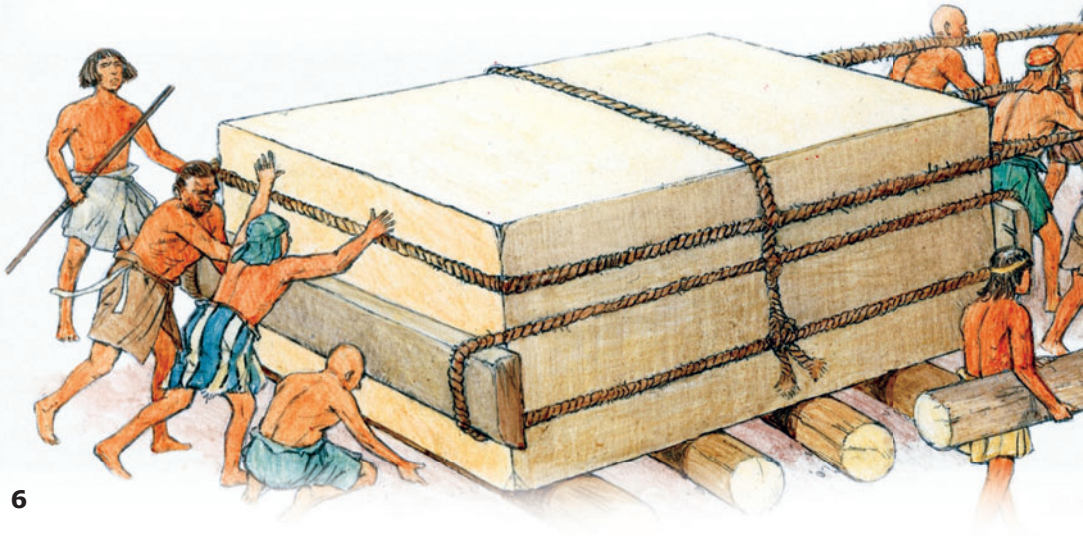
CHAPTER 1

# Inventing the Wheel

**IT'S A MAN-MADE INVENTION, IT HAS COMPLETELY CHANGED THE WAY WE LIVE, AND IT'S EVERYWHERE IN THE WORLD. WHAT IS IT? THE WHEEL!**

Wheels are all around us. You use them every day, but you probably don't think about them very often. In fact, the wheel as we know it is quite a new **invention**.

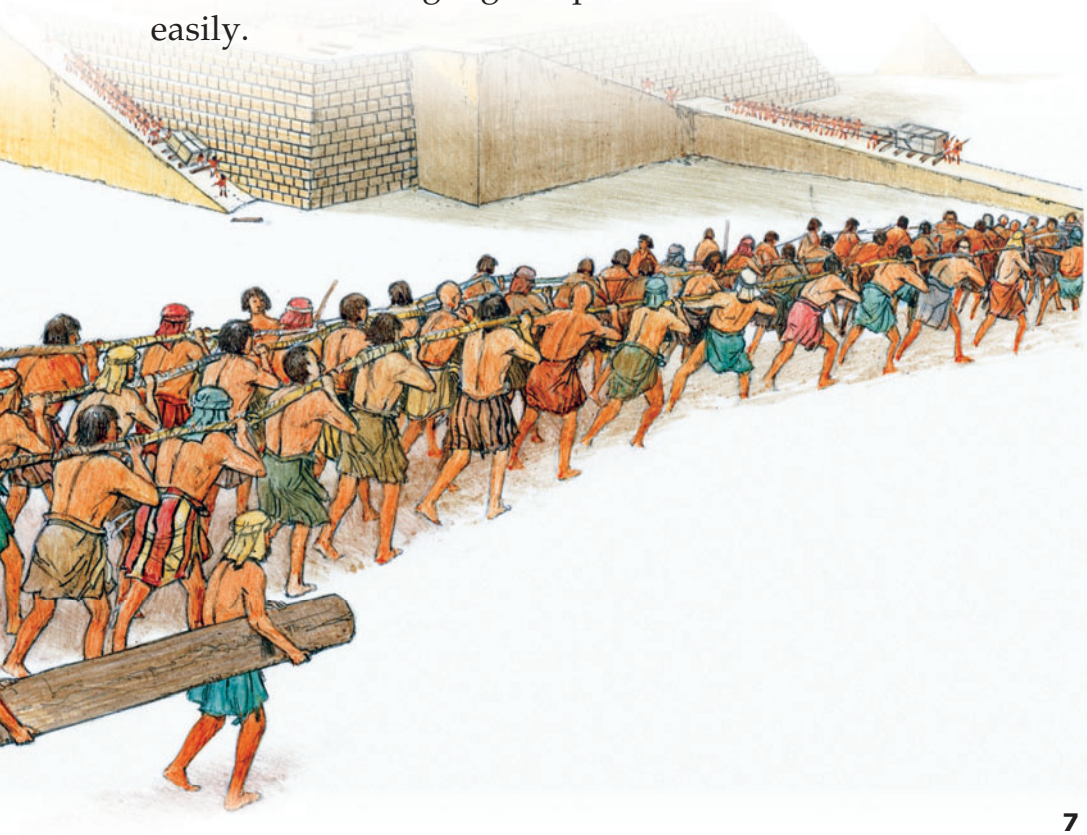
There are no real wheels in nature. There aren't any animals that use wheels to get around. But why not? Why are there no animals with wheels instead of legs? Perhaps because wheels aren't any good on some kinds of ground. It's hard to cross the desert or the forest or to climb a mountain on wheels. However, for humans, the wheel has been an amazing invention.



