2007

By Land, Sea, and Air: Historic Works from the Transportation History Collection

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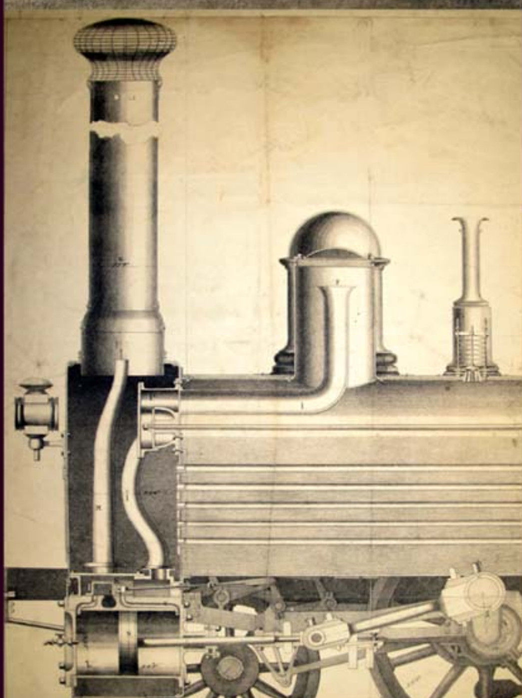
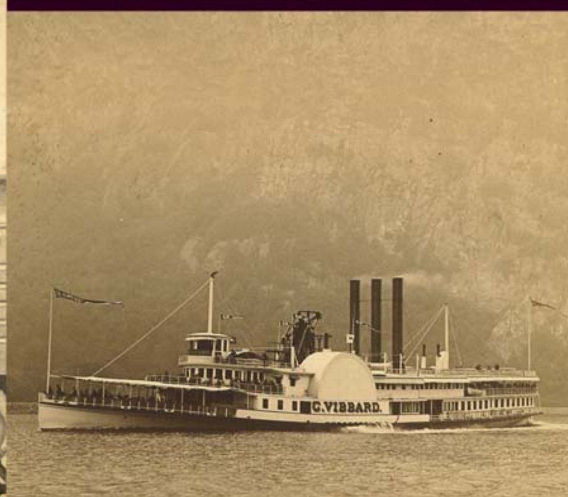
https://hdl.handle.net/2027.42/120292

BY LAND, SEA & AIR

HISTORIC WORKS FROM THE TRANSPORTATION HISTORY COLLECTION





BY LAND, SEA & AIR

Historic Works
from the
Transportation History Collection

12 February • 31 May 2007

Curated by
Kathleen Dow

Special Collections Library
University of Michigan

Special Collection Library Exhibit Hours:

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Welcome to this exhibit highlighting the rich resources of the Transportation History Collection in the Special Collections Library.

As one of the more recent additions to the Special Collections Library (transferred here in 1991), the Transportation History Collection has excited a lot of interest and enthusiasm in staff, as we have learned more about its holdings and come to understand how students and researchers use it. The collection attracts students and researchers from all corners of the United States and abroad and epitomizes our mission of supporting the educational and research activities of the University of Michigan while also making our collections available to any person who might wish to use them.

Kathleen Dow, who is both Curator of the Transportation History Collection and Curator of this exhibit, has prepared a display that expertly combines the beautiful with the technologically significant. Whether a 16th-century book or a 20th-century photograph, the items she has so thoughtfully selected are a pleasure to look at and draw us inexorably into satisfying our curiosity about what they are and what role they played in developing modes of transportation. Moreover, each carefully selected item represents a host of others that could not be shown due to limitations of space, time, and one's ability to stand and view exhibits! Indeed, many of the materials on display are taken from very large archives of material related to the subject. You are cordially invited to come to the Special Collections Library to plumb the depths of this collection at your convenience.

