Pillars of Culture:
50 People who Made America Great

This chapter requires a companion activity book in which students respond to questions on text content. Answers are found in the Teacher's Resource Kit.



Chapter 4
Text

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Pillars of Culture
Great Inventors



Chapter 4, Section 1
Topics 1-5



Alexander Graham Bell

Sometimes tragedy prompts a person to do the impossible. In an odd sort of way, that is what happened with Alexander Graham Bell when his two brothers died from ***tuberculosis*** in Scotland, and both parents were diagnosed with the disease in 1870. Alexander's parents were concerned that their remaining son would also die, so the Bell family moved to Ontario, Canada. There, Alexander assisted his father in working with ***acoustics*** to help deaf people, including Mrs. Bell.

Alexander was a ***precocious*** child who was homeschooled and learned to play the piano before he could read or write. At age twelve, he built a ***corn-husking*** device. He also collected and classified plants, stamps, and coins. His father was an expert on speech, hearing, and ***elocution***. Thus, Alexander grew up in an ***environment*** where he became familiar with efforts to ***facilitate*** hearing and communication. Mr. Bell challenged young Alexander to learn about speech defects, and to invent a "speaking machine." By age nineteen, Alexander was a serious student of books written by European inventors who were working with electricity to build a "speaking device."

Alexander moved to Boston in 1872 to teach deaf children how to read and speak. He continued to research, and discovered that each sound of the alphabet had its own mathematical frequency, or vibration. Applying knowledge learned at home, through books he read, and observations of deaf children, Alexander began to develop concepts that would help deaf people to communicate. He learned that an electrical current could cause a ***membrane*** to vibrate. He visited Professor Henry, the man who had encouraged Samuel Morse in his code efforts. During their conversations, Professor Henry challenged Alexander to acquire the mathematical skills needed to develop an electrical device that would enable people to communicate. Bell acquired those skills and worked diligently to invent a "talking machine."

VOCABULARY

Tuberculosis: a lung disease causing great weakness
Acoustics: sounds
Precocious: having mature intellect at an early age
Corn-husking: remove covering from ears of corn
Elocution: public speaking, speech
Environment: culture, life around you
Facilitate: make happen
Membrane: thin fiber sheet

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Finally, at the age of 29, Alexander Graham Bell was ready to test his device. On March 10, 1876, Bell and his assistant, Thomas Watson, succeed in transmitting human voice over battery-charged wires. The device was exhibited at the Centennial Exhibition in Philadelphia in 1876. Hardly anyone paid attention to his device, until Emperor Dom Pedro of Brazil recognized Bell, and strolled over to talk with him. He noticed the telephone, and asked Bell to demonstrate how it functioned. The rest is history. Alexander Bell became famous "overnight" as word spread about the marvelous "talking machine" that enabled people to talk over wires.



Bell Demonstrating the Telephone before an Audience

Alexander showed his invention to Thomas Edison, who facilitated improvements by inventing a microphone that was added to Bell's telephone. Bell Telephone Company was organized, and soon city skylines were crisscrossed with telephone wires. By 1877, more than 150,000 people had telephones in homes and businesses. In that same year, Alexander and Mable Hubbard were married. Upon return from their honeymoon in Europe, Bell faced legal challenges from men who claimed that they were the original inventors of the telephone. Throughout the next 18 years, Bell defended his invention in more than 550 court battles. Finally, the US Supreme Court declared that Alexander Graham Bell invented the telephone. Bell and his team continued to improve designs. Today, people carry smartphones that allow communication anywhere, anytime without wires, because Alexander Graham Bell started out with a dream, and developed it into a device that connected the world.

LIFE PRINCIPLE:

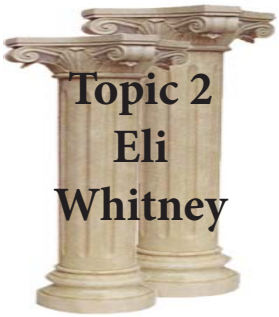
"Sometimes we stare so long at the door (of opportunity) that is closing that we see too late the one that is opening."
-Alexander G. Bell, inventor

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Pillars of Culture
Great Inventors



Chapter 4, Section 1
Topics 1-5



Eli Whitney

Portrait by Samuel Morse

Every boy who has pretended to be a frontiersman or soldier can thank Eli Whitney for producing muskets. Eli Whitney learned that business success grows out of observing a need and filling it, while working hard to earn a financial profit. He learned that the benefit of America's free culture enables inquisitive and diligent people to apply free enterprise (capitalism) to dream big and accumulate wealth. He also learned to gain from mistakes, and to avoid temptations to succumb to greed. Eli's work ethic, ***ingenuity***, and business skills earned the title "Inventor of standardized production."

Eli was born on a Massachusetts farm in 1765, when more than 80 percent of people lived in rural areas and had to produce their own food, clothes, and furniture. Eli learned to work hard from sunup until the candles were snuffed out at night. He wasn't particularly fond of doing farm chores; he preferred to "tinker" and "fiddle around" with tools in his father's shop. At about age 15, Eli observed that farmers needed nails, and that women needed hairpins to hold their hair in place. He saw an opportunity, and began making and selling nails and pins.

