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WHO INVENTED the AUTOMOBILE?

by Kathiann M. Kowalski

Leonardo da Vinci's 1472 sketch of a self-propelled vehicle may have provided the first inspiration for the automobile.

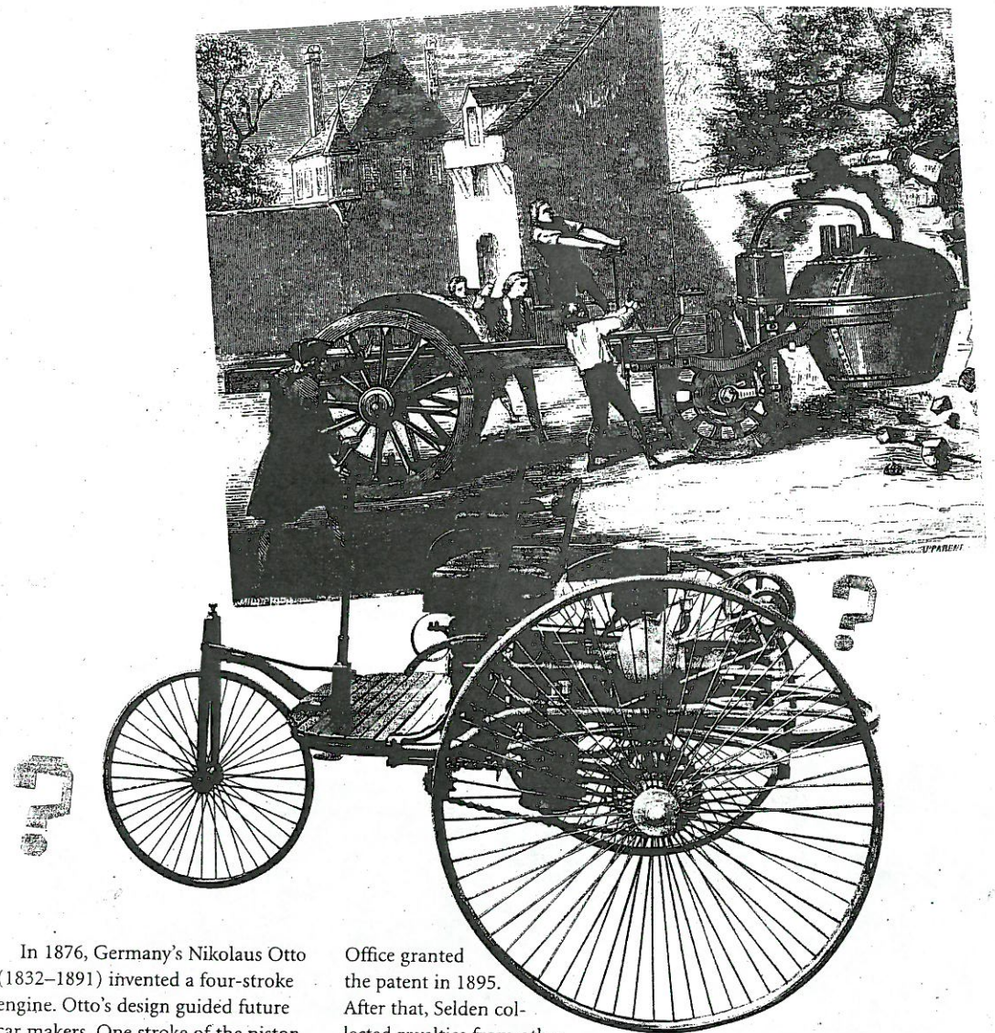
Henry Ford changed the way America made and sold cars. But he didn't invent cars. Rather, a number of people — both in the United States and in Europe — played a part in inventing the automobile. How many of these names look familiar to you?

Italy's Leonardo Da Vinci (1452–1519) designed a spring-run car, but he never bothered building it. German watchmaker Johann Hautsch (1595–1670) built a spring-powered car in 1649, but it wasn't practical. Who wants to stop to wind his or her car every 275 yards?

France's Nicolas-Joseph Cugnot (1725–1804) built a steam-powered automobile around 1770. It crashed into a garden wall during an early run. Even before the world had its first practical car, it had its first auto accident.