Peggy Daub, Director
Special Collections Library

John Stephen Worley
Founder and Curator,
University of Michigan Transportation Library, 1923—1946

By Land, Sea & Air is a long overdue presentation of items from the Transportation History Collection. This collection, transferred to the Special Collections Library in 1991, was originally part of the University of Michigan Engineering Library, and before that part of a separate Transportation Library on campus. The latter library was founded in 1923 by John Stephen Worley, Professor of Transportation and Railroad Engineering and respected highway expert at the University of Michigan. He began building the collections to support transportation-related studies in the School of Engineering, and is reported to have amassed some 60,000 items by 1929. Until his retirement in 1946, Prof. Worley continuously added materials that broadened and deepened the holdings of the collection, and subsequent curators have continued in his footsteps.

The Transportation History Collection now includes thousands of rare and important books and periodicals on railroads (including several thousand volumes of railroad annual reports and other official documents), early air navigation, ships, carriages, automobiles (particularly early 20th century luxury models), and the planning and building of highways, as well as manuscripts and archives, printed ephemera, and a rich collection of prints, drawings, and photographs on these topics.

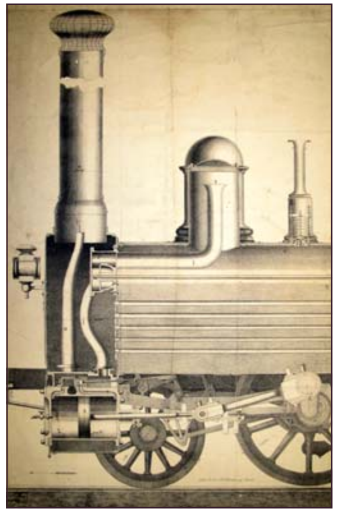
This exhibit tells the story of the history of transportation through the lens of materials in our collection. What is on display was chosen because it illustrates an important point in that history, while at the same time helping us make the breadth and depth of our collection better known. One thing that becomes evident is the deep roots of this collection within an engineering and technological framework. Although many of the items have great beauty, their importance is most often measured by what they can tell us about technological achievements in transportation.

A project of this size could never have been accomplished without the wisdom, talent and support of my colleagues in the Special Collections Library, Peggy Daub, Morgan Jones, Sarah Schaefer, Will Lovick, Bill Gosling, and Julie Herrada. My grateful thanks go to conservators Cathleen Baker, Tom Hogarth and Leyla Lau Lamb for the year-long project to preserve the graphic material in the collection, and for their work in mounting the exhibit. But most importantly I thank the late John Worley, whose tenacious collecting skills and far-ranging contacts in the field of transportation engineering allowed him to lay the foundation of an extraordinary collection that illustrates how human beings long to go farther and faster (in style if possible), whether by land, sea, or air.

Kathleen Dow, Curator
March 2007

Trains & Railroads • case 1

***Laengen Durchschnitt der Locomotive von Stephenson.* [Lithograph] Cassel: Theodor Fischer, ca. 1840.**



British engineer George Stephenson (1781-1848) built his first steam railway locomotive in 1814. Based on the earlier steam engines developed by Richard Trevithick and William Hedley designed for use on roads (tramways), Stephenson's "Blucher" was one of the first successful flanged-wheel locomotives that traveled on fixed rails and employed rods instead of gears. The coal-fed boiler produced steam fed through pipes to the cylinders, which moved the pistons in a reciprocating motion. The pistons in turn connected to rods which connected to the driving wheels, thus propelling the locomotive forward. The use of driving rods instead of gears produced a much more powerful and efficient engine.

This detailed schematic drawing, based on Stephenson's engine the "Locomotion" of 1825, was published in Christian Potente's *Praktisches Handbuch der Eisenbahnen- und Dampfmaschinen-Kunde* (1847).