After the War for Independence from England (1776-1783), Eli desired more education. He graduated from Yale College and accepted a tutoring job with a wealthy gentleman in Savanah, Georgia. While traveling to Georgia, Eli met the widow of Nathanael Greene, the famous war hero who had aided George Washington. Mrs. Greene was impressed with Eli's manners and honesty, and invited him to visit her plantation. While discussing the challenges of cotton farming, Eli learned that farmers could not make a profit because of high labor costs to ***extract*** cotton seed. Later, Eli observed farmers and their children and/or slaves ***meticulously*** picking seeds by hand from cotton bowls. Within a few days, Eli had produced the first cotton gin ("gin" was short for engine) that allowed rapid removal of seeds by simply turning a hand-crank on a wooden box.

VOCABULARY

Ingenuity: creativity
Extract: remove
Meticulously: very carefully

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Eli and a venture capitalist formed a partnership and obtained a ***patent*** on the cotton gin in 1794. Unfortunately, they attempted to restrict production to only themselves. Consequently, other men pirated the idea, and Eli did not earn wealth from his invention. However, in 1797, pending war with France caused the US government to request businessmen to produce thousands of muskets. At that time in history, two arms producers could supply only 1000 rifles in three years, because each rifle had to be made individually by hand. Eli broke from ***status quo*** manufacturing techniques, and developed a system by which parts could be ***standardized*** and ***interchangeable***. His techniques astonished Congress, which granted a contract to Eli Whitney. He produced thousands of rifles in two years, and eventually manufactured 35,000 rifles.



Whitney's cotton gin

Eli Whitney changed the cotton industry, but became a wealthy man by introducing assembly lines and mass production to the way in which factories operated. Thus, he propelled the United States into the Industrial Revolution and world leadership of manufacturing. Later, Henry Ford applied Whitney's techniques to mass-produce automobiles, thereby putting America on wheels. Eli Whitney proved that success rests in the combination of initiative, perseverance, creativity, honesty, and meeting needs of other people.

VOCABULARY

Patent: legal ownership of a product design
Status quo: regular, standard procedure
Standardized: identical, uniform, same
Interchangeable: identical parts can be used on similar products

LIFE PRINCIPLE:

"If once you forfeit the confidence of your fellow citizens, you can never regain their respect and esteem."
-Eli Whitney, inventor

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Pillars of Culture
Great Inventors



Chapter 4, Section 1
Topics 1-5



Elias Howe

Artist Unknown

Before the mid-1800s, people made clothing by hand-sewing animal skins, wool, silk, and cotton fabrics to fashion robes, shirts, trousers, and capes. Primitive needles were made from thorns and bones of fish, birds, and animals before copper and iron needles were invented. Thread was made from wool, animal hides, and plant fibers. Hours were required to make ***elegant*** gowns and suits. That ***laborious*** process began to change in 1846 when Elias Howe built a ***mechanical*** sewing machine.

Elias was born in 1819 on a farm in Massachusetts. His father manufactured roof shingles from cedar trees. Young Elias spent a lot of time exploring in woods, fields, and barns. He learned to read and sketch illustrations of plants and animals. Because he had a lame foot, farm labor was tiring and painful. So, at age 16, he became an ***apprentice*** in his father's shingle factory. There, Elias observed machines equipped with rotating pullies, gears, chains, and belts. He was ***fascinated*** by machines.

Shortly thereafter, Elias worked in a cotton-processing factory. Then, he moved to Cambridge, Massachusetts to work in a shop for making and repairing watches, clocks, and surveying instruments. During those years, Elias gathered insight and knowledge that years later would enable him to build the first practical sewing machine. In 1839, Howe overheard two men talking about inventing a machine that would sew. Other men in Europe had invented crude devices that could replace hand-sewing, but the machines were considered too ***cumbersome*** to be practical. However, like other great inventions that changed history, development of the sewing machine occurred over time as inventors learned from one another to improve designs.

Elias married in 1840, and had three children. Poverty motivated him to find a way to earn money to feed, clothe, and shelter his family. As he watched his wife sew garments by hand, Elias birthed his dream to build a mechanical sewing machine. A

VOCABULARY

Elegant: fancy, beautiful
Laborious: much labor, hard work
Mechanical: operated by physical means
Apprentice: one trained by working at a job
Fascinated: very interested
Cumbersome: awkward, difficult

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friend with money believed in Howe's idea, and provided housing and ***venture capital*** needed to build a model of Howe's ***concept***. In 1845, he built a machine with which he produced two suits of clothes in a fraction of the time required to sew by hand. Then, he sewed clothes for free to demonstrate the practicality of his invention. But, no one in America wanted to buy his machine. So, the Howe family went to England to visit ***textile*** factories. A factory owner bought Howe's machine for $1,250, and promised to pay ***royalties*** for use of Howe's machine; but the man never paid royalties, even though he earned more than a million dollars from Howe's concept.