Scotland's Robert Anderson experimented with electric cars during the 1830s. Meanwhile, other inventors worked on the internal combustion engine, which burns fuel to produce controlled explosions. Gases from those explosions push a piston (a sliding disc inside a cylinder). The piston turns a crankshaft, and the crankshaft makes a car's wheels turn.

In 1859, Jean Joseph Étienne Lenoir (1822–1900) of Belgium invented an electric ignition system to start his internal combustion engine. In 1863, Lenoir also designed a carburetor, which mixed air with the engine's fuel to make it more combustible.



In 1876, Germany's Nikolaus Otto (1832–1891) invented a four-stroke engine. Otto's design guided future car makers. One stroke of the piston draws in fuel and air. The next stroke compresses, or squeezes, them. Expanding gases from burning fuel force the piston down for the third stroke. And the fourth stroke pushes the exhaust gases out.

In 1879, American George Selden (1846–1922) filed a patent application for a car, even though he hadn't built any car yet. The U.S. Patent Office granted the patent in 1895. After that, Selden collected royalties from other companies. Henry Ford later defeated Selden's patent claims in court in 1911.

Long before then, however, German engineers had already developed actual cars. Karl Benz (1844–1929) built his first three-wheeled automobile in 1885. Gottlieb Daimler (1834–1900) and Wilhelm Maybach (1846–1929) introduced the first

TOP: Smash! Nicolas-Joseph Cugnot's 1770 three-wheeled steam carriage propels itself into a wall. ABOVE: Karl Benz's first automobile looks more like an adult-size tricycle than a motorized car, doesn't it?

"Thinking is the hardest work there is, which is probably the reason so few engage in it."

– Henry Ford

Pneumatic means filled with air.

four-wheeled car in 1886. The Benz and Daimler models were the first modern, practical cars.

During the 1890s, French engineers René Panhard (1841–1908) and Émile Levassor (c. 1844–1897) improved the car's body design. Among other things, they moved the engine up front. Panhard and Levassor also invented the modern transmission. The transmission changes the engine's single speed to the varying speeds needed to drive in traffic.

More design improvements followed. For example, John Dunlop (1840–1921), a Scottish veterinarian, invented ***pneumatic*** bicycle tires in 1888. French industrialists (and brothers) André Michelin (1853–1931) and Édouard Michelin (1859–1940) first adapted them for automobiles in 1895, for a smoother ride.

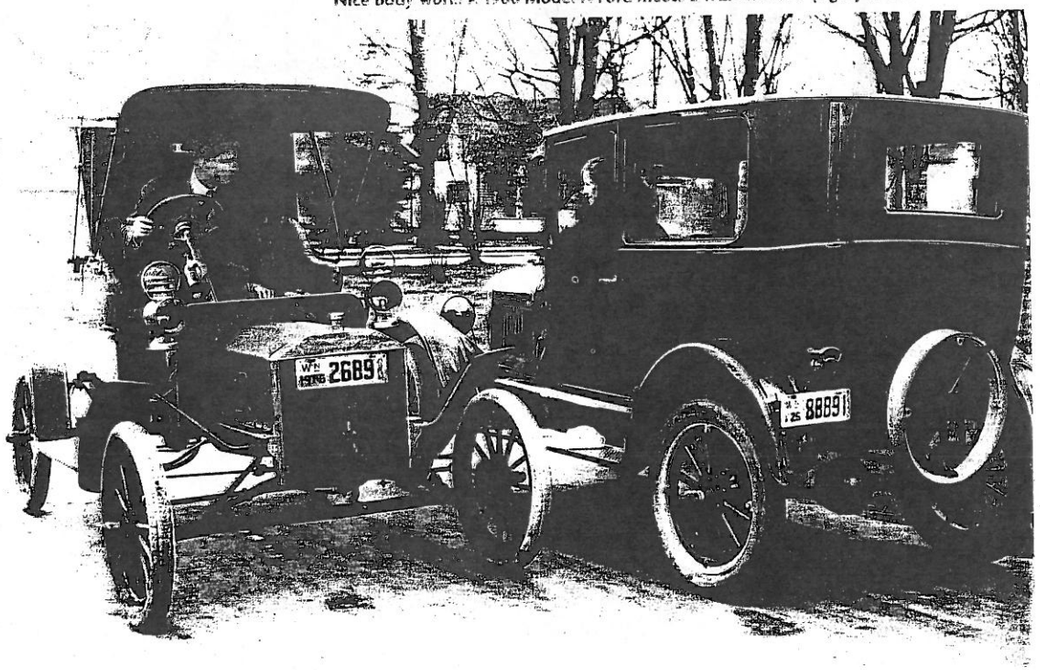
As cars caught on, more people entered the business. Brothers Charles Duryea (1861–1937) and Frank Duryea (1869–1967) of Springfield, Massachusetts, became America's first auto manufacturers in 1893. Ransom Eli Olds (1864–1950) made America's first mass-produced automobile in 1901 in Detroit, Michigan.