George Stephenson, 1781-1848.
***Log of Owners and Residents of Land Adjoining the Proposed Route of the Darlington and Stockton Railway.* [Manuscript] 1822.**

In addition to his innovations which revolutionized the steam locomotive for use on railways, Stephenson played a key role in the early development of the British railway system. Legally established as the Stockton and Darlington Railway, this line was the first public railway in the world. It ran from the collieries of Darlington in northeast England to the shipping town of Stockton on the River Tees. Originally conceived as an efficient and effective means of transporting coal, it quickly became a passenger line as well.

This log book, compiled by George Stephenson, records the owners and tenants residing along the corridor through which the railway would run. It was necessary to arrange for the purchase of these lands before Parliament would pass the Stockton and Darlington Railway Act of 1821 and construction could begin. The railway opened on September 27, 1825.

***Olive Mount.* [Etching] Liverpool: I. Shaw, March 13, 1831.**

With the success of the Stockton and Darlington Railway, British businessmen became keenly aware of the profits to be made by the relative ease of moving goods, and passengers along rail lines. George Stephenson was enlisted to develop a railway linking the textile center of Manchester in northern England and the western port of Liverpool on the Mersey estuary.

The etching depicts the cutting near the village of Olive Mount engineered by Stephenson to complete the route of the Liverpool and Manchester Railway. Nearly two miles long and eighty feet deep, over 480,000 cubic yards of sandstone had to be removed from the hill before the track could be laid. The print also shows one of Stephenson's steam locomotives pulling a series of early passenger carriages.

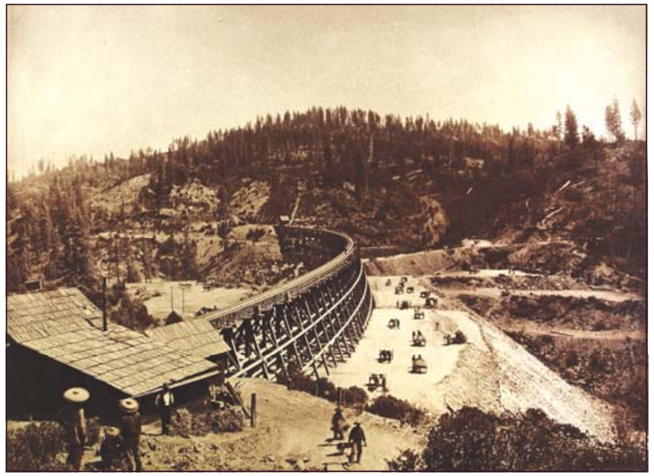
Carleton Watkins, 1829-1916 (photographer).
***Trestle on the Central Pacific Railroad.* [Albumen Photograph] ca. 1868. Reproduction.**

With the explosion of railroad-building in the American West after the Civil War, the two dominant lines, the Union Pacific Railroad and the Central Pacific Railroad, were eager to entice people to travel westward. One way to entice was to show photographs of interesting or beautiful locales, feats of engineering, and historic events. For this, the railroad companies turned to some of the greatest photographers of the 19th century.

Carleton Watkins was, indisputably, one of the greatest American photographers of his age. A master of the large format camera, Watkins hauled the oversize box and the equally large glass plate negatives across the Rockies and the Sierra Nevada

Mountains, through the Yosemite Valley, and up and down the Pacific Coast, taking some of the most beautifully composed commercial photographs in the history of photography.

This to-scale reproduction of the original albumen print known as a mammoth plate print (usually measuring 17" by 21") depicts the extraordinary trestle bridge built deep in the Sierra Nevadas by the CPRR. Chinese and Irish laborers were recruited to perform the most dangerous construction, including building bridges in mountainous terrain and laying track in the desert. Watkins' composition centers the graceful curve of the bridge as the apparent focal point, but the eye is also drawn to the workers and their conical hats in the foreground and to the dense vegetation of the hill beyond the bridge.



The original photograph cannot be displayed here due to the albumen print's tendency to fade under exposure to light. The original photograph may be viewed in the covered display case inside the Reading Room.

