Locks: understanding and maintenance

(mainly old locks)

About locks

Locks have an obvious practical function: they are involved both with the practical need to keep doors etc. shut; and with security. Yet unlike most other mechanical devices, and other parts of buildings, they are commonly neglected, sometimes for literally centuries, until they fail.

This memorandum covers the most common British cases; there are however many exceptions and unusual locks still to be found in service.

Locks can be fitted to doors in several ways, the most common in Britain being:

- Rimlocks: these are fitted to the surface of the door (normally the inside face), so that all of the lock body is visible.
- Mortice locks: these are fitted into a slot (mortice) cut in the edge of the door.

Rim lock and mortice lock are terms only describing a method of fixing. The terms say nothing about either the lock's key mechanism (both have been made with a variety of key mechanisms), or function, quality, or security. The two commonest lock functions are: latch; deadlock.

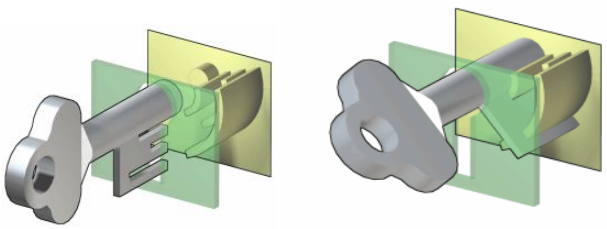
A sliding **latch** bolt can be pushed in by end pressure.

A **deadlock** for a door has a bolt moved in both locking and unlocking direction by key, usually from both sides. When shot out, it cannot be pushed in by end pressure (less than needed to destroy the lock).

Both deadlock and latch functions may be combined in one case. Modern upright two-bolt locks are often called 'sash locks'. Most of the locks on doors today are of these types of key mechanism:

Lock mechanisms: WARDS

A ***ward*** *is a fixed obstruction built into a lock* which prevents wrong keys from fitting into, or operating fully, to open a lock. The correct key is suitably shaped, or cut, to pass the wards in the lock.



Two diagrams showing the warded lock principle (in a single-sided lock), using wheel wards.

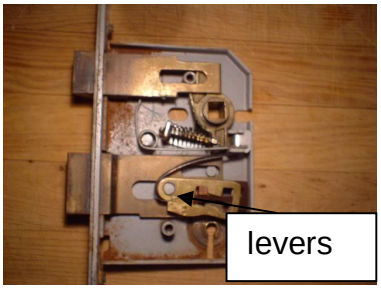
Some warded locks (12-mid20C) have no metal case. The mechanism is fitted on a backplate into a wood stock – the '[plate] stock lock' – or without a backplate – the 'Banbury stock lock'. Stock locks and metal-cased warded locks all have essentially the same mechanism.

Banbury stock lock and its distinctive key (left). Stock lock [plate stock lock] late 19C, removed from its stock, looking at the inside keyhole side (right).

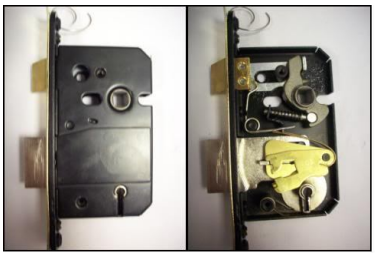
The 'church door lock' is a substantial (usually two bolt) stock lock, with metal bands or other decoration in ecclesiastical style. They date from the beginning of the 19C through to the early 20C. Church door locks, often of large size, were popular fittings, and many are still in service. They were used not only on churches, but also 'gothic' country houses and other buildings.

Typical robust 19C 'church door stock lock'.

Lock mechanisms: LEVERS



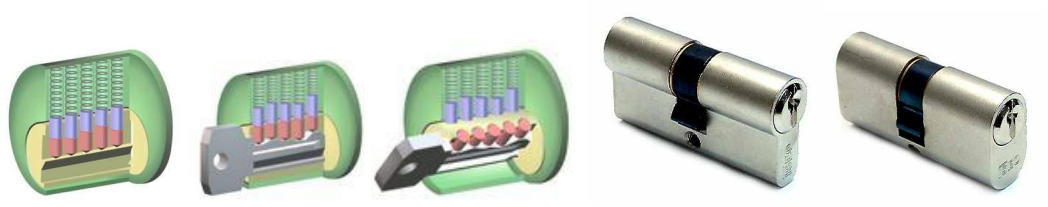
Basic 3 lever 2-bolt lock (sash lock) suitable for privacy for interior door — UNSUITABLE for exterior doors. This example shows H-shaped ('Chubb type') levers.