Elias borrowed money to send his family back to America, while he continued to market his machine. Finally, he returned to New York ***destitute*** and discouraged. His wife died, and Elias had to borrow a suit to attend her funeral. While working as a mechanic, Howe built another sewing machine and began to demonstrate it. Other manufacturing businessmen, including Isaac Singer, "pirated" Howe's idea and began to manufacture sewing machines. Elias sued for ***remedy***, and in 1854 a judge ruled that Elias Howe was the rightful inventor of the sewing machine, and deserved royalty payments for every sewing machine built in America. In a few years, Howes annual income exceeded $250,000. Years of perseverance and hard work had finally paid off. The American garment industry ***escalated*** as Howe's sewing machine was improved by other inventors. By 1900, thousands of American homes were equipped with sewing machines produced by Singer and other entrepreneurs, who changed America.



Howe's Sewing Machine

VOCABULARY

Venture capital: money to start a business
Concept: idea, plan
Textile: clothe
Royalties: payment for permission to produce
Destitute: broke, no money
Remedy: justice, right to payment
Escalated: grew rapidly

LIFE PRINCIPLE:

"The man who can keep a secret may be wise, but he is not half as wise as the man with no secrets to keep."
-E.W. Howe, inventor

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Pillars of Culture
Great Inventors



Chapter 4, Section 1
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Self-portrait of
Robert Fulton

In 1777, a twelve-year old boy on a Pennsylvania farm drew pictures of mechanical devices, including steam engines and paddle-wheel boats. His ***inventive*** mind startled his mother, who noticed that Robert Fulton asked a lot of questions about machines. As he grew, the questions increased to include mathematics, canals, languages, and portraits. As a young man, Robert traveled to France and England to paint portraits and to learn about water craft and man-made water passages. He began to develop concepts about canals, submarines, torpedoes, and steam-powered boats.

When Robert returned to America, he stood on the bank of the ***Hudson River*** and watched rivermen laboriously propel their clumsy boats with long poles and oars. The men rowed terribly slow against the river current, and drifted lazily when they flowed downstream with the current. A plan began to take shape in Robert Fulton's mind. He went back to his dwelling and drew sketches of a steam-powered, paddle-driven boat. He pulled together his knowledge of boats, steam engines, and paddle wheels to design a motorized ***vessel*** that would carry passengers and freight. He designed a boat equipped with a steam engine that would cause two, side-mounted paddle wheels to propel the craft.

Fulton was inspired by the belief that commerce would improve ***dramatically*** if freight and passengers could travel on ***mechanized*** boats. He knew that other inventors had tried and failed to produce a steam-powered boat capable of traveling long distances. Fulton studied the mechanical failures of other inventors and designed improvements. He equipped a 143 feet long boat (the *Clermont*), with a steam engine and 15 feet diameter paddle wheels mounted on each side of the ship.

On August 17, 1807, Robert Fulton was ready to prove his idea of steam-powered commerce. A crowd of ***spectators*** gathered to witness "Fulton's folly." Scoffers laughed, jeered, and ridiculed the idea that a steam engine could propel a large ***craft*** against a

VOCABULARY

Inventive: creative
Hudson River: a 315-mile-long river in New York
Vessel: boat, ship
Dramatically: a lot, great deal
Mechanized: powered by machine rather than human effort
Spectators: on-lookers, people
Craft: boat

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river current. Even Robert's friends were ***skeptical***; they were convinced that Robert would be called a fool for trying to make the steam-powered *Clermont* safe, practical, and ***efficient***. None-the-less, Robert squared his shoulders and shoved his ship away from the dock. After traveling only a short distance, the ship stopped. Howls of laughter erupted from the crowd of on-lookers. But, Robert calmly examined the engine, and soon had the ship moving again. Hoots and ***catcalls*** grew silent as Fulton waived to the crowd.

The craft gained a speed of 4.7 miles per hour as it puffed and chugged up the Hudson River. It travelled more than a hundred miles and returned safely. The crowd of skeptics changed to inspectors who gawked and examined the *Clermont*. They even made suggestions for improving it. Within a few years, other steam-powered, paddle-driven, boats were ***plying*** up and down America's rivers. Fulton's so-called "silly idea" changed the way America and the world carried freight and passengers on rivers and oceans. Moreover, success of the *Clermont* stimulated other entrepreneurs to build factories that produced ships, paddle wheels, steam engines, chairs, luxury cabins, dinning equipment, and other products associated with ***commercial*** travel. Robert Fulton not only changed the way people traveled, his application of initiative, creativity, and effort in America's capitalistic economy created hundreds of jobs for other people. Fulton's life is an example of what can be done by one person with a dream and ***determination***, even when scoffers laugh and ridicule.

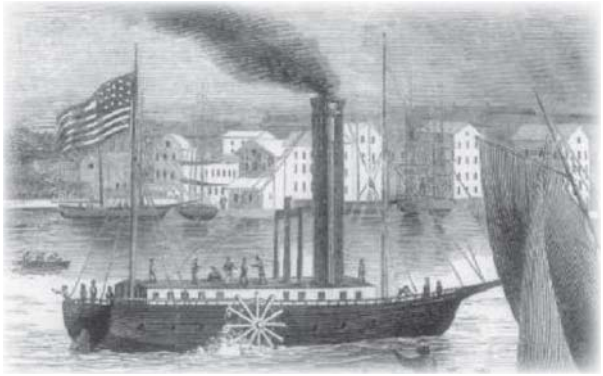


Illustration of the *Clermont*

(Artist Unknown)

VOCABULARY

Skeptical: doubtful
Efficient: works well
Catcalls: ridicule, taunts, jeers
Plying: propelling, motoring, cruising
Commercial: exchange of money for goods
Determination: commitment to perform

LIFE PRINCIPLE:

"Show me your hands. Do they have scars from giving? Show me your feet. Are they wounded in service? Show me your heart. Have you left a place for Divine love?"