Henry Ford began building Model Ts in 1908 and started his assembly line in 1913. But innovation in auto manufacturing didn't stop there. Thanks to the efforts of many other designers and engineers, cars now have heating systems, air conditioning, defrosters, automatic transmissions, air bags, seat belts, radio and CD players, cupholders, and much more.

Who knows where the inventive spirit will take us next? Wherever it is, buckle up and enjoy the ride.

Kathiann M. Kowalski drives a Dodge Caravan, but her first car was a Plymouth Duster. She has written 17 books for young people and writes often for *COBBLESTONE* and *ODYSSEY*.

Nice body work! A 1906 Model N Ford meets a 1925 Model T (right) on the road.



A Driving Force

by Karen Bradley Cain

Mass production is the making of large quantities of a product at a low cost per unit.

"The man who will use his skill and constructive imagination to see how much he can give for a dollar, instead of how little he can give for a dollar, is bound to succeed."

– Henry Ford

In 1913, Henry Ford put his future on the line — the assembly line, that is. He pioneered a new way to produce cars for the masses. Ford and his team followed four basic principles of ***mass production.*** First, they relied on standard, interchangeable parts. Second, work moved continuously, so one job flowed into the next. Third, they divided labor into a number of tasks performed by different workers. Fourth, they cut wasted time and effort.

Before this time, a car under construction stayed in one spot on the factory floor, while workers took turns doing different jobs until it was finished. Determined to speed up the process, Ford installed the industry's first moving assembly line at his plant in Highland Park, Michigan. He used conveyor belts to bring the work to the workers, who were stationed along the line with tools and parts. "Some men do one or two operations; others do more," he explained to the press. "The man who places the part does not fasten it. The man who puts in a bolt does not put on a nut; the man who puts on a nut does not tighten it."

