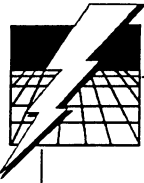


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# Introduction

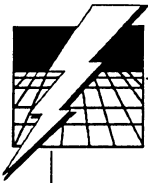
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Machines and mechanisms have been explored by people from the very beginning. They have evolved through needs, and from these needs basic principles have been derived. This book will show the importance of machines and mechanisms to our way of life. We may live in an electronic age but we still need mechanical devices to do the physical work.

The book is divided into five sections which extend the principles of mechanisms from simple to complex through everyday situations. The first section (**What Is a Machine?**) is an introduction to the vast range of everyday machines using simple concepts. The following four sections deal with situations in which we use a variety of machines to help us (**Helping Hand**), to move things (**Movement**), to measure (**Measurement**), and to control (**Control**). To help you understand and explore, there are over 40 tasks which question your knowledge of mechanisms. Those should be tackled in the context of project work.

When you come across an important word for the first time, it will be printed in **bold** letters. Try to remember these words and what they mean.

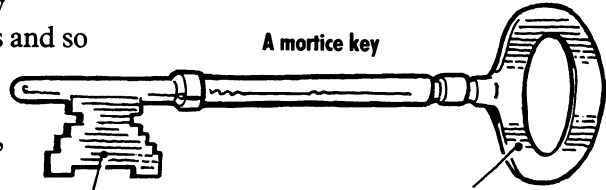
At the back of the book there is a mini-dictionary which explains the meaning of words that you may not have come across before. If you are not sure of a word, *look it up*.



# 1 What Is a Machine?

## The Key ...

Keys have quite a long history. Examples from excavations show that keys have been used for hundreds of years. Yet if you compare these keys with modern keys they have hardly changed at all. With so many inventions and so much development over the centuries, why is it that the key has not been 'improved'? We are not, at the moment, concerned with how the lock works but with the shape of the key itself.

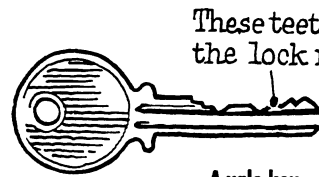


A mortice key

This part operates the lock mechanism.

This part is turned by finger and thumb.

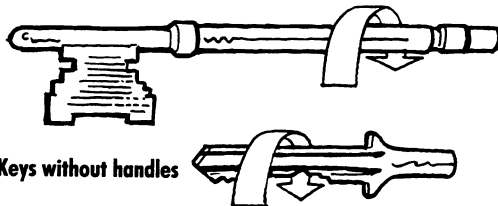
One answer to why the shape of the key has remained the same for so long is that it is a simple machine that works well, so there is no need to change it.



These teeth operate the lock mechanism.

A yale key

Could you make a lock work with the keys shown below?



Keys without handles

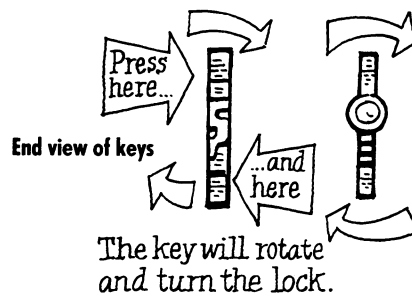
The older keys were much larger. Can you suggest reasons for this?

Come back to this page after you have learnt about **levers** and try to identify the type of lever used and the forces involved.

How easy is it to turn these keys?

The reason that keys have a larger end is to give more leverage.

Look at the keys end on.



## ... and Sauce Bottle

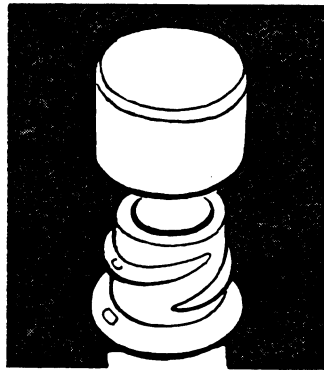
The screwtop does not have such a long history as the key, but let us ask, why is it used, and so frequently?

The main answer is that the screwtop makes an airtight seal.

When screwed on tightly, the inside of the top presses against the top of the bottle, thus keeping the contents fresh.

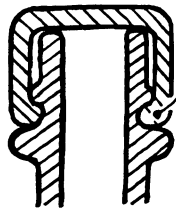
But why the screwtop?

This is a simple machine that works well, so it has been adapted for many uses.



The top of a sauce bottle showing a large screw-thread.

