

From Wagon to Maglev: The History of Trains



Steam engine trains such as this used to be the main way that people traveled across the country.

Summary of Points

- The first "trains" were horse-drawn carriages that rode in tracks dug into the ground.
- The steam engine locomotive was invented in 1804 by Richard Trevithick.
- Steam engines use hot water to create steam. The pressure from the steam powers the engine and turns the wheels.
- Steam engines became very popular and changed human history.
- Diesel engines soon replaced steam engines.
- Diesel trains use fuel to ignite trapped air. The energy from the explosion turns the wheels.
- Maglev trains are a recent invention. They use strong electromagnets to push the train forward.

Why it Matters

- People have been trying to find the best way of transporting people and items for all of human history.
- Trains played an important role in history.
- People are always looking for quicker and more efficient methods of travel.

Words to Know



transport – carrying people and items from one place to another

steam engine – an engine powered by steam created from heated water

locomotive – a vehicle that runs on a track

diesel engine – an engine powered by diesel fuel

fuel – something that can be burned for energy

efficient – works well with little waste

maglev – a train that is pulled along by magnets

levitation – floating in the air

hyperloop – an idea for a train that runs at super-fast speeds inside a vacuum tube



Did you know?

The China-Europe Block Train is the longest train track in the world. At 8,077 miles, it connects Spain to China, spanning all of Europe and Asia.

Do you have family or friends who live far away that you visit? How do you travel to them? Do you drive, take an airplane, or ride a train? Nowadays, we sometimes take for granted the ability to travel from one place to another. In fact, travel used to be difficult and take a much longer time than it does today. Since ancient history, people have explored how to get themselves and their belongings from one place to another as quickly as they can.

The Oldest Trains

In Ancient Greece and Rome, people used wagons to **transport**¹ people and items from one place to another. These wagons, often pulled by animals, traveled much slower than modern cars. To make wagons move more quickly, Greeks and Romans sometimes dug tracks for the wheels to ride in. This made the wagon drive more quickly, and it is the earliest known use of train tracks.

Modern trains wouldn't be designed for another 2,500 years, until the year 1804, in Cornwall, England. The **steam engine**² was a new invention that used heated water to cause objects to move. Using the steam engine, Richard Trevithick created a **locomotive**,³ a vehicle that drives on tracks. His one-car "train" traveled on the tracks made for wagons. People were impressed that his machine had enough power to pull 70 people and 10 tons of iron. But at five miles an hour, his "train" drove slower than a horse. And the train tracks were made for lighter carts. In 1808, he started charging people to ride in his steam locomotive.



The very first locomotive, built by Richard Trevithick Credit: OprendeK, Wikimedia

- 1 **transport** – carrying people and items from one place to another
- 2 **steam engine** – an engine powered by steam created from heated water
- 3 **locomotive** – a vehicle that runs on a track

This worked well until the heavy locomotive broke the rail and tipped on its side with the riders still inside! People stopped taking the idea seriously, and Trevithick died penniless.

After Trevithick's death, his idea started "gaining steam." By 1845, steam engine trains were widespread in Britain, carrying 30 million people a year. The United States started using trains as well. In around 1830, Peter Cooper introduced steam locomotives to America. He actually raced his train, named "Tom Thumb," against a horse. Tom Thumb raced as fast as it could go and nearly won! But before it crossed the finish line, a piece of the train broke off. The horse galloped to the end, and Tom Thumb lost.

Steam engines in the United States played a big part in the country's history. They helped the North win the Civil War. Trains moved people across the country to the rural West. By 1916, there were enough railroad tracks in the U.S. that if they were lined up next to each other, they would have reached the moon!

Modern-Day Trains

Steam engines were exciting. People loved hearing the whistle of the steam coming out of the smokestack and watching the train puff away in a cloud of white smoke. However, steam trains cost a lot of money to run, and the trains had to stop often to fill up with water. In 1890, Rudolph Diesel invented the **diesel engine**.⁴ Instead of boiling water and using the steam to power the engine, diesel engines work by burning **fuel**.⁵ Because diesel engines are more **efficient**⁶ than steam engines, most trains you see today run on diesel fuel.



*Although they lacked the noise, smoke, and excitement of the steam engines, diesel locomotives became the main type of train used in the 1900s.
Credit: Markv, Wikimedia*

4 **diesel engine** – an engine powered by diesel fuel

5 **fuel** – something that can be burned for energy

There is a new type of train without any engine inside it at all. We call these super-fast trains “**maglev**,”⁷ short for “magnetic **levitation**.”⁸ Levitation means to float in the air. Maglev trains use magnets to literally keep the train in the air and move it forward. The maglev train is much more efficient than a diesel train, and it does not need a driver. Also, the magnetic force keeps it moving at a constant speed.