-Robert Fulton, inventor

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Pillars of Culture
Great Inventors



Chapter 4, Section 1
Topics 1-5



Thomas Edison

Thomas Edison was born in 1847, when people lit their homes with oil lamps and candles. As a child, Thomas was hyper-active, easily distracted, and difficult to manage. In fact, his behavior was so "off the wall" that Mrs. Edison decided to withdraw Thomas from school in-order-to teach him at home. There, the young boy became a ***voracious*** reader and ***independent*** learner through books. He was motivated to solve challenges and apply his high energy level to accomplishing goals. Thomas had a ***compulsion*** to take things apart to discover how they functioned. He channeled his energy into selling newspapers at age 12, and by the age of 15, he was a telegraph operator. Each conquered goal raised his ambition to tackle difficult tasks that other people thought were impossible to accomplish.

VOCABULARY

Voracious: ravenous, excessive, huge
Independent: learns alone
Compulsion: driving need, tendency
Cumbersome: awkward, clumsy
Stock ticker: machine that reported profits and losses
Laboratory: room where experiments are conducted
Quadruplex telegraph: system that allowed four telegraph messages to be transmitted simultaneously
Entrepreneur: business owner
Incandescent: glass bulb that shines brightly

In 1869, Edison moved to New York, where he learned about the Stock Market. He observed that investors were challenged by ***cumbersome*** means of keeping track of buying and selling stocks. The challenge gripped Thomas, and he sat down to assess the problem. Soon, he developed an improved ***stock ticker*** that streamlined management of stock exchanges. He was paid $40,000 for production rights to his invention. He used the money in 1870 to move to New Jersey, where he established an experimental ***laboratory***. In 1871, he married 16-year-old Mary Stilwell, who birthed three children, before she died in 1884. Two years later, Edison married Nina Miller, who was 19 years younger than himself. He taught her Morse Code so they could communicate secretly while courting in the presence of Nina's parents.

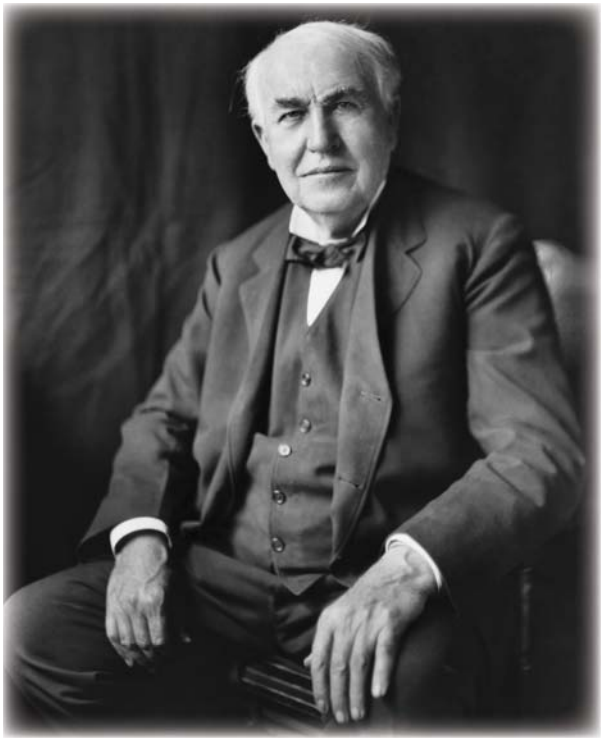
Thomas invented the ***quadruplex telegraph*** for Western Union, but railroad ***entrepreneur*** Jay Gould paid Edison $100,000 for the invention. The courts eventually had to resolve who should be the legal owner of the device. In the meantime, Edison was well on his way to becoming the greatest inventor in America. He invented the ***incandescent*** light bulb (1880), phonograph (1877), and motion picture projector (1897). He researched discoveries

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made by other inventors, and then set about making improvements which he could patent. In his lifetime, "the wizard of Menlo Park" filed more than 1093 patents before his death at age 84. He gained worldwide fame as "America's greatest inventor." At one time, he joked that "The chief function of the body is to carry the brain around."

Throughout his life, Thomas Edison looked about for needs in industry and homes, and set out to find solutions. He hired a team of engineers to assist him at Menlo Park. His team developed more efficient ***storage batteries*** for Henry Ford's Model T automobile, and even invented devices for detecting submarines during WWI. He founded Edison ***Illuminating*** Company in 1879 to produce electricity to power street lights in New York City. Edison was a successful businessman, who ***diversified*** his investments, and sold production rights to many of his inventions; others were produced and marketed by his own company, which became General Electric, one of the largest companies in the world. Like his friend, Henry Ford, Thomas Edison applied his energy and creative mind to produce thousands of jobs for people who manufactured lightbulbs, phonographs, batteries, and motion picture projectors. Not only did Edison light up America, he illuminated the lives of millions of people around the globe after sundown to read, engage in sports, and work night shifts in restaurants, theaters, and factories. Edison connected America with electricity. In fact, he lit up the world.