5 lever 2-bolt (BS3621) lock (sash lock) suitable for securing exterior doors. This example shows end-gated levers.

Lock mechanisms: PIN TUMBLER CYLINDER

Cylinder locks mostly use a pin tumbler cylinder locking device, as invented by Linus Yale Snr and Jnr. including round cylinders, and other profile 'cylinders', the euro-profile now being most common in Britain. (Other cylinder key mechanisms are available)



Pin tumbler cylinder cutaway diagrams

Two forms of profile cylinder locking device now common in Britain. Europrofile (left), Union oval (right).

Locks tend to have a hard life, usually with little or no maintenance. They are often neglected, sometimes for literally centuries, until they fail. Possibly the commonest problem with old (i.e. warded) locks (especially on outside doors) is stiffness caused by dirt and rust, and disuse. Be aware also that their nature is to have very strong springs, which makes them seem stiffer than modern locks. Frequent use can keep parts moving. Periodically operating little-used doors and their locks is good for them.

There is a wide choice of lubricants, using silicone, Teflon® (PTFE), graphite, synthetic oils, and a molybdenum compound (molybdenum disulphide). They should be used sparingly.

Dirt and foreign bodies

Old locks, especially rimlocks, but also mortice locks, commonly suffer rusting, which, with dirt, makes them very stiff. Moist air is acidic and therefore corrosive of iron and also dusty and gritty. This grit, mixed in grease or gummy old oil, makes a very effective grinding paste. It is now preferable to use a dry lubricant, preferably with corrosion inhibiting properties.

Fit of door

When lock service is needed, much of the testing is the same whatever type of lock is in use. That the door operates correctly and the lock aligns with its staple cannot be taken for granted on older buildings, and wooden doors.

Test door open:

1. Test that the door fully opens and closes without any binding. The commonest causes of binding are:

Loose hinges; swollen by damp; door dropped out of square; door opening out of square.

Inspect **modern mortice locks** for correct installation. British Standard locks should have a boxed keep, in which the bolt receiver is a little steel box welded to the back (i.e., inside) the long steel striking plate. Faces of mortice locks – and particularly the bolts – should not be painted.

Modern multi-point locks. – see a modern master locksmith

2. The lock's operation should be tested with the door open.

Test any latch. A spring-impelled sliding latch should push all the way in smoothly, and spring out again fully and lively when released

Using the correct key, test that the lock operates smoothly – from both sides if it is a two-sided lock. The lock must be tested for a **half-shot bolt**. It is common for a worn key not to throw the bolt fully, (especially when the key is turned slowly), and a deadbolt must be thrown fully and deadlocked by the key. **It should not be possible to push in the dead bolt by end pressure, nor to pull it out until it clicks.**

3. Test the lock with the door closed, ensuring that the bolt aligns with its staple. The lock should operate as fully and smoothly as with the door open. For doors hung on pintles, take the opportunity to clean the pintles thoroughly, and grease them with white lithium grease.

If the lock is not working correctly and smoothly, particularly if the deadbolt can be pushed in by end-pressure, the lock would need to be removed for examination – but very old locks might still be nailed onto the door and should not be removed. Such historic locks should simply be retired from service if not working now.

Lock (probably 14C) nailed through the oak door and ends of nails clenched over — not removable without damage.

Lock and key problems

Deadbolt half-shot, i.e. not fully thrown and locked when the key is turned. This is a most **serious fault**, and should have prompt attention, as the bolt is not actually locked, and can easily be pushed back by a simple tool! It **can usually be cured** by a new key, correctly fitted by a master locksmith. (This does NOT mean a copy of the existing worn key from a heel bar.)

Key wobbles in **worn keyhole**. Usually curable by a master locksmith. For pin tumbler cylinder locks replacement of the cylinder (with a 6-pin cylinder) is usually better and cheaper than repair.

Key does not turn easily, 'clicks', or is erratic. This usually is caused by a worn key or keyhole, and is usually cured by correctly fitting a new key. Test the key in **both** sides of a two-sided lock. In warded locks it can also be caused by bent and damaged wards – usually the result of forcing a wrong key. This is usually repairable by a master locksmith with experience of such locks, but usually involves removal of the lock.