If there are no wheels in nature, how did people first make them? Nobody really knows the answer. There are many round shapes and circles in nature, but they aren't like wheels; they aren't used to help move things.

The earliest people worked with **stone**. So, maybe they saw round stones rolling. But they also made boats from wood. Perhaps they saw the logs they used for building boats rolling down a hill!

One of the earliest uses of logs to move things was in Egypt about 3000 BCE. Logs were used to build the pyramids. The heavy stones for these buildings were put on flat sleds and pulled forward over logs, called rollers. The rolling logs helped move the stones more easily.



The first wheels were solid wood.

The first real wheels were probably made in Mesopotamia, now Iraq. But **scientists** think that those first wheels were not used for moving a vehicle. They were used in pottery wheels. These machines turned quickly in a circle to help people make things like cups and bowls. Another early wheel, a millstone, was a heavy, round stone. It was used for breaking down plants for cooking and for making flour.[1]

The earliest pictures of wheels on vehicles are on Mesopotamian paintings from 3000–2700 BCE. These wheels were made of solid[2] wood and turned on a simple axle. Around 2000 BCE the Egyptians started using spokes on their chariot wheels. These wheels needed less wood, so they were cheaper to make. They were also much lighter and could travel faster.

[1] **flour:** used to make bread, cakes, etc.
[2] **solid:** without any holes or openings

The wheel was soon used by different groups of people across Europe and Asia. By 500 BCE, many types of wheeled vehicles were in use, from fast chariots to large, slow carts.[3] The wheels they used are much like the wheels we use today.

However, in other places in the world, wheels were never used. Central and South American peoples, like the Mayans or Incas, built amazing cities and temples without using wheels. Nobody knows why, but it may be because they lived in mountainous areas, where it was impossible to use wheeled vehicles.


A Mayan temple

Wheels are no good in high mountains, in deep snow, or in desert sands. Even today in the Sahara desert, animals like the camel are more useful than wheeled vehicles.

[3] **cart:** a vehicle with two or four wheels that is pushed by a person or pulled by an animal

[4] **all-terrain vehicle:** a vehicle that can travel on many different kinds of ground

**Video Quest**

**Legs or Wheels: part 1**

Watch this video about some men trying to make a new kind of all-terrain vehicle.[4] What is the idea behind the new invention?

CHAPTER 2

# Making Wheels Work

**THE WHEEL IS BEST KNOWN FOR ITS USE IN VEHICLES, BUT IT WAS FIRST USED IN INDUSTRY.**

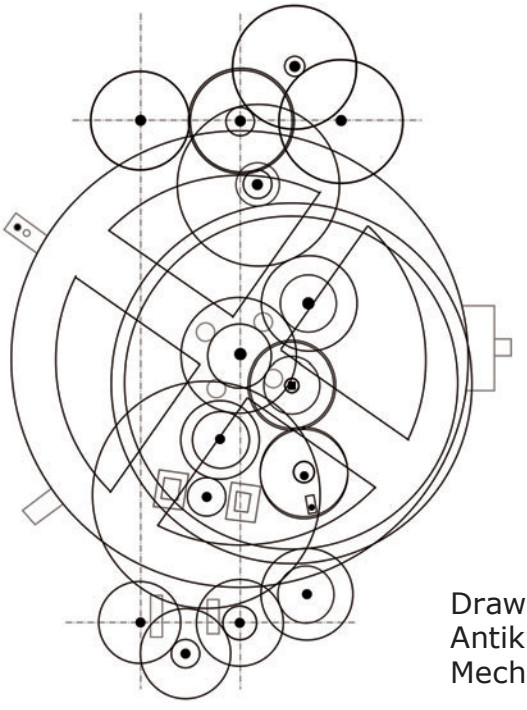
Throughout history machines have used wheels. And for a long time wheels also made machines work. The first wheel used for **power** was the waterwheel. This was a great improvement in **technology** because it let people use running water to power machines instead of using animals or other people.