Thomas Edison

VOCABULARY

Storage batteries: batteries that start motors
Illuminating: light producing
Diversified: increased the variety of

LIFE PRINCIPLE:

"Our greatest weakness lies in giving up. The most certain way to succeed is always to try just one more time."
-Thomas Edison, inventor

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Pillars of Culture
Industrial Giants



Chapter 4, Section 2
Topics 6-10



Henry Ford

Henry Ford was born July 30, 1863, near Dearborn Michigan. At age 13, Henry was bored with farm work, so he took his father's pocket-watch apart to discover how it worked. Then, he reassembled the watch. The result was that neighbors began to ask Henry to repair their broken timepieces. When Henry was 16, he decided that he was tired of putting saddles on horses in cold weather, so he walked several miles to Detroit to become an apprentice machinist at a ship factory. In 1893, Henry was hired as an engineer by the Edison Illuminating Company. While working for Thomas Edison, Henry began to formulate ideas for building a motor-powered "horseless carriage." Thus, began the career of the man who walked to his first place of employment, and later became the man who put America on wheels.

Henry Ford built the *Quadricycle* – a horse carriage mounted on a metal frame supported by four spoked wheels, and powered by a small internal combustion engine. It huffed, puffed, and jerked along the dirt road in front of Ford's home. It was an attention-grabber for ***pedestrians***, but it was considered too crude to be practical. Thomas Edison challenged Henry to improve the design. He did; and in 1903, he introduced the Model T Ford Automobile to America. He streamlined manufacturing techniques by training employees to specialize in ***implementing*** the assembly line production of standardized parts, so that his factory could produce almost a dozen cars each day. By 1918, half of all cars on American roads were Model T's. Henry sold more than 15,500 Model T cars. However, his success created problems.



Pedestrians: people who walk
Implementing: putting into place/action
Competitors: seller of similar products
Shareholders: owners of a business
Flourish: prosper, increase

Henry Ford's efficiency in building cars at a fourth of the cost of other automobiles stirred ***competitors*** and their ***shareholders*** to try to shut down Ford's factory. They wanted higher profits from *their* investments of venture capital, and tried to cut off Ford's supplies of raw materials, and stirred up strife among Ford's employees. After a series of court battles in 1911, Henry Ford retained ownership of his patents, and began to ***flourish*** as a

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businessman. His legal victory opened the floodgates for automobile manufacturing. By keeping production costs down, Henry Ford produced affordable vehicles, and put thousands of people to work.

Henry Ford continued to improve his automobile, and introduced the Model A in 1927. It was an instant success. Several million Model A's began zipping down city streets and chugging along country roads, as Americans gave up horses in favor of motorized wheels. Multiple thousands of jobs were created as entrepreneurs established gasoline refineries, operated filling stations, constructed motels and restaurants, and built such items as seat covers, windshields, headlights, horns, transmissions, and tires. Henry Ford cut costs for raw materials by buying mines for producing iron ore and coal, and ships to deliver materials to factories in Detroit. He even established schools for employees and their families. He taught farmers how to read complicated blueprints of automobile parts, and how to ***calculate*** complex mathematical ***equations***. He paid his employees well, and even involved them in profit-sharing programs so that his employees could afford to purchase their own cars. Ford's efficiency forced competitors to lower their prices for automobiles.

Henry Ford was a major ***catalyst*** during the era of industrial expansion in the United States. His hard work, creative engineering, and business "smarts" enabled him to put America on wheels.



Ford with a Model A Car

VOCABULARY

Calculate: figure out how
Equations: formulas
Catalyst: starter, initiator

LIFE PRINCIPLE:

"Obstacles are those frightful things you see when you take your eyes off your goal."
-Henry Ford, inventor

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Pillars of Culture
Industrial Giants



Chapter 4, Section 2
Topics 6-10



Samuel Morse

For thousands of years before 1844, messages were sent by smoke signals, fires, pigeons, flags, and fleet-footed runners or horsemen. That slow system of communication began to change in 1825, when a messenger on horseback notified Samuel Morse that his wife had become ill. She died before Samuel arrived home several days later. Samuel ***determined*** that he would develop a faster system of communication. He did, but thirty years of experiments, failures, and successes, using wires and ***electromagnets***, ***elapsed*** before Samuel's dream came true. You may have heard about teenage Pony Express riders, who galloped on horseback in 1860 to deliver letters between Missouri and California in fourteen days. That communication system, and ***carrier pigeons***, were the fastest means of delivering long-distance messages in the United States, until wires mounted on ***telegraph*** poles appeared along railroads and trails.