Andrew Joseph Russell, 1830-1902 (photographer).
The Joining of the Union Pacific Railroad and the Central Pacific Railroad at Promontory Point, Utah. **[Albumen Photograph] 1869. Reproduction.**

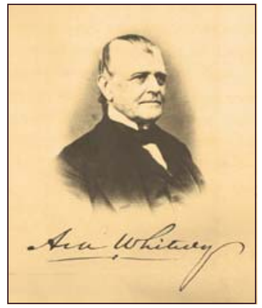
Along with Carleton Watkins and William Henry Jackson, A.J. Russell stands out as one of the leading photographers of Western America in the 19th century. He is best known for his series of photographs that document the momentous occasion of the joining of the Union Pacific and the Central Pacific Railroads at Promontory Point in northern Utah on May 10, 1869. Sometimes known as "Driving the Golden (or Last) Spike," these photographs show the ceremony marking the fulfillment of Asa Whitney's dream of a transcontinental railroad across America. [See Case 2 for more on Whitney.]

The original photograph cannot be displayed due to the albumen print's tendency to fade under exposure to light. The original photograph may be viewed in the covered display case inside the Reading Room.

Union Pacific Rail Road.
Across the Continent West from Omaha, Nebraska. **[Promotional Brochure] New York: Union Pacific Rail Road, 1869.**

In addition to contracting adventurous and talented photographers to take photographs of the railroad lines, bridges and locomotives, the railroad companies also produced pamphlets and hardbound books extolling the virtues of the West. These publications were intended to allay fears of the unknown and promote the ease and comfort of traveling by train.

Trains & Railroads • case 2



Asa Whitney, 1797-1872.
Diary, June 2, 1845 to August 4, 1846. **[Manuscript]**

Asa Whitney, 1797-1872.
A Project for a Railroad to the Pacific. **New York: Printed by George W. Wood, 1849.**

American merchant and early government lobbyist Asa Whitney is best known for his tireless work in urging legislators and railroad barons to build a transcontinental railroad. He is often called "The Father of the American Transcontinental Railroad." It is possible that Whitney was inspired by the dreadful sea passages that he endured on his trade missions to China, but he also realized what a boon a swift continuous passage from Chicago to San Francisco would be to the American economy.

Whitney's daily diary is open here to passages describing a visit to Washington, D.C. in which Whitney cultivated future Vice President, and later President of the United States, Millard Fillmore. Other sections record his observations as he traveled, by horse, carriage, and boat, along the possible routes of a transcontinental railroad. Whitney's advocacy also led him to publish two monographs on the topic: *National Railroad Connecting the Pacific* (1845); and *A Project for a Railroad to the Pacific* (1849). Frustrated and discouraged after almost twenty years of working for this cause, Whitney gave up his efforts in 1852.

Baltimore and Ohio Railroad Company.
First Annual Report of the Directors to the Stockholders. **Baltimore, October 1, 1827.**

The B&O Railroad, the first commercial railroad in the United States, was chartered in 1827. Inspired by the work of the British, businessmen in Baltimore banded together and planned a line that would initially reach to Wheeling, West Virginia. Following the lead of George Stephenson, early B&O directors contracted Peter Cooper, proprietor of the Canton Iron Works in Baltimore, to build a steam locomotive. Cooper's "Tom Thumb" was one of the first steam engines to work the rails in the United States.

Baltimore and Ohio Railroad Company.
134th Annual Report … Year Ended December 31, 1960. **Baltimore: Baltimore and Ohio Railroad Company, 1961.**

After almost 140 years, the Chesapeake and Ohio Railroad took control of the B&O in 1963, and incorporated it, along with the Western Maryland Railway, into the Chessie System in 1973. In 1980, the Chessie System merged with the Seaboard System Railroad to create CSX. In 1986, the B&O finally went out of existence as a corporate entity when it formally merged with the C&O (which itself merged with CSX later that same year). At the height of railroading's golden age, the B&O was one of several trunk lines uniting the northeast quadrant of the United States into an industrial zone.