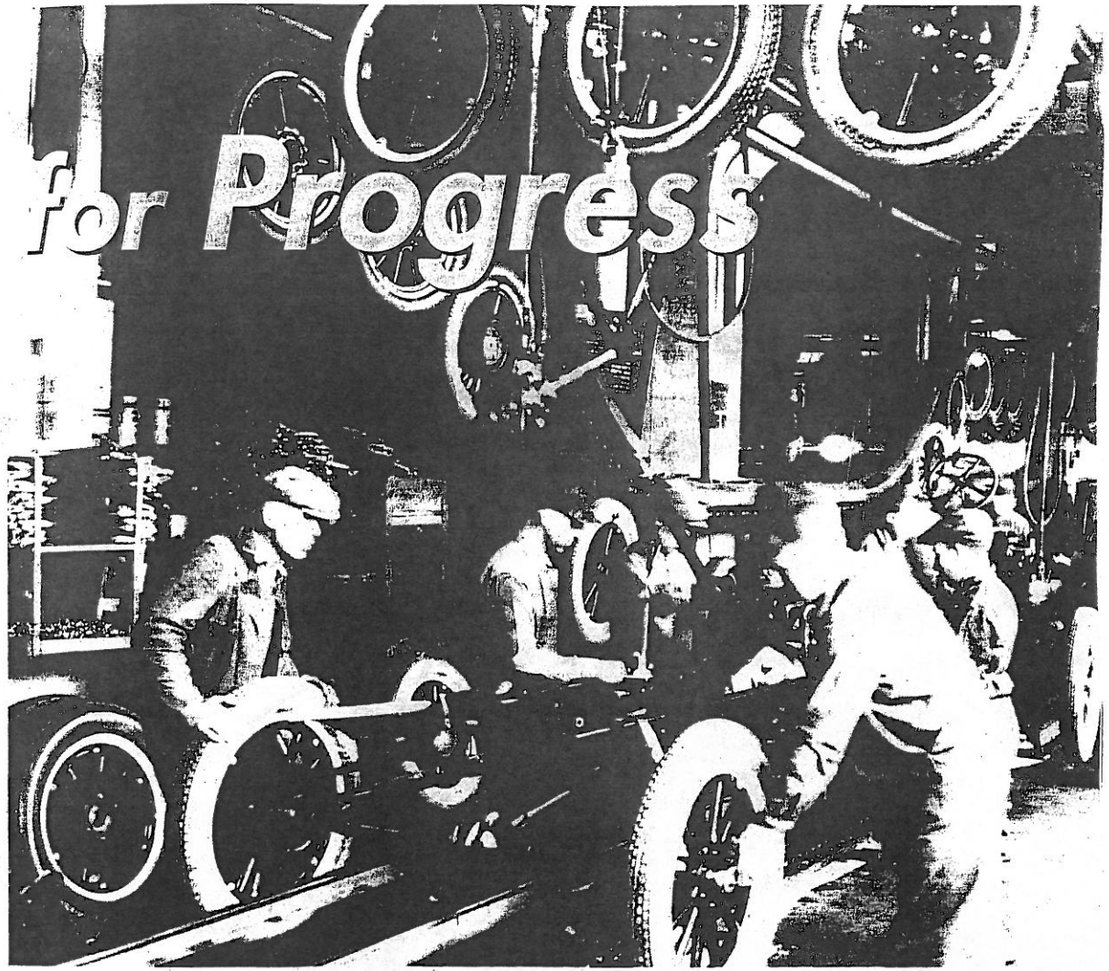
His conviction that "everything must move" boosted Ford Motor Company's production and reduced its costs. In less than a year, assembly time for each car dropped from slightly more than 12 hours to 93 minutes. The price of a new Model T dropped, too, going from 850 dollars in 1908 to 390 dollars in 1915.

Meanwhile, Ford took dramatic steps to create more customers for his "motor car for the multitudes." On January 5, 1914, he announced the "Five-Dollar Day." Ford promised to pay eligible employees at least five dollars per day, more than twice the average wage earned by auto workers at that time. He also cut the workday from nine to eight hours, enabling the factory to operate three eight-hour shifts.

These moves prompted some to praise him as a humanitarian, while others condemned him as "a traitor to his class." To Ford, however, they were simply good business decisions. He believed that giving employees a share of the profits made them work harder and smarter. Moreover, many workers spent their extra cash on low-priced Model Ts. Summing up his philosophy, Ford said, "There is one rule for the industrialist and that is: Make the best quality of goods possible at the lowest cost possible, paying the highest wages possible."

Although such ideas may seem commonplace today, Ford's attitudes

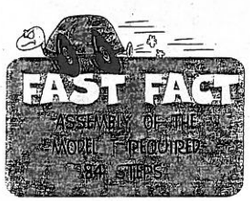
for Progress



Mass production changed the way cars were manufactured. Here, workers install tires on a Model T as it moves along the assembly line at Ford's Highland Park plant.

and decisions sent shock waves throughout the world of the early 1900s. Manufacturers from England, Germany, and Russia studied and soon borrowed his methods. Sociologists began using the term "Fordism" to describe the cycle of mass production and mass consumption that was taking hold in the first quarter of the 20th century.

To many, he became a symbol of American ingenuity and innovation. He sought advice from both employees and experts. His openness to fresh ideas encouraged others to push the boundaries of science and business. The idea for Ford's moving assembly line, for example, began with foreman William Klann and several other employees, who had seen something similar at a meatpacking plant in Chicago in 1912. The plant's "disassembly line" consisted of overhead trolleys that carried animal carcasses to meat cutters at fixed stations. Each butcher performed a single task before the meat traveled to the next station.