Travelers on Japan's Shinkansen bullet train get to see the beautiful Mount Fuji as they speed past. Credit: tansaisuketti, Wikimedia

When all the trains on the track move at the same speed, there are fewer accidents, and the trains are almost always on time. Japan is famous for its bullet train that relies on maglev technology to travel at 200 miles per hour. Its Shinansen train system attracts many tourists who enjoy the smooth ride and the beautiful views of Mount Fuji. Japan plans to develop maglev trains that run even faster. Their goal is to connect the cities of Osaka and Tokyo with trains that travel at more than 300 miles per hour.

Trains of the Future

American inventor Elon Musk wants to design a new mode of transportation. His **hyperloop**⁹ vehicles will run on maglev rails. But they will also be inside a massive vacuum tube. He intends for the vacuum to literally suck the train cars across land at high speeds, even faster than airplanes can go. Musk imagines all the countries on Earth connected by high-speed vacuum tubes. He plans to replace older trains and even airplanes with his hyperloop. Is this the future of train transportation? Who knows? One thing is for sure—we have come a long way from horse-drawn trains. Maybe you can help design the trains of tomorrow.

6 **efficient** – works well with little waste

7 **maglev** – a train that is pulled along by magnets

8 **levitation** – floating in the air

9 **hyperloop** – an idea for a train that runs at super-fast speeds inside a vacuum tube

Different Engines, Different Methods

How does a steam engine work?

Think about a pot of pasta. The boiling water in the pot turns to steam that rises out of the pot when heated. Put a lid on the pot, and the pressure inside builds up. Pressure is a force created when something is pushed into a tight space. All the steam in the pot wants to escape upwards and out of the pot, so it pushes against the pot lid. The force of the steam under pressure is able to push and move things. You may see this in the pasta pot, when the lid rattles and moves because of the steam pushing it. The steam engine also uses steam and pressure. By controlling how much steam is let out, the heat energy can be changed to motion. The steam engine uses cranks, levels, pistons, and gears to change the direction of the motion. The steam engine can push things up and down, side to side, and in a circle.

What is diesel?

Diesel usually means the type of fuel (gas, oil, coal, etc.) that powers the engine. Diesel engines trap air, which gets heated up. The diesel fuel ignites when it is heated under pressure. This causes a mini explosion, and the energy from the explosion is changed into energy of motion using pistons, cranks, and gears.

How does a maglev train work?

Hold up two magnets and you will see that one side of the magnet is attracted to the other. Flip one of the magnets over, and you will notice that you won't be able to get them to attach. This is because the magnets are repelling each other. The maglev train has super strong electromagnets. The electromagnets are on the corners of the train and on the rails on the sides of the train. Because the magnets are being repelled, the train levitates in the air between the tracks. The forces of attraction and repulsion pull the train forward at high speeds.

Questions



1. Circle the choice that has the same meaning as the following sentence from the lesson: *Musk imagines all the countries on Earth connected by high-speed vacuum tubes.*

- A. Musk wants to clean up countries with high-power vacuums.
- B. Musk believes that vacuums will one day blow country dirt through tubes.
- C. Musk has an idea of uniting Earth through fast vacuum tubes.
- D. Musk thinks that all countries on Earth should unite.

2. Circle the vocabulary word that best fits the sentence.
The magician caused his cat to float using (levitation, transport).

3. Mark each statement as T (true) or F (false).

- ___ To make wagons move more quickly, Greeks and Romans sometimes dug tracks for the wheels to ride in.
- ___ "Tom Thumb" won the race against the horse.
- ___ Trevithick's locomotive traveled faster than cars.
- ___ Diesel engines are more efficient than steam engines.
- ___ Maglev trains do not need drivers.

4. Place a check mark next to each statement that correctly describes maglev trains.

- Maglev trains can heal people's hearts.
- Maglev trains use magnets to keep the train in the air.
- Maglev trains travel slower than boats.
- Maglev trains move at a constant speed.
- Maglev trains need three drivers.
- Maglev trains get into fewer accidents.

5. What was the author's purpose in including the paragraphs describing Greek and Roman tracks? Circle the correct answer.

- A. The author wanted to show that Greeks are smarter than Romans.
- B. The author wanted to mention the first known use of train tracks.
- C. The author wanted to compare maglev trains to locomotives.
- D. The author wanted to show the effect of trains on the environment.

6. Which phrase in the paragraph about Peter Cooper helped the author introduce the idea that trains became more popular?

7. Contrast steam trains and diesel trains. How are they different?

8. How have trains changed since they were invented?