VOCABULARY

Determined: committed to fulfill, not hesitant
Electromagnets: magnets charged with electricity
Elapsed: passed
Carrier pigeons: birds that carried tiny messages tied to their legs
Telegraph: message composed of dots and dashes sent over wires
Theology: study of Bible beliefs
Intrigued: fascinated by, interested in

Samuel Morse was born in Massachusetts in 1791. His father was a pastor, who believed that education should include moral instruction and Christian principles. Samuel attended Yale College to study ***theology*** and mathematics. While at Yale, Samuel also learned about discoveries relating to electricity since Benjamin Franklin's experiment with a kite and Key in 1751. Morse supported himself in college by painting portraits and scenes. He graduated with honors, and went to Europe during The War of 1812 to study painting. His artistic talent enabled him to become one of the best portrait painters in America. Many of his paintings were of religious themes and famous people, including President James Monroe.

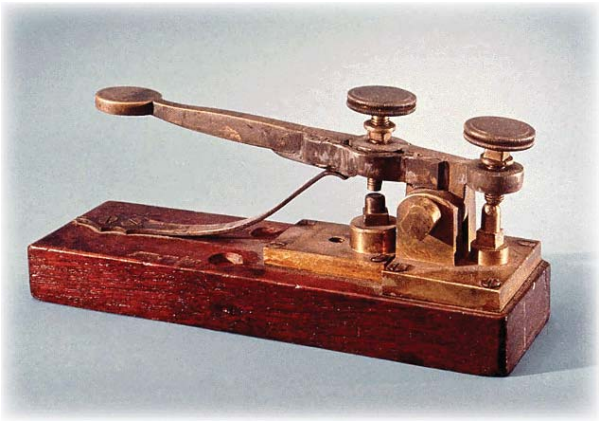
While in France and England, Morse learned that other men had been exploring ways to transmit messages over wires. On a ship headed back to America, Samuel overheard passengers talking about electricity. The conversation ***intrigued*** Morse, and when he arrived at his home, he began to experiment with methods to improve previous inventions using electricity, batteries, and

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wires. He also began developing a system for communicating with alphabet letters represented by dots and dashes. Those dots and dashes were the birth of the "Morse Code", which became the primary means of long-distance communicating for the military and businesses, such as railroads, media, and law enforcement officials.

After many failed experiments in his one-room home, art studio, and laboratory, Morse had a breakthrough, when Professor Leonard Gable and assistant Alfred Vail joined Morse to develop magnetic-powered, single-wire transmission of messages. Then, in 1842, Morse demonstrated his telegraph system with coded dots and dashes to Congress. They were impressed, and ***allocated*** $30,000 to build an ***experimental*** telegraph line that extended from Washington, DC to Baltimore, Maryland. On May 24, 1844, Morse transmitted the famous message, "What hath God Wrought?" Soon thereafter, wires strung on wooden poles began to cover skylines of the United States. Western Union constructed a line of poles along railroad tracks in the west, effectively shutting down Pony Express riders after 1861, as telegraph operators tapped out Morse Code to send messages across mountains, through deserts, over meadows, across rivers, and ***eventually*** beyond the Atlantic Ocean to Europe by means of a transatlantic cable. Samuel Morse fulfilled his dream to develop a faster way to communicate over long distances, by using dots and dashes transmitted over wires that enabled people to make America a great nation.



An Early Telegraph Machine

VOCABULARY

Allocated: provided money
Experimental: test, trial
Eventually: later

LIFE PRINCIPLE:

"Every child has a dream; to pursue the dream is in every child's hand to make it a reality."
-Samuel Morse, inventor

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Pillars of Culture
Industrial Giants



Chapter 4, Section 2
Topics 6-10



Theodore Judah

Theodore Judah was called "crazy" because of the way he talked as he ***pursued*** his big dream to build railroads in America. He was born in 1826, when railroads were beginning to develop. As a boy, Judah studied engineering. By age 18, he was a railroad surveyor. In 1854, Judah began to talk about building a west coast railroad. Friends and skeptics thought Judah was "out of his mind." He was criticized for wasting time to dream of such an "impossible" project. Fortunately, the dream would not go away. It ***dominated*** every waking hour, and disturbed his sleep. Judah and his wife decided to move away from ***scoffers*** and critics, so they traveled to California, where plans were made to build The Sacramento Valley Line. Judah found persons who were willing to listen to his dream. Thus, the first railroad west of the Mississippi River was built.

Judah then set his sights on building a great ***transcontinental*** railroad that would connect the Pacific and Atlantic coasts with a ribbon of steel rails. Judah trekked across the Sierra Madre Mountains, through Donner Pass, and into Utah, to determine the best route for his future railroad. With a route map in his hand, Judah began to share his dream with businessmen, Congressmen, and President Abraham Lincoln. They listened ***cautiously***, but with much interest. Finances were obtained from entrepreneurs who believed in paying for Judah's dream to become reality. Investors caught Judah's vision of using the railroad to generate public migration to western territories.

