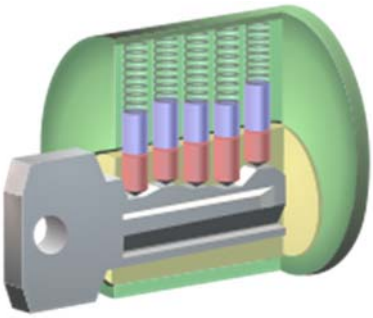
Modern Mechanism



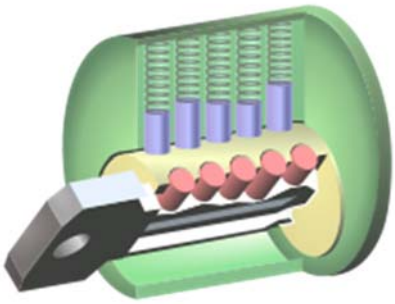
Without a key in the lock, the driver pins (blue) are pushed downwards, preventing the plug (yellow) from rotating.



When an incorrect key is inserted into the lock, the key pins (red) and driver pins (blue) do not align with the shear line; therefore, it does not allow the plug (yellow) to rotate.



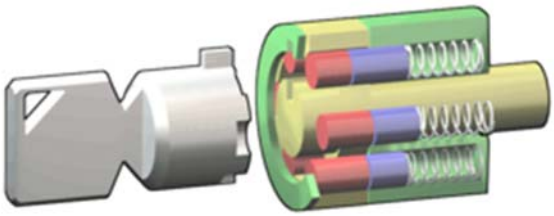
When the correct key is inserted, the gaps between the key pins (red) and driver pins (blue) align with the edge of the plug (yellow).



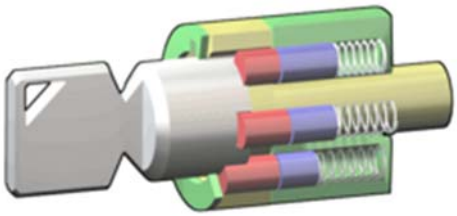
With the gaps between the pins aligned with the shear line, the plug (yellow) can rotate freely.

Tubular and radial locks (from https://en.wikipedia.org/wiki/Tubular_pin_tumbler_lock)

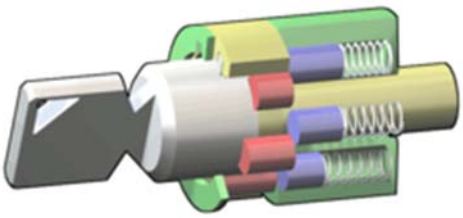
Mechanism



The key pins (red) and driver pins (blue) are pushed towards the front of the lock, preventing the plug (yellow) from rotating. The tubular key has several half-cylinder indentations which align with the pins.



The protrusion on top of the key fits into the rectangular recess in the lock, causing the indentations to properly align with the pins. When the key is inserted, the gaps between the key pins (red) and driver pins (blue) align with the shear plane separating the plug (yellow) from the outer casing (green).

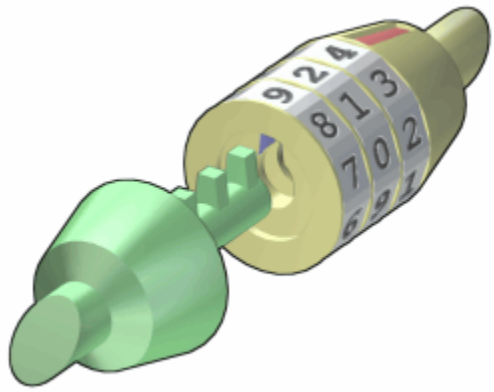


With the pins correctly aligned, the lock may turn.

Combination locks (from https://en.wikipedia.org/wiki/Combination_lock)

A [Wordlock] letter combination lock

Exploded view of the rotating discs. The notches on the disc correspond to the numerals in the correct combination. In this case, the combination is 9-2-4.



