

Schools Design Prize — Automatic Window Lock

The window lock project was a direct consequence of the A-level Design and Technology course. A list of possible final year projects was suggested, out of which the household lock seemed to be the most exciting; especially since a situation for design presented itself within my own home.

While preparing for a family holiday it was noticed how insecure a large wooden framed window was. Although shut, the window was not secure and would present no obstacle to a housebreaker. Obviously the project could be undertaken with a great deal more enthusiasm, with a real application in the home.

It was now possible to set a preliminary design brief.

To design a locking system to secure a large wooden-framed, hinged window. This was a rather sketchy brief but served as a starting point from which to undertake some detailed research into the area of window locks.

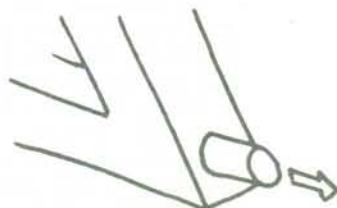
The research involved correspondence with a number of well-known lock manufacturers and visits to several home security shops, all of whom were very helpful. Once all of the research material was collected it was a matter of collating it into some meaningful order and analysing the data. All possible areas of locks were investigated, areas such as locking mechanisms, principles of operation, how to fit the device, the good points of all locks and the awkward disadvantages. A thorough analysis proved very rewarding and I was able to identify exactly what I wanted in my lock, enabling a more detailed design brief. This was:

To design a window locking system which could be fitted to a wooden framed window with the utmost ease and would operate with a very simple mechanism.

Since other people may have the requirements the lock should be made as adaptable as possible and produced with full fitting instructions.

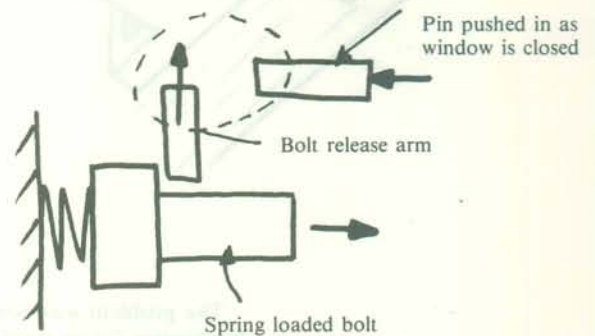
The detailed research enabled a comprehensive list of design parameters to be compiled. The parameters were then arranged in a factor interaction chart, where, as one may expect, the strength and size of the lock came out as the major consideration. It would also be necessary to design a strong fixing to the frame that could be easily applied.

With all preliminary design stages completed the idea sketches came freely and soon showed a bias towards a definite method of locking.

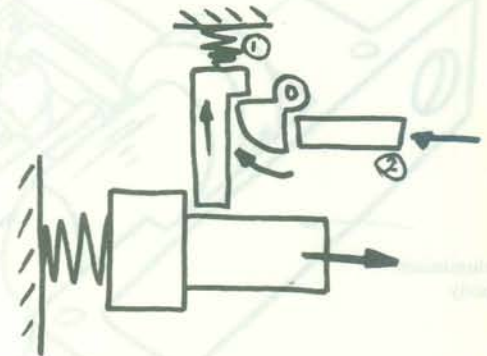


They seemed to envisage a bolt flying across into a housing as soon as the window is closed. Early ideas showed the bolt being within the actual frame, but this was soon rejected as the limitations of size and weakening of the frame were realised. This system would also have caused considerable problems during fitting which was defeating the object of the brief. So the locking mechanism would have to be treated as a separate entity to the frame.

Possibly the largest amount of time was taken up trying to design a mechanism suitable for the lock. The idea was to close the window and have it automatically release the bolt. The main problem was in transferring motion in one place into motion in another within the limited space available inside the lock eg: Area where motion in one plane is converted to motion in an orthogonal plane.



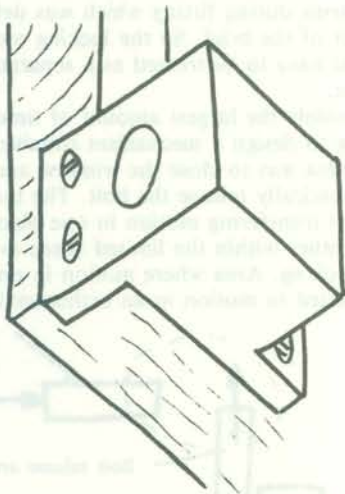
Several methods were tried to solve the linkage problem, such as inclined planes and arms with rollers on the end, but the best solution involved the use of a cam in the centre.