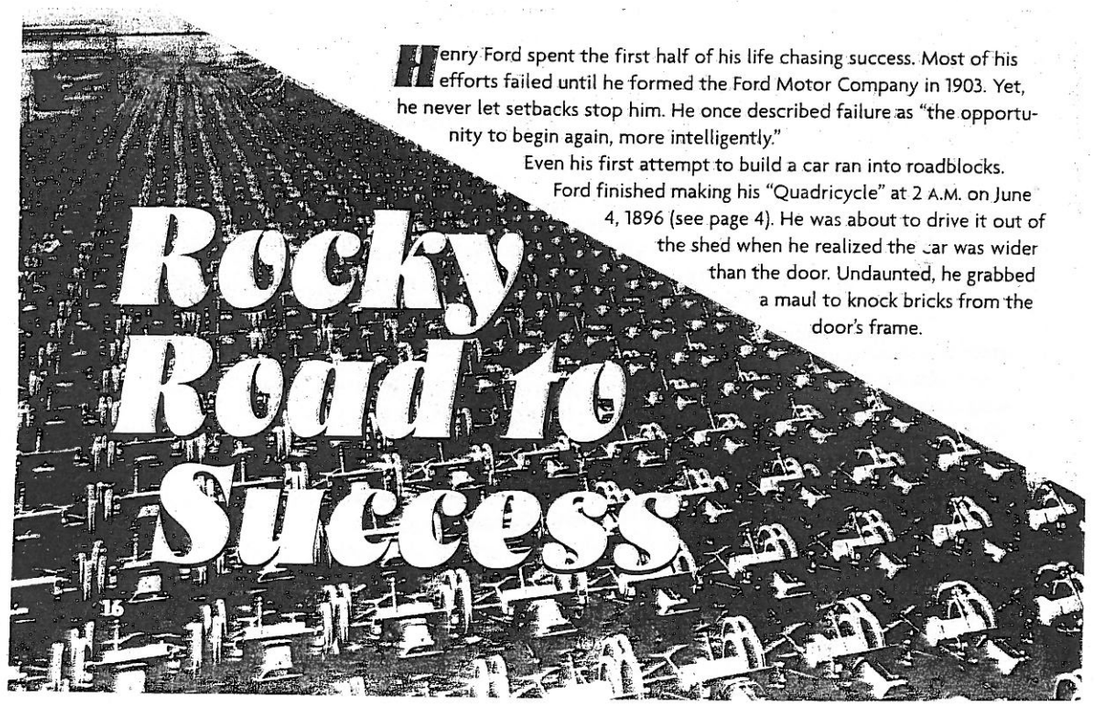


Klann said, "If they can do it, we can do it." Klann and his coworkers first experimented with the process for making the flywheel magnetos that generated the electricity for the Model T's spark plugs. The moving assembly line cut production time from 20 minutes to five minutes. Their success prompted Ford to install conveyor systems throughout the factory.

Ford's team also benefited from studying earlier examples of mass production. The ancient Romans, for instance, had employed division of labor to construct roads, monuments, and public buildings. Nineteenth-century clockmakers and gun manufacturers had built products with interchangeable parts. Yet Ford's approach was more wide-ranging. To make the factory run as smoothly as possible, the company also carried out efficiency studies. Experts analyzed jobs to discover the most effective ways to complete them. Tasks were simplified, decreasing the need for highly paid craftsmen.

Some argued that the new processes put too little emphasis on skill. More serious criticism came from people concerned about the ***dehumanizing*** effects of the assembly line. Using quick, robotic motions, each worker performed the same job over and over again. Factory bosses with stopwatches monitored workers' output and forbade them to speak to one another. Workers feeling bored

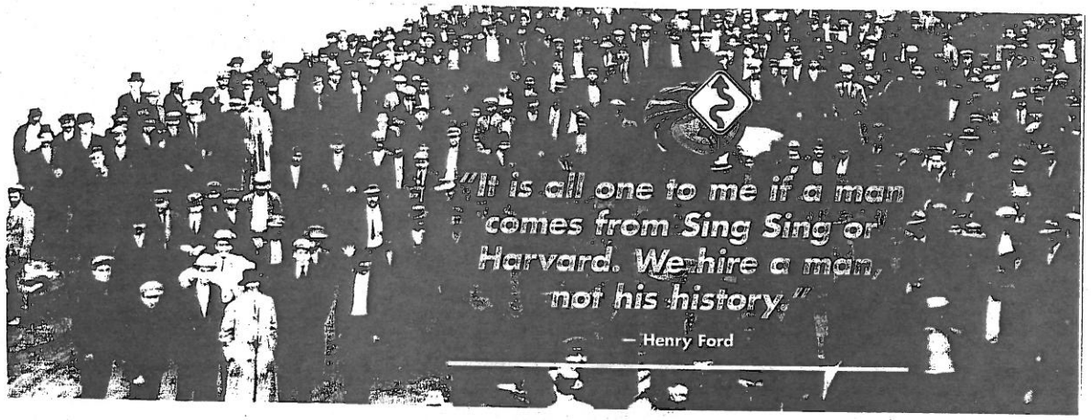
Dehumanizing means taking away a person's spirit or personality.