Difficult to see in this picture, but the bridge ward on the upper right has been bent — this is easily remedied (late 19C stock lock).

If a lever lock key turns stiffly or with difficulty, must be jiggled, something – often the key, sometimes the keyhole – is worn. A master locksmith can usually remedy this.

Key has **little spring tension**, or latchbolt does not spring out. Weak or broken spring, which is repairable.

Lock is very stiff, with dirt or rust. Dismantle and clean – best left to a locksmith. This is more often a problem with very old warded locks, which need care. If the lock can be removed, it can be gently cleaned. Screws are not interchangeable. Soaking an iron lock first in kerosene will soften rust, which can then be removed by careful wire-brushing. After soaking with kerosene, which contains dissolved water, the lock should be washed with acetone or white petrol, and blown dry in a well-ventilated space. Both acetone and petrol are flammable. GT85 spray can then be used to protect the lock. – a dust mask should be worn.

19C 3-bolt rimlock (the coin is a £1). The practice of painting locks black is quite modern — up to the 19C locks were painted with the same paint as the door, or on varnished doors the lock was left with the finish as supplied, usually black japan or art black. Avoid painting over the bolts. This is especially important on modern locks with saw-resistant bolts.

Bridge ward clogged — needs cleaning; GT85 and toothbrush will shift most of this. The talon (notch) of the bolt tail is visible above the bridge; the tumbler is unseen below it.

Single-sided locks with a pipe key, such as a few old stock locks, sometimes have the drill pin, on which the key turns, become loose and wobbly. This is usually repairable, but involves removing the lock from the door, which might be difficult. If so, this fault might be a reason to retire an old lock from service, and keep it for historic value.

Pipe keys should be inspected for dirt or other foreign material clogging the pipe – this can prevent a key fully entering its lock if not removed.

Lubrication

Very old locks had no lubrication. They do benefit from being cleaned of loose dirt and rust, and *lightly* lubricated with a dry (PTFE or Moly) corrosion-resisting lubricant, such as GT85, or its matching white lithium grease. If this is done, the lock should be periodically inspected. Otherwise, grease and oil becomes gummy and holds abrasive grit which over time acts as a grinding paste. Springlatch bolts and their striking plates benefit from a *modest* smear of white grease. Periodic *use* keeps parts moving and prevents accumulation of rust.

Modern lever locks have mechanisms mainly of brass, which does not need lubrication. A slight smear of white grease on the bolt tail can be useful occasionally. Modern springlatch bolts and their striking plates benefit from a modest smear of white grease.

Pin tumbler cylinder locks should have nothing other than ONE puff of powdered graphite (bought from a locksmith) blown into the keyway. Additionally, some graphite may be rubbed onto the blade of the key with a finger. Cast-iron door hinges, unlike those are made of brass, also benefit from oiling. If pintles and cast-iron door hinges are lubricated, they should be inspected annually, and occasionally old grease or oil cleaned away and replaced.

Keys

Broken key — the result of dropping on a hard floor.

Keys of this quality should be carefully guarded – they are expensive to replace. This one, c1810, shows wear from the strongly sprung tumbler, the key having been used only from one side. Time to retire this key to secure storage (or display, if the lock is not relied on, e.g. its door cannot be opened from outside) and use a modern replacement.

Modern bronze replacement key for use on an 1890's stock lock. Not pretty, but functional. This lock is still in service, but this is not a final exit door – there are also bolts on the inside.

Additional keys

Modern keys are generally easy and inexpensive to copy, provided that the pattern key works well and smoothly. If it does not, take both the key and its lock to a master locksmith when asking for a duplicate.. One common problem on thick old doors is that many modern key blanks are not long enough for such thick doors. Lengthening the key is usually not difficult, but many locksmiths do not do it, so this is something to enquire about before ordering. It will be charged in addition to the basic cutting charge.

Old keys, for warded locks, can be a problem – some modern locksmiths do not make such keys.

Modern large cast key blanks for old locks can cost the locksmith up to £30 to buy. Charge for supplying these cut is likely to be a three-figure price for each key.

When ordering a copy of a key for a warded lock, the master locksmith will need the lock also, for several days, in order to make an accurate key.

