

**The AM Radio****Inventions that Shook the World Series****Grade Levels:**

5-12

**Subject Areas:**

Science

Technology

Engineering

Math

**Synopsis:**

In 1906, Reginald Fessenden successfully transmitted sound wirelessly. His work leading to this achievement included unsuccessful attempts at creating artificial radio waves using spark gap technology. His persistence and innovation eventually allowed him to create a continuous radio wave using an alternator, and eventually transmit the human voice wireless to ships at sea.

**Learning Objectives:** Students will:

- Understand the role that trial and error plays in inventions.
- Explain why radio waves were used to carry the sound waves created by the human voice.
- Analyze the innovative nature of wireless communication during this time, including its practical applications.
- Appreciate the personal characteristics that help inventors successfully overcome obstacles.

**Vocabulary:**

invention, radio waves, sound, Reginald Fessenden, spark gap transmission, wireless communication, wave frequency, static, Marconi, amplitude, alternator, mechanical energy, electrical energy, amplitude modulation

**Pre-Viewing Discussion:**

What inventions in communication do you think preceded the AM radio?

How do you think inventors use existing technology and innovation to create something new?

What obstacles have you encountered when trying to accomplish a goal? How did you overcome them?

**Post-Viewing Discussion:**

Why was wireless communication important? What practical applications did wireless communication have at this time?

What were some of Fessenden's first jobs?

Why did Fessenden have to create artificial radio waves? How did he attempt to do this? Was he successful?

What were some of the obstacles Fessenden encountered when trying to create artificial radio waves? How did he overcome them?

What were some of the problems with the validity of Marconi's claim that he'd sent a message across the Atlantic?

**Further Activities:**

Research the lives and accomplishments of Fessenden and Marconi. Compare and contrast their achievements and impact on the 20<sup>th</sup> century.

Research one of the other inventions mentioned in the program. Be sure to include information about the inventor, the struggles encountered when attempting to create the new invention, and the ultimate success.

Describe the personal characteristics inventors seem to share. Evaluate why these traits seem to be important for the successful inventor.

## The Airplane

### Inventions that Shook the World Series

**Grade Levels:**

5-12

**Subject Areas:**

Science  
Technology  
Engineering  
Math

**Synopsis:**

In the late 1800s, inventors around the world were attempting to create and fly gliders. Despite the relatively unsuccessful attempts, the Wright Brothers began working on a glider of their own. Bringing together an understanding of how to control motion with their creativity and genius, they build a glider and test it at Kitty Hawk. Their glider is a disaster. Through problem solving and perseverance, the Wright Brothers change the design of their glider and achieve success. Once they learned how to control the motion and forces acting on a flying machine, they successfully complete the first motorized flight.

**Learning Objectives:** Students will:

- Understand how science, engineering, and design came together in the Wright Brothers' successful glider and airplane.
- Explain how changes to the glider's design allowed the Wright Brothers to control the forces of motion acting on the glider.
- Appreciate the personal characteristics that help inventors successfully overcome obstacles.

**Vocabulary:**

Wright Brothers, Otto Lilienthal, glider, pitch, yaw, lateral movement, force, wing warping, courage, lift, drag, rudder, design, engineering

**Pre-Viewing Discussion:**

What do you know about the Wright Brothers? Do you know any other inventors that worked on flying machines at around the same time?

How might the motion of a bicycle relate to the motion of an airplane?

How does courage often play into a successful invention?

**Post-Viewing Discussion:**

How do pitch, yaw and lateral motion relate to one another?

How did geometry provide an idea for how a glider could adapt the concept of wing warping for human use?

What were some of the problems with the Wright Brothers' initial glider? How did the Wright Brothers solve these problems?

**Further Activities:**

Write a biography of the Wright Brothers. Be sure to include information on their lives and accomplishments, as well as the reasons you think they were successful in creating an airplane.

Explain how the invention of the airplane changed the 20<sup>th</sup> century. What do you think the 20<sup>th</sup> century would have been like without this invention? Write a short story about how the world would be different today if the Wright Brothers had not invented the airplane.

Describe the personal characteristics inventors seem to share. Evaluate why these traits seem to be important for the successful inventor.

**The Disposable Razor**  
**Inventions that Shook the World Series**

**Grade Levels:**

5-12

**Subject Areas:**

Science

Technology

Engineering

**Synopsis:**

Before inventing the disposable razor, King Gillette was selling bottlecaps door to door. He is restless in this role, and his boss, William Painter, advises him to invent something that can be used only once—something that will create a recurring customer. When Gillette cuts himself shaving, he has the idea to create a razor that the user would throw away after use. Despite design and materials challenges, Gillette builds a disposable razor and an incredibly successful business.