Rocky Road to Success

Henry Ford spent the first half of his life chasing success. Most of his efforts failed until he formed the Ford Motor Company in 1903. Yet, he never let setbacks stop him. He once described failure as "the opportunity to begin again, more intelligently."

Even his first attempt to build a car ran into roadblocks. Ford finished making his "Quadricycle" at 2 A.M. on June 4, 1896 (see page 4). He was about to drive it out of the shed when he realized the car was wider than the door. Undaunted, he grabbed a maul to knock bricks from the door's frame.



and trapped by the assembly line complained, "Which is the slave — man or machine?"

But the result — reliable cars at reasonable prices — won over the public. And as the Ford Motor Company grew and worker satisfaction became more important, Ford took steps to address the need to keep employees happy.

Ford's introduction of the Five-Dollar Day reversed the tide and increased employee morale. Daily absenteeism fell from 10 percent to 0.3 percent. Fewer workers quit. And anyone who left was soon replaced by one of the 10,000 applicants seeking jobs at the factory.

To qualify for the daily minimum wage, workers had to meet special criteria. Married men were required to live with their families and take care of them. Single men older than 22 had to demonstrate "proven thrifty habits." Ford established a Sociological Department, which sent investigators to employee homes. Investigators offered health, home-making, and shopping advice to workers, many of whom were recent immigrants. The department also discouraged employees from gambling, smoking, and drinking alcohol — habits Ford disliked.

Despite certain restrictions on the Five-Dollar Day, it turned out to be a success. Ford Motor Company workers received close to six million dollars in increased profit-sharing wages in 1914 alone. Eventually, other industrialists followed Ford's lead and started paying their employees "a living wage." Ford responded by announcing a "Six-Dollar Day" in 1919. And in 1926, Ford cut his employees' average workweek from six to five days. By instituting a five-day, 40-hour work-week, he indirectly helped create the modern weekend. Ford's dream to create a reliable car for the American masses changed how the world worked *and* played.

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Ford's decision to raise the wages of his employees to five dollars a day attracted a crowd of willing workers.

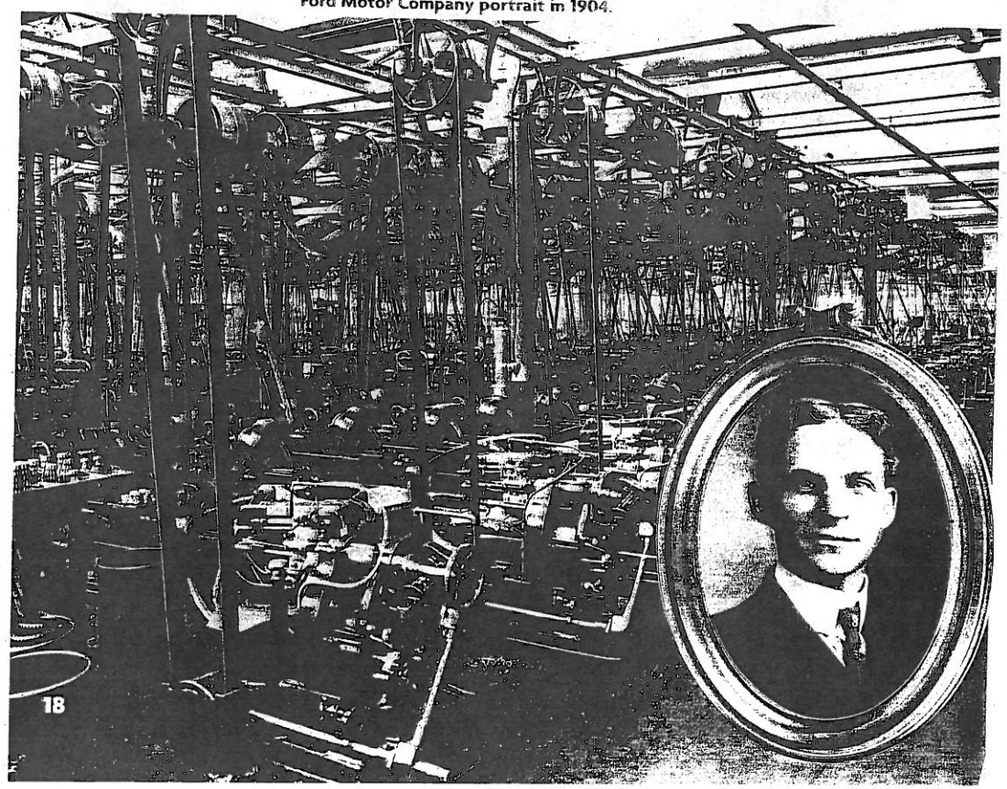
While other automobile inventors saved their early work, Ford was forced to sell the Quadricycle. He needed money so he could build new and better cars. Sometimes he managed to convince local business leaders to invest in his work.