There is a possible alternative for making duplicate old large warded keys, if a good working pattern key is available. Some master locksmiths can arrange for a cast bronze (not brass) copy to be made. The locksmith will need the key and lock for probably a month.

Finding a master locksmith

There is a search function on the MLA's site: www.locksmiths.co.uk to be sure it is a bona-fide MLA Approved Company. If at all possible, visit the bricks-and-mortar shop (there are genuine mobile locksmiths who operate entirely from a van with no retail premises, but they are less likely to be able to serve customers with historic locks, if they do not also have a workshop). When a locksmith arrives, he can be asked how long he has been in the trade and what experience and training he has undertaken, as well as what vetting he has undertaken. The great majority of locksmiths are honest, though with so many new entrants in recent years, some have little experience of old locks.

It is admittedly more difficult to find a competent reliable conservation locksmith able to work on old locks, rather than modern ones, and several of those who do, serve a national customer base. It need not be a matter of concern if one cannot be found locally.

Afterthoughts on security

Some historic locks are nailed on, or bolted on, and have been undisturbed for centuries. Desirable as it is to keep old locks in service, some are practically impossible to remove without damage. On balance, if such a lock has become faulty, probably the best course is to leave it alone, and retire it for historic merit only, then fit an additional lock, in a sympathetic manner.

Insurers have little confidence in most old warded locks, so will not accept them for final exit doors. Usually, a discreet small side door (which preferably is not a fire exit) can be used, and fitted with a modern lock or locks. In general, lever locks are more secure than pin tumbler locks, especially profile cylinders, though they have slightly larger keys. Most modern master locksmiths can advise on modern security, (or for fire exit doors, consult a Fire Prevention

Officer) including some possibly larger locks such as Bramah and Banham. There are also some larger foreign locks.

Where more than one lock is being fitted for security, it is useful to fit different types — or at least, different models. Although this can slightly inconvenience the user, foregoing the opportunity to have them keyed alike so fewer keys need be carried, it can greatly inconvenience potential burglars.

Push-button mechanical combination locks are not as secure as key locks, and should not be used on outside doors. Once known, the combination can be used without leaving any sign or damage. This is likely to frustrate any attempt to claim on burglary insurance. Profile cylinders with an inside thumbturn are vulnerable to an easy modern method of surreptitious opening from outside which causes no damage.

Further Information

GT85 and SG85 lubricants:

http://www.gt85.co.uk/gt85%20products.php

Master Locksmiths Association
5d Great Central Way, Woodford Halse, Daventry, Northants NN11 3PZ (MAP)
Telephone 01327 262 255 Fax 01327 262539
Email enquiries@locksmiths.co.uk / steffan.george@locksmiths.co.uk

http://www.locksmiths.co.uk/

Door & Hardware Federation
42 Heath Street, Tamworth, Staffs B79 7JH
Tel: Tamworth (01827) 52337 Fax: Tamworth (01827) 310827
Email: info@dhfonline.org.uk

www.dhfonline.org.uk The website has various free downloadable publications available.

A summary of the relevant standards for locks can be downloaded free from here:

http://www.dhfonline.org.uk/downloads/pub98.pdf

A summary list of other relevant British and other standards is here:

http://www.dhfonline.org.uk/standards.asp

A simpler summary listing is here:

http://www.securedbydesign.com/professionals/doorslocks.aspx

Advice on fire escape hardware can be freely downloaded here:

http://firecode.org.uk/Code_of_Practice_hardware_for_fire_and_escape_doors.pdf

This is a general leaflet on crime prevention tips, mainly intended for homeowners, but much is of wider application:

http://www.securedbydesign.com/aware/security-hints-and-tips.pdf

This is the companion leaflet for businesses; it contains much useful advice, including on physical security:

http://www.securedbydesign.com/pdfs/your-business-keep-crime-out-of-it.pdf

This is the Master Locksmiths' guidance for domestic security, quite detailed, covering windows, doors, and fire exits:

http://www.locksmiths.co.uk/wp-content/uploads/2012/04/MLA-MSR-OCT-2011.pdf

Some online directories of services:

http://www.buildingconservation.com/directory/prodserv.php

http://www.buildingconservation.com/directory/prodlist.php?category=Architectural+ironmongery

http://www.buildingconservation.com/directory/prodlist.php?category=Blacksmiths