The University of Michigan's holdings of the B&O Annual Reports document the legendary railroad from beginning to end.

Reuben N. Rice.
Letterbook of the Michigan Central Railroad, 1863. [Manuscript]

Reuben N. Rice was the General Superintendent of the Michigan Central Railroad, which was chartered in 1837 as a central line to run between Detroit and St. Joseph, Michigan. Sold to private investors in 1846, the line grew, first reaching Chicago, then building on or incorporating smaller branch lines. Much like the B&O, the Michigan Central Railroad was subsumed by a larger line, the New York Central Railroad, in 1930.

Superintendent Rice's letterbook for the year 1863 contains correspondence regarding cartage, the working hours of engineers, problematic passengers, the need to move goods more quickly, and frequent requests for free tickets or passes. The heartbreaking letter on display is the plea of a father who lost two children to the railroad, which can surely spare a free pass as restitution.

***Constitution and By-Laws of the Grand International Brotherhood of Locomotive Engineers*. Cleveland: Cleveland Printing and Publishing Co., 1892.**

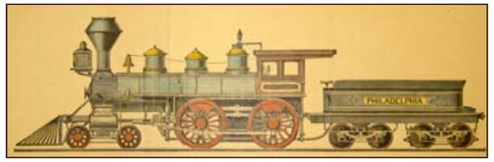
In 1862, angered by the Michigan Central Railroad's low pay ($60 for 2500 miles, per month), unfair dismissals, and unsafe working conditions, thirteen engineers met at the home of William D. Robinson in Marshall, Michigan and founded the first union of railroad engineers. Formally named the Brotherhood of the Footboard, the first meeting was held in Detroit, Michigan, on May 5, 1863, and, along with a protective association formed by Baltimore & Ohio engineers, began the long history of the unionization of railroad workers. Headed by the Grand Chief Engineer, the organization sought to protect the rights of locomotive engineers and provide benefits such as life insurance, which was notoriously difficult to obtain in such a hazardous profession. The union grew to include the membership of engineers from almost all railroad lines in the country, and eventually after extending an invitation to their brethren in Canada, prompted a name change to the International Brotherhood of Locomotive Engineers.

***The Khyber Railway*. Peshawar: R. B. Holmes, ca. 1925.**

During the late nineteenth and early twentieth centuries it may have appeared that the majority of railroad lines were being built in Britain and the United States. On closer examination, this proves untrue as there was an explosion of international railroad building, including lines in most European countries, Central and South America, Russia, the Middle East, Africa, and Asia.

A feat of modern railroad engineering blasted from the rock of the Safed Koh Mountains in the foothills of the Hindu Kush, the Khyber Railway's route begins in Jamrud, (now in Pakistan), the "gateway to the Khyber Pass", and ends in Landi Khana near the Afghanistan frontier. Built over the course of five years by the British colonial government in India, with the assistance of local tribal families, the standard-gauge (5'6") railroad was to be used for the transport of troops. The 27-mile long railroad includes 4 reversing stations, 34 tunnels with an aggregate length of more than 2.5 miles, 92 bridges and culverts, and climbs more than 2000 feet at its highest point.

This album, created to commemorate the opening of the railway, was printed by Randolph B. Holmes. Holmes's family operated a photography studio in Peshawar, Pakistan, from the 1890s through 1940.



Baldwin Locomotive Works.
***Standard Passenger Engine, Made by M. Baird & Co.* [Lithograph] Philadelphia, 1872.**

Matthias W. Baldwin, originally a maker of bookbinding tools and fabric-printing cylinders, founded Baldwin Locomotive Works in 1832 in Philadelphia. The company rapidly became one of the foremost manufacturers of steam locomotives in the United States. Baldwin, along with American Locomotive Company and Lima Locomotive Works, dominated the manufacturing of steam locomotives for close to 100 years.