In 1899, he started the Detroit Automobile Company. Wealthy backers gave him funds to hire workers and buy materials. They expected to receive profits when Ford began making and selling cars. To their dismay, however, the delivery truck that Ford produced was not very good. The investors wanted to market a passenger automobile like the Oldsmobile Company's popular runabout car. In the end, the Detroit Automobile Company went bankrupt when all involved agreed to disband the partnership.

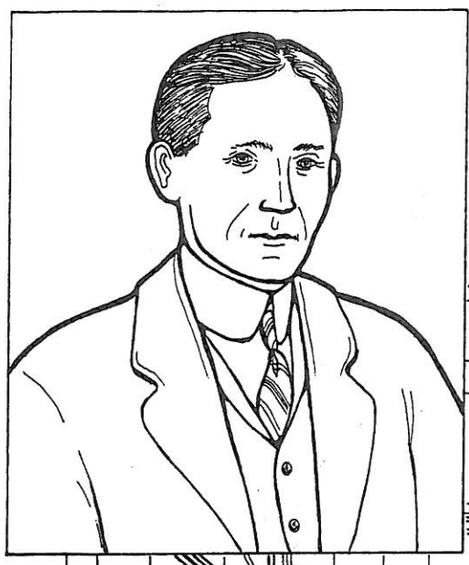
Ford turned to building racecars that set new speed records (see page 11). His racing achievements inspired businesspeople to lend him money again. On Nov. 30, 1901, the Henry Ford Company was born. The following March, it went out of business because Ford and his backers disagreed on the company's direction and goals.

Eventually, Ford's persistence and belief in himself paid off. With 28,000 dollars invested by businessmen, he started the Ford Motor Company on June 16, 1903. Less than two months before his 40th birthday, Ford was finally on his way to making history. **— K.B.C.**