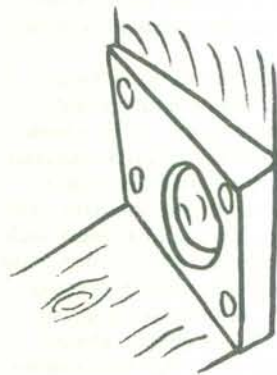
The mechanism itself is also spring loaded (1) so that it will return to its original position as soon as the outer arm (2) is free of the frame and can push back out.

Schools Design Prize Automatic Window

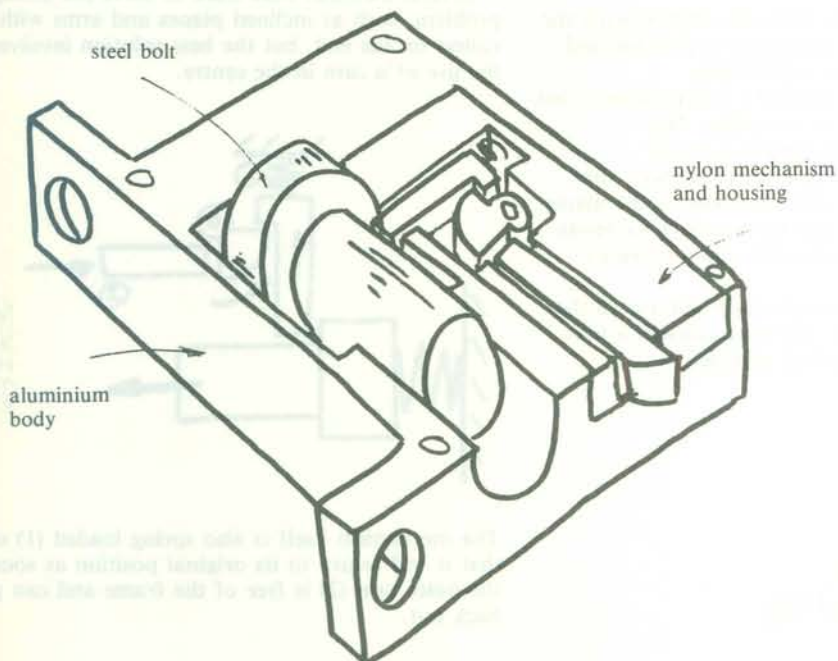
This whole mechanism would be housed within a main body which had to be fitted to the frame with the most strength and ease, and with as little alteration as possible to the existing frame. In fact the lock is held in place by four screws on two arms protruding from the main body of the lock, the only modification to the frame being a small cut-out in one corner.



The striking plate, that pushes pin in to release the bolt, and which then houses the bolt, is simply screwed to the inner frame.



The problem was now solved with an effective mechanism fitting nearly onto the existing window frame.



The materials chosen for the job were carefully considered so as to promote strength and ease of operations and maintenance.

The bolt is of a hardened tool steel and made of circular section so that any attempt to saw through it will be foiled by a rolling action.

The whole of the mechanism to release the bolt is made from nylon, which exhibits the self lubricating properties ideal for such an application. The whole of the mechanism comes in an individual unit that can be removed completely from the main body for maintenance, or replacement.

The main body is an aluminium block that was machined to house the bolt and mechanism. All of the components were machined in the school workshop and this had some bearing on the choice of materials and the way in which they were used. If the limitations of the school resources were removed, then certain changes would be made. All of the components, possibly with the exception of the bolt, would be cast. The nylon parts could be cheaply injection moulded and the main body would be cast in a zinc, or aluminium based alloy.

The completed lock was fitted onto a mock-up frame and fully tested and evaluated. It could be seen to fulfil the design brief in full and worked very efficiently. It offers many advantages over existing locks that would be used as main selling points.

The simple action of pulling the window closed will operate the mechanism, against the striking plate, and lock the window. The houseowner now knows that if his window is shut then it is locked and every window doesn't have to be meticulously checked and locked before leaving the house. The fact that no key is required is very important. A key can be easily lost or mislaid rendering a lock useless and ineffective, this is not a problem with the automatic lock. To unlock the window, no key is required again. Simply push a small flat object against the bolt (which is accessible through a small slot on the inside of the lock housing) and hold it back until the mechanism is clear of the frame and can slide back to its original position.

It could be said that this is too easy to open and would present no obstacle for a housebreaker. This is the same of any window lock and a determined thief can gain entrance via a window and any lock with a small number of tools. The lock acts as a deterrent and to a 'casual' housebreaker, who decides on the spur of the moment, this lock would act to deter him, with the solid metal block and no immediate access to the mechanism visible.

My immediate aims are a reduction in size of the lock, this should be easily possible with casting techniques available in industry. With a reduction in size and the new materials used for casting made available, the lock could be put on the market for around five pounds.

The lock is in the process of being registered and a number of lock manufacturers are to be approached, looking for possible marketing outlets.