**Learning Objectives:** Students will:

- Evaluate why Gillette was unhappy as a salesman and apply that evaluation to their own choices.
- Explain how the choice of materials is key when building a new product.
- Analyze how Gillette built this idea for a disposable product into a tremendously successful business.
- Appreciate the personal characteristics that help inventors successfully overcome obstacles.

**Vocabulary:**

King Gillette, William Painter, William Nickerson, razor, characteristics of metals, entrepreneur

**Pre-Viewing Discussion:**

How many disposable razors do you think are used every day?

How do you think Gillette came up with the idea for a disposable razor? Why was a disposable product attractive?

**Post-Viewing Discussion:**

Why do you think King Gillette was unsatisfied as a salesman? What does this tell you about finding and following your passion in your career?

How did Gillette's boss, William Painter, change the way Gillette thought about invention?

What were some of the problems with using a straight razor to shave?

How did William Nickerson try to help Gillette solve the problems he was having with the sheet steel? What eventually worked?

**Further Activities:**

Write a biography of King Gillette. Be sure to include information on his life and accomplishments, as well as the reasons you think he was successful in creating a business around his idea for a disposable razor.

Describe the personal characteristics inventors seem to share. Evaluate why these traits seem to be important for the successful inventor.

**The Air Conditioner**  
**Inventions that Shook the World Series**

**Grade Levels:**

5-12

**Subject Areas:**

Science

Technology

Engineering

**Synopsis:**

Today we take air conditioning for granted, but in the early 1900s, business and home environments were subject to the weather outside. This posed a problem for a publishing company that printed in color: the changes in humidity were causing the paper to swell and shrink. This company tasked Willis Carrier with finding a way to control room temperature and humidity, which became the air conditioner.

**Learning Objectives:** Students will:

- Evaluate the personal characteristics that helped make Willis Carrier a successful innovator.
- Explain how fog inspired Carrier in his design of the first air conditioner.
- Analyze how Carrier used water and dry air to control humidity.

**Vocabulary:**

temperature, humidity, Willis Carrier, fog

**Pre-Viewing Discussion:**

What do you think life was like before air conditioning? How do you think a lack of temperature control affected businesses?

What would be a reason that a business might ask an engineer to create a machine that can control humidity?

**Post-Viewing Discussion:**

How do you think Carrier's belief that you can achieve anything you put your mind to impacted his ability to invent new technology?

Why was it important for the paper to go through the printing press the same way each time? Why was the humidity affecting this?

Why did Carrier want to re-create fog? How did this help him establish the 55% humidity required by his client?

What impact did the invention of air conditioning have on business environments? Home environments?

**Further Activities:**

Write a biography of Willis Carrier. Be sure to include information on his life and accomplishments, as well as the reasons you think he was successful in creating a business around his innovations.

Describe the personal characteristics inventors seem to share. Evaluate why these traits seem to be important for the successful inventor.



**The Vacuum Cleaner**  
**Inventions that Shook the World Series**

**Grade Levels:**

5-12

**Subject Areas:**

Science

Technology

Engineering

**Synopsis:**

James Spangler is a night janitor at a department store, where he cleans the carpets. The dust created by the carpet sweeper irritates his asthma. Looking at the ceiling fan, Spangler has the idea to create a motorized carpet sweeper...but he has to find something to collect the dust!

**Learning Objectives:** Students will:

- Evaluate the personal characteristics that helped make James Spangler a successful innovator.
- Explain how a ceiling fan was the inspiration for a motorized carpet sweeper.
- Analyze how Spangler overcame the challenges he faced as he created the vacuum cleaner.

**Vocabulary:**

asthma, vacuum cleaner

**Pre-Viewing Discussion:**

How did people clean carpets before the vacuum cleaner? What were some of the problems with this method of cleaning?

What do you think inspired someone to create a vacuum cleaner?

**Post-Viewing Discussion:**

What made Spangler's job as a night janitor so tough on him? How did that lead to his invention of the vacuum cleaner?

How did the ceiling fan inspire Spangler? What challenges did he face with his initial design? How did he overcome them?

**Further Activities:**

Research the history of the Hoover Company. Describe the company's beginnings and where they are today. What made them successful? How successful is Hoover in the market today? What are their biggest challenges?

Describe the personal characteristics inventors seem to share. Evaluate why these traits seem to be important for the successful inventor.