Based on the work of Oliver Evans, George Stephenson, and other engineers, Baldwin explored the capabilities and design of steam engines, while also giving a nod to exterior design. The Baldwin steam locomotive is the iconic image of the 19th-century train, and is memorialized in thousand of lithographs. This lithograph shows a steam locomotive made for the Pennsylvania Railroad which was built by Matthew Baird, who took over Baldwin Locomotive Works after Mathias Baldwin's death in 1866.

Baldwin Locomotive Works.
***Pennsylvania Railroad T1 Locomotive.* [Print] Philadelphia, ca. 1942.**
By the mid-1920s, Baldwin started experimenting with oil and diesel engines, and by 1939 was producing diesel electric locomotives. This locomotive for the Pennsylvania Railroad was Baldwin's last steam engine. Two prototypes and 50 production models were produced between 1942 and 1946. These duplex locomotives were sleek, powerful, and fast with an engine that split the driving wheels into two sets, each with its own set of cylinders and driving rods. Maintenance on the duplex en-

gine proved to be expensive and complicated; no more were built after the initial 52. The demise of the T1 essentially signaled the end of the era of the steam locomotive.

By 1953 Baldwin had merged with the Lima-Hamilton Company of Ohio, and the Austin-Western Dump Car Company of Aurora, Illinois, and became the Baldwin-Lima-Hamilton Company, which continued until 1972.

Alco (American Locomotive Company)/General Electric.
***Diesel Locomotive.* [Color Print] 1950s.**

Tracing its roots to the Schenectady Locomotive Works, founded in 1851 in Schenectady, New York, the American Locomotive Company was formed in 1901 by the merger of seven locomotive manufacturers. It first built steam locomotives, but by the 1920s, with the ubiquity of the internal combustion engine, Alco diversified into diesel-electric locomotives. After refitting as tank production facilities during World War II, the post-war years found the company focusing production on diesel locomotives. A decades-long relationship with General Electric, the maker of the electric components in the Alco locomotive, proved advantageous for both companies. After GE broke away from Alco and began building its own line of locomotives in the late 1950s, the company foundered and went through various name and product changes. It is now known as Alco Power, a manufacturer of diesel power plants, and parts for aging Alco locomotives.

Alco (American Locomotive Company).
Training Materials for Engineers.
[Lantern Slides] 1950s.

In order to train locomotive engineers to understand and run their diesel locomotives, Alco created a series of glass lantern slides as teaching tools. These slides were packed in custom-made wooden boxes and carried from station to station by an Alco representative who would use them to illustrate various details of the Alco engine.

Philip Phillips.
***The Forth Bridge, in its Various Stages of Construction and Compared with the Most Notable Bridges of the World.* Edinburgh: R. Grant & Son, 1890.**

Built by North British Railway, the Firth of Forth Bridge was the crucial link in a line designed to connect the Scottish cities of Edinburgh, Dundee, and Aberdeen. The massive structure, which some critics considered overbuilt, was designed by engineers Sir John Fowler and Benjamin Baker to withstand the most intemperate weather and to carry heavily-laden freight trains while spanning approximately one mile of the estuary of the Forth River. Although it was considered one of the civil engineering wonders of the Industrial Revolution, William Morris, one of the founders of the Arts and Crafts Movement, called it "the supremest specimen of all ugliness." After the tragic collapse of the Firth of Tay railroad bridge in 1879, railroad authorities were particularly interested in constructing the most structurally-sound bridge in the world. The cantilever design, consisting of massive beams supported by a series of diagonal struts, was expensive to build but is exceptionally sturdy.

Begun in 1882 and completed in 1890, the Forth Bridge consists of three cantilevers connected by aprons, and measures 1.6 miles, including ramps. The construction of this behemoth required 54,000 tons of steel, 21,000 tons of cement, and approximately seven million iron rivets. Of the 5000 workers employed on the bridge, 57 lost their lives during construction.


FIFE CANTILEVER.

This commemorative volume, authored by British engineer Philip Phillips was published to coincide with the bridge's gala opening by HