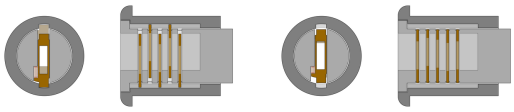
16:04 Bars of Brass or Wafer Thin Security?

by Deviant Ollam

Many of you may already be familiar with the internals of conventional pin tumbler locks. My associates and I in TOOOL have taught countless hackers the art of lockpicking at conferences, hackerspaces, and bars over the years. You may have seen animations and photographs which depict the internal components — pins made of brass, nickel, or steel — which prevent the lock's plug from turning unless they are all slid into the proper position with a key or pick tools.

Pin tumbler locks are often quite good at resisting attempts to brute force them open. With five or six pins of durable metal, each typically at least .1" (3mm) in diameter, the force required to simply torque a plug hard enough to break all of them is typically more than you can impart by inserting a tool down the keyway. The fact that brands of pin tumbler locks have relatively tight, narrow keyways increases the difficulty of fabricating a tool that could feasibly impart enough force without breaking itself.

However, since the 1960's, pin tumbler locks have become increasingly rare on automobiles, replaced with wafer locks. There are reasons for this, such as ease of installation and the convenience of double-sided keys, but wafer locks lack a pin tumbler lock's resistance to brute force turning attacks.

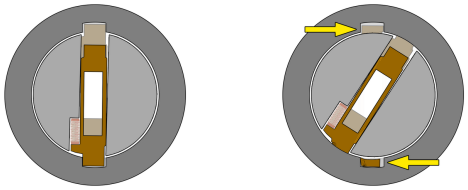


The diagram above shows the plug (light gray) seated within the housing sleeve (dark gray) as in a typical installation.

Running through the plug of a wafer lock are wafers, thin plates of metal typically manufactured from brass. These are biased in a given direction by means of spring pressure; in automotive locks, it is typical to see alternating wafers biased up, down, up, down, and so on as you look deeper into the lock. The wafers have tabs, small protrusions of metal which stick out from the plug when the lock is at rest. The tabs protrude into spline channels in the housing sleeve, preventing the plug from turning. The bitting of a user's key rides through holes punched within these wafers and helps to "pull" the wafers into the middle of the plug, allowing it to turn.

However, consider the differences between the pins of a pin tumbler lock and the wafers of a wafer lock. While pin tumblers are often .1" (3mm) or more in thickness, wafers are seldom more than .02" or .03" (well below 1mm) and are often manufactured totally out of brass.

This thin cross-section, coupled with the wide and featureless keyways in many automotive wafer locks, makes forcing attacks much more feasible. Given a robust tool, it is possible to put the plug of a wafer lock under significant torque, enough to cause the tabs on the top and bottom of each wafer to shear completely off, allowing the plug to turn.



Such an attack is seldom covert, as it often leaves signs of damage on the exterior of the lock as well as small broken bits within the plug or the lock housing.

Modern automotive locks attempt to mitigate such attacks by using stronger materials, such as stainless steel. An alternate strategy is to employ strategic weaknesses so that the piece breaks in a controlled way, chosen by the manufacturer to frustrate a car thief.

Electronic defenses are also used, such as the known resistance described by Brandon Wilson on page 7. Newer vehicles use magnetically coupled transponders, sometimes doing away with a metal key entirely.

Regardless of the type of lock mechanism or anti-theft technology implemented by a given manufacturer, one should never assume that a vehicle's ignition has the same features or number of wafers as the door locks, trunk lock, or other locks elsewhere on the car.

As always, if you want to be certain, take something apart and see the insides for yourself!