When it is first placed on to the bottle the top is loose. As you turn the top the **screw-thread** on the bottle comes into contact with two bumps on the inside of the top. As you continue to turn, the bumps are pulled down by the slope on the thread. The more you turn, the more the top is pulled down, and the better the seal.

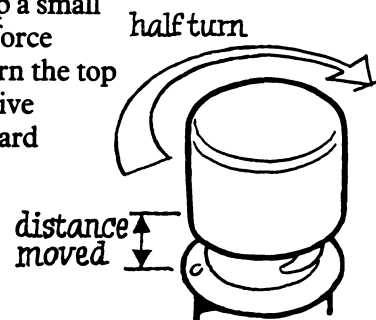


Cross section of the top of the sauce bottle with the cap.

Bump inside top

If you just pressed down do you think you could make the same seal? The reason for using the screw-thread is because you gain a mechanical advantage.

If you rotate the top by half a turn it will only move down or up a small amount. So the force that we use to turn the top is magnified to give a greater downward force.



The lid turns to close the bottle.

This will be explained in more detail in the next few pages.

### Task

Can you think of other objects that use the screw-thread?

# What Is a Machine?

## Where Are the Machines?

Is there a definition of a machine?

How about . . . almost anything manufactured to do a job is a machine, so anything from a supersonic plane to a nutcracker could be a machine.

We are surrounded by machines. They help us to do a variety of jobs and functions as a society. We have machines which move people and heavy objects, machines which build and destroy and, most importantly, machines which do whatever we want them to do.

The truth is that it is very difficult to avoid labelling every device as a machine.

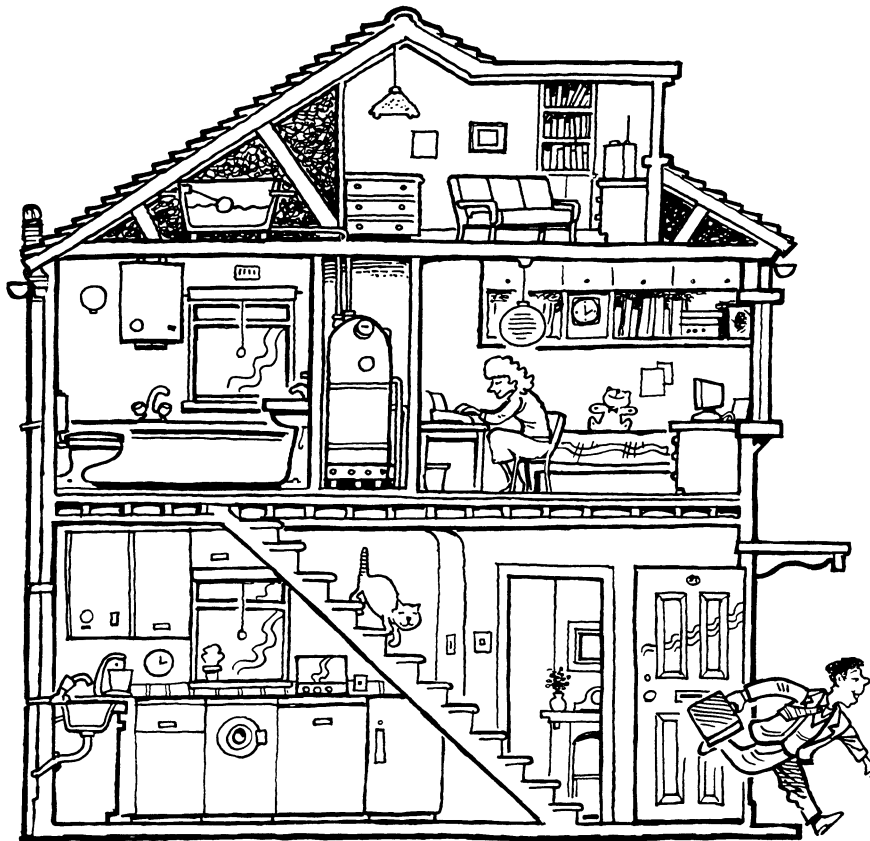
Are machines everywhere?

We are so used to making our lives easy that we forget how many types of machines we use daily.

Do you realize how many machines are used in your home in the short space of time between when you get up and when you leave for school?

Imagine now, if you can, all the different types of machines used on a farm, in a factory, on a building site, in an office, in a school, on the roads, on the railways, in hospitals. The list is endless.

We soon discover that we cannot live without machines.



A cross-section of a house showing the variety of everyday machines.