Like most great accomplishments, ***culmination*** of Judah's dream had a series of starts, delays, stops, and restarts before the golden spike was driven on May 1, 1869 at Promontory, Utah. Two teams competed for cash rewards promised to the men who fulfilled their agreements to cross prairies, tunnel through mountains, and build bridges over canyons. Irish crews built from the East, while Chinese crews built from the west. They had to cut, trim, and haul trees from whatever forests were available to produce wooden ***ties*** to support the rails. Supply trains followed freshly-laid rails as crews

VOCABULARY

Pursued: followed, chased
Dominated: ruled, occupied
Scoffers: critics, nay-sayers, doubters
Transcontinental: coast-to-coast
Cautiously: polite but skeptical
Culmination: completion, fulfillment
Ties: wood beams that support steel rails

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labored from daylight to dark surveying the route, shaping roadbeds, and driving metal spikes into ***crossties***. Hunters harvested wild game for food. A "Railroad village" of tents followed the crews to provide food, shelter, and protection from harsh weather, hostile Indian tribes, and rogue bandits.

Dust storms, freezing rain, sleet, thieves, ***sabotage***, buffalo herds, and snow ***hampered*** progress. But, the dream was maintained with perseverance, determination, and courage. Some men died. Some quit. Most stuck with their tasks until the railroad was completed. Sadly, Theodore Judah did not live to see the golden spike driven in Utah in 1869; he died in October, 1863. His life was like many others who invested in a dream that was started, but had to wait for someone else to fulfill.

The United States expanded westward rapidly after 1869, when steam-powered locomotives ***chugged*** across Mid-America, carrying livestock, merchandise, and people. Towns sprang up where previously only coyotes, deer, and antelope roamed. Cattle ranches began to produce beef to feed communities previously too isolated to receive regular service by merchants who traveled with wagons, mules, and horses. Judah did a great service to America by dreaming, and undertaking one of the largest projects in the 19th century. His dream of building a railroad across America changed the way factories provided materials that made America a great nation.



The Last Spike, painted by Thomas Hill, depicts the completion of the Transcontinental Railroad.

VOCABULARY

Crossties: wooden beams that support steel rails
Sabotage: destruction by enemies or discontented employees
Hampered: obstructed, slowed down
Chugged: labored slowly

LIFE PRINCIPLE:

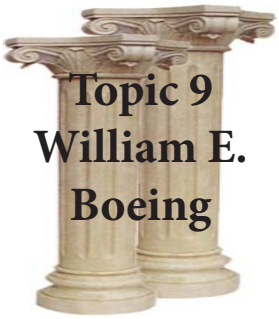
"If at first you don't succeed, try, try, try again."
-William Edward Hickson, writer

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Pillars of Culture
Industrial Giants



Chapter 4, Section 2
Topics 6-10



William Boeing

William E. Boeing was eight years old when his father died in 1889. Boeing's mother remarried a medical doctor, who sent William to ***boarding schools***, where he was an ***avid*** reader. He proceeded to finish high school, plus two years of college at Yale University. But, frustration with his step-father and a desire to seek his fortune prompted William to quit college at age 22, and travel to the state of Washington. There, he invested in the timber industry and developed a profitable business. He married Bertha Paschall, who had two sons from a ***previous*** marriage. William and Bertha also had a son together.

In 1910, William attended an air exhibit in southern California. While there, he began his love affair with aviation. He rode on a single-engine ***floatplane*** made of wood and canvass, and powered by a water-cooled engine. Boeing was an inquisitive and curious man, who paid close attention to details. After ***assessing*** the structure and materials used to build the floatplane, Boeing believed that he could build a better-designed airplane. He already owned a factory for processing wood, so he ordered a plane kit, and assembled his first airplane in his lumber factory in 1917.

His ingenuity was recognized by the US Navy, which ordered two floatplanes for service in WWI. That was the beginning of Boeing Airplane Company. Inspired by his success with the floatplanes, Boeing bid on contracts to deliver mail from Chicago to San Francisco. Later, he built planes to haul passengers. Each new contract stimulated ***innovations*** for wings, engines, body styles, windows and landing gear. He transitioned from manufacturing with wooden planes to craft made from aluminum. By 1928, Boeing held 30 percent of mail and passenger contracts in the United States. Shortly thereafter, the company had grown from a dozen employees to more than 1000 personnel. Unfortunately, politics in Washington, D.C. caused Boeing to lose the mail-delivery contracts. But, by that time, Boeing Airplane Company had become United Air Lines.

VOCABULARY

Boarding schools: provide meals, lodging, and academics away from home
Avid: enthusiastic, eager
Previous: earlier, past time
Floatplane: airplane that lands on water
Assessing: careful, study, evaluation
Innovations: inventions, improvements

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William E. Boeing resigned his leadership and financial interest in the airline industry in 1934; but he continued involvement as an ***aviation consultant*** for several years. Then, after age 53, he turned his attention to raising thoroughbred horses and quality beef cattle. He had the satisfaction of guiding a ***fledgling*** airplane manufacturing company that produced wooden, single-engine, floatplanes, to a ***mammoth*** corporation that produced multi-engine bombers (such as the B-17 and B-52), and passenger planes that could travel more than 5000 miles at speeds in-excess-of 450 miles per hour. The *Enola Gay*, a Boeing B-29 bomber, delivered the atomic bomb on Hiroshima August 5, 1945 to force the Japanese to surrender, thus ending World War II.