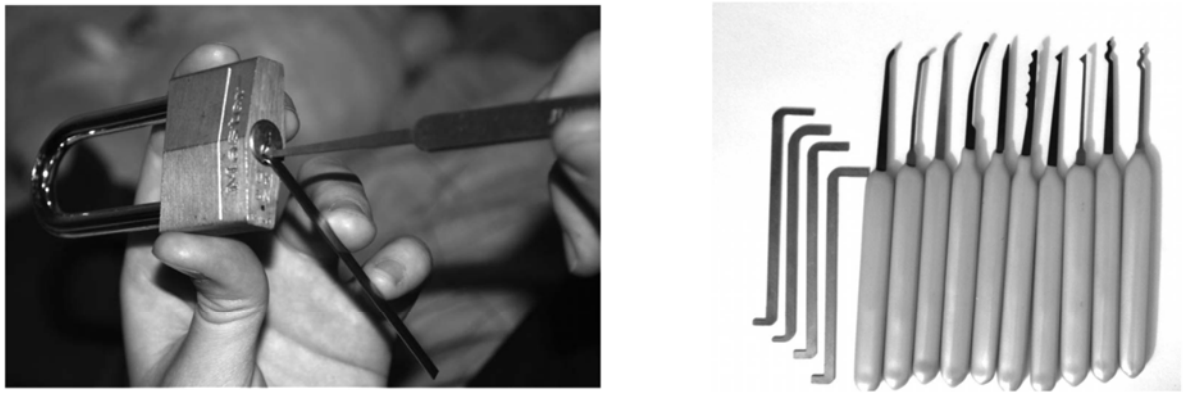
The discs are mounted on one side of the lock, which may in turn be attached to the end of a chain or cable. The other side of the lock, or the other end of the cable, has a pin with several protruding teeth

Electronic combination lock (from https://en.wikipedia.org/wiki/Electronic_lock)

A deadbolt electronic lock mounted in a home safe

Simple PIN electronic lock securing an elevator

Attacks on Locks and Safes



(a) (b)

Figure 2.5: Lockpicking: (a) A lock picker attempts to open a padlock by applying a rotational force with a tension wrench and picking the pins individually. Photo by Dan Rosenberg included with permission. (b) Lock-picking tools. Photo by Jennie Rogers included with permission.

Figure 2.6: Bump keys and hammer. Photo by Jennie Rogers included with permission.

Lock bumping is a technique that received widespread media attention in 2006. The technique utilises specially crafted bump keys, which are unique to each particular brand or lock.

A typical bump key (from https://en.wikipedia.org/wiki/Lock_bumping)

When bumping a lock, the key is initially inserted into the key way one notch (pin) short of full insertion. Bumping the key inward forces it deeper into the key way. The specially designed teeth of the bump key transmit a slight impact force to all of the key pins in the lock. The key pins transmit this force to the driver pins; the key pins stay in place.[9] This physics action can be visualized by observing the same effect on the desktop toy: Newton's cradle. Because the pin movements are highly elastic, the driver pins "jump" from the key pins for a fraction of a second, moving higher than the cylinder (shear line of the tumbler), then are pushed normally back by the spring to sit against the key pins once again. Even though this separation only lasts a split second, if a light rotational force is continuously applied to the key during the slight impact, the cylinder will turn during the short separation time of the key and driver pins, and the lock can be opened while the driver pins are elevated above the key way. Lock bumping takes only an instant to open the lock. The lock is not visibly damaged, although the force of the bump can leave an indentation on the front of the cylinder. Certain clicking and vibrating tools designed for bumping can also be used. These allow for rapid repetition of bumping against locks that have advertised "bump proof" features. Only a rare few key-pin locks cannot be bumped.

8.2. Authentication Technologies

Barcodes

(a) (b)

Figure 2.8: Examples of barcodes: (a) A one-dimensional barcode. (b) A two-dimensional barcode, which was used for postage.

One- or two-dimensional patterns using vertical lines, dots, squares, encoding data

SIM cards