The first waterwheel we know about was in a flour mill in Byzantium, now Turkey. The first waterwheels lay on their sides. But by 240 CE, in Alexandria in Egypt, people were using wheels that stood up in rivers and were much more powerful.

To use waterwheels to drive machines, people needed a way to send the power from the turning wheel to the things they wanted to work on. They used more wheels! They found that if you cut teeth into two wheels and put them together, the first wheel turns the second one.

As early as 330 BCE, the Greek inventor Archimedes talked about toothed wheels, called gears. He **realized** that when the teeth from the first wheel push the second, the second wheel turns in the opposite direction. But a third wheel moves opposite to the second, in the same direction as the first one. By putting gears together, you can send the power from a waterwheel to a machine. The Greeks used gears to make complicated mechanisms[5] like clocks.

[5]**mechanism:** one part of a machine that does a special job



Drawing of the Antikythera Mechanism

Perhaps the most **complicated** early use of gears that we know about is the Antikythera Mechanism. It was found under the sea in a shipwreck[6] near the Greek Island of Antikythera in 1901. There was a case with instructions in Greek, 30 gears, and 82 pieces made of the metal bronze.

Scientists thought that these pieces were part of a very complicated kind of clock, but it took them almost 100 years to put the pieces together! In fact, the Antikythera was a planetarium, a machine that shows the movements of the planets[7] and the moon around the sun. It was actually a kind of calendar. It showed scientists that the ancient world had complicated technology and knew a lot about space.

[6] **shipwreck:** a ship that sank in an accident

[7] **planets:** very big, round things, like Earth, that move around a star

Another important wheel for **industry** was the windmill. Windmills use sails to catch the wind and make power. Unfortunately, windmills only work if it's windy! But they have one great advantage. Waterwheels need rivers, but you can build a windmill anywhere that's windy. Modern windmills, called wind turbines, are used as a clean way to make electricity.


A windmill with sails

Finally, steam power, the key to the Industrial Revolution,[8] also used the wheel. Steam from boiling water moved wheels and powered machines. From the 17th century, steam power was seen more and more in mills and factories. By the 19th century, steam was powering the new trains and ships and driving forward trade[9] and industry. The age of industrial power had begun!


A steam engine

[8] **Industrial Revolution:** the time in history when machines in big factories started doing a lot of work

[9] **trade:** buying and selling things

**UNDERSTAND**

Describe two ways wheels were used in the past.

A bucket wheel excavator moving earth

CHAPTER 3

# A World Full of Wheels!

**WE SEE WHEELS EVERYWHERE WE LOOK.**

Wheels make modern transportation possible. There are big wheels, small wheels, fast wheels, slow wheels. Let's take a look at some facts about wheels, and some of the inventions that have made them better.

## Small wheels

The smallest motor vehicle you can drive on a road is the Peel P50. It was first built in the 1960s on the Isle of Man between England and Ireland, but only 50 were made. The P50 had only three wheels, was very light, and had just one front light and one door. It could only drive forward. If you wanted to go backward, you had to pull it by hand. But it was small enough to keep in your house!

An articulated truck

## Big wheels

The biggest vehicle in the world is the bucket-wheel excavator. These machines use very big wheels to move large pieces of earth. The biggest, the Bagger 293, is 96 meters tall and 225 meters long, and it weighs 142,000 kilograms! Its wheel is 21 meters across! But it can only move very slowly, traveling just half a kilometer an hour!

## Lots of wheels

The road vehicle with the most wheels is the articulated truck. These big, heavy vehicles carry food, animals, gas, and many other things. They often have five axles and eighteen wheels and are sometimes known as 18-wheelers. Only the front two wheels are like the wheels on a normal car. The other sixteen wheels sit in pairs on four of the axles. This makes the vehicle safer.