During the war, Boeing Aircraft Company operated factories in Kansas, Washington, Nebraska, and Georgia. After the war ended, the company converted factories to production of passenger planes, and eventually the elegant 747 passenger liner that hauls more than 350 passengers at 600 miles per hour across oceans. Today, Boeing produces military and civilian airplanes for multiple nations. Thousands of people are employed at airports, travel agencies, factories, and restaurants because a man believed he could build a better floatplane. He did, and he helped change America.



The *Enola Gay*

VOCABULARY

Aviation: airplane manufacturing, development, and design
Consultant: advisor, counselor
Fledgling: small, vulnerable
Mammoth: huge, gigantic

LIFE PRINCIPLE:

"No one is to dismiss any novel idea with the statement that 'it can't be done!'"
-William Boeing, entrepreneur

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Pillars of Culture
Industrial Giants



Chapter 4, Section 2
Topics 6-10





Wilbur (top) and Orville (bottom) Wright

One day during the early 1880s, an American preacher presented to his two sons a miniature toy helicopter made from wood. That gift was the inspiration for developing motorized flight. Those boys, Orville and Wilbur, never stopped dreaming about flying like a bird. The boys ***alternated*** their focus on learning arithmetic and aviation. Their father and mother made sure their children learned to read and think, as well as develop moral character and integrity. Because the father moved his family to a distant city, and the mother suffered from tuberculosis, neither boy earned a high school diploma, but their minds remained imaginative and full of ideas. They never forgot the toy helicopter, or how it dared them to dream.

After dropping out of high school, the boys started a printing business and newspaper. While ***compiling*** news, the brothers learned about aviation experiments in Europe and the United States. They collected articles about gliders, kites, and crashes as men experimented with wings and controls. However, the need to earn money ***compelled*** the Wright brothers to ***suspend*** their interest in aviation temporarily.

VOCABULARY

Alternated: changed from one thing to another
Compiling: gathering
Compelled: forced
Suspend: stop
Tinkering: play around with, experiment
Accumulating: gathering, collecting
Bi-wing: two wings

In 1892, the Wright brothers opened a bicycle shop, where they repaired and sold bicycles, and even manufactured their own brand. While "***tinkering***" with bicycles, the brothers developed knowledge about mechanical devices, balance, gears, chains, friction, and motion. They read about French inventors, who had developed gliders and kites while exploring principles of aviation. Both brothers spent long hours observing birds as they flew, glided, dipped, banked, and landed. They studied the various shapes of bird wings, and how birds spread and folded their feathers during flight.

After ***accumulating*** a little money, they began experimenting with kites and gliders in North Carolina, where winds along the coast were ideal for testing aviation concepts. Their first "lift-off" occurred in a large ***bi-wing*** kite. Then, they

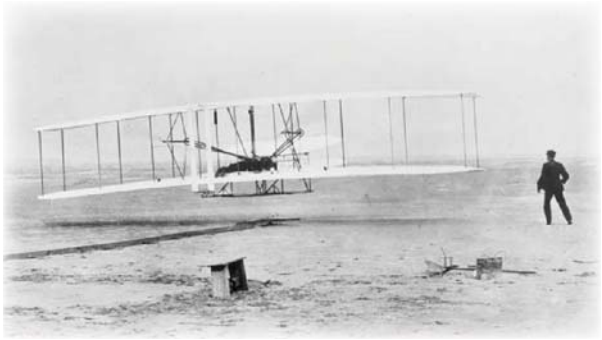
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developed gliders. Crashes occurred, wings were destroyed, and bones were broken, but the Wright brother persevered for five years. They determined that other inventers were crashing because they focused too much on wings and motors, rather than on controls. Thus, the Wright brothers pulled together their experiences with bicycles and printing presses to develop a system of effective mechanical controls that allowed the pilot to adjust the aircraft to wind ***fluctuations*** and speed.

The first motorized flight occurred in 1903 at Kitty Hawk, North Carolina; the flight lasted 59 seconds, and covered a distance of 852 feet. But, it inspired and encouraged the Wrights to continue their experiments. ***Ironically***, that historic event raised very little attention among newspapers and military officials. Most people simply disbelieved that human flight was possible, and certainly not practical. So severe was criticism, ridicule, and ***skepticism*** that no flights were made in 1906 and 1907.

However, in 1908, the Wright brothers gained world-wide fame when they successfully flew a bi-wing, motorized, airplane in France for more than an hour. The fact that a woman (Edith Berg) was aboard raised eyebrows among media skeptics and military personnel. The brothers returned to the United States as heroes. They started The Wright Brothers Flying School, and trained more than 115 pilots; many flew combat missions over France during World War I (1914-1917). Aerial combat made headlines, inspired movies, and accelerated the aviation industry. Today, huge jet-powered planes can circle the globe at ***supersonic*** speeds — a dream that began with a toy helicopter. ***enabled*** mankind to fly like birds.



The *Wright Flyer* begins its historic flight at Kitty Hawk, North Carolina, in 1903.

VOCABULARY

Fluctuations: variety, changes
Ironically: surprisingly, should have, but did not
Skepticism: doubt, disbelief
Supersonic: faster than the speed of sound

LIFE PRINCIPLE:

"Do not let yourself be forced into doing anything before you are ready."
-Wilbur Wright, inventor

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