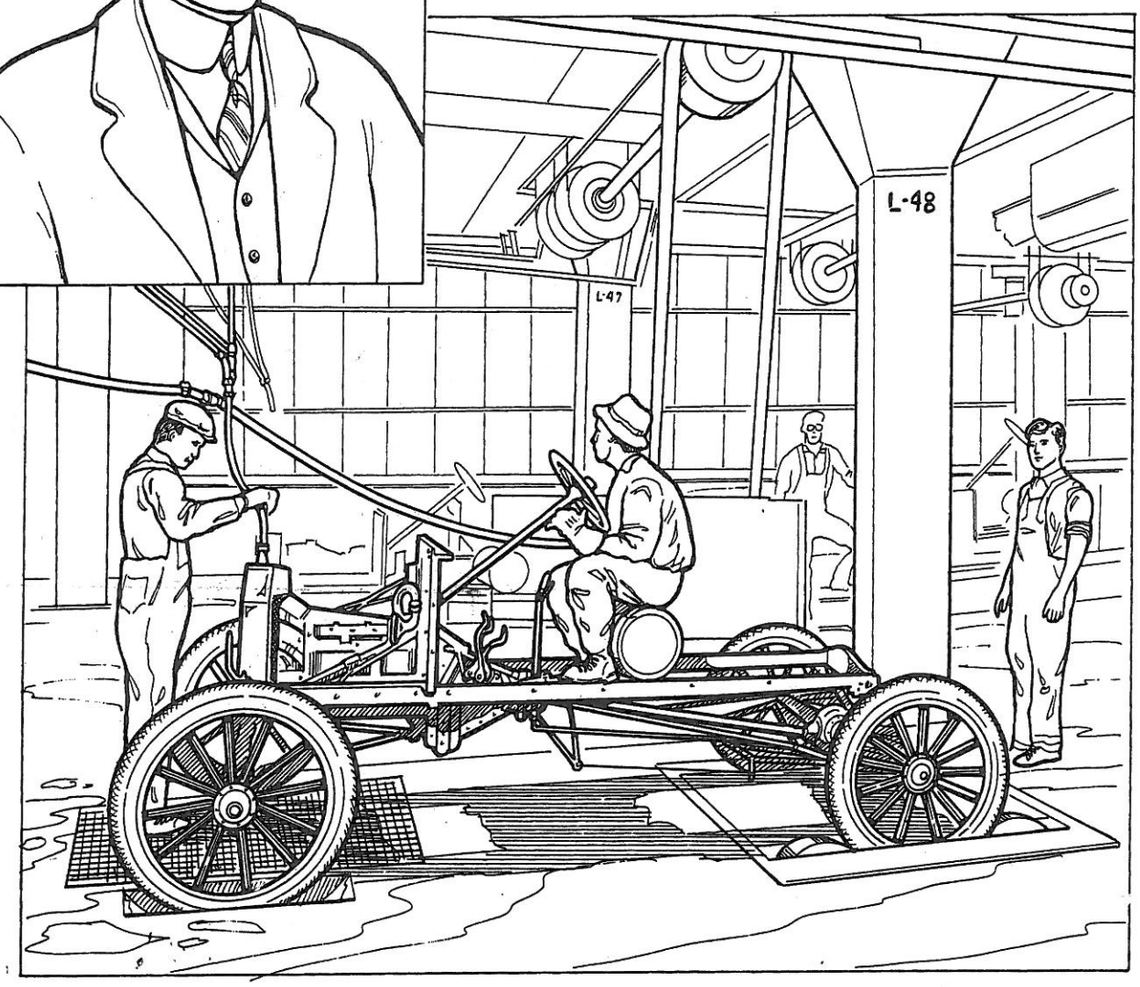
A view of the Highland Park plant's machine shop shows rows and rows of gear hobbers. INSET: A youthful Ford was photographed for his first official Ford Motor Company portrait in 1904.



One shift's production — 1,000 Ford chassis, or steel frames for cars — is ready to roll!



HENRY FORD



MASS PRODUCTION and THE AUTOMOBILE (1908) HENRY FORD

America at the turn of the century was a nation heavily dependent on horses for most of its basic transportation needs, but by developing the assembly line, mechanic turned industrialist Henry Ford (1863–1947) was able to produce automobiles in a quantity, and at a price, that made them available to the average working person.

Henry Ford was the son of Irish immigrants, and like many children of that era, received little formal education. He showed a keen interest and aptitude for mechanics, however, and by 1899 had become Chief Engineer at the Detroit Edison Company. His interest in mechanics prompted him to build his first automobile in 1892. He began his own automobile company in 1903.

The mass production system used by Ford for his automobiles was pioneered by other American inventors including Eli Whitney and Samuel Colt. The basic principle of the system was for the manufacturing process to be broken down into smaller tasks along an assembly line. As the product traveled down the line it would have parts or systems progressively added until reaching completion at the end of the line.

In 1908 Ford began mass production of the famous "Model T" or "Tin Lizzie." By 1913, most working Americans could afford the $500.00 price of a Model T. With as many as 1000 cars per day being built, Ford sold over 15 million Model T's between 1908 and 1927. By the end of their production run, the cost of a Model T had been lowered to just under three hundred dollars.

Besides being an innovative businessman, Henry Ford was an enlightened employer who steadily increased his workers' pay, reduced their hours, and instituted a profit-sharing plan. His success in business made him a very wealthy man. This in turn enabled him to establish a charitable organization, the Ford Foundation, to donate money to worthwhile individuals, causes, educational institutions, and others. The automobile industry, as represented by Ford, did much to pave the way for the economic growth and security of the U.S. during the first few decades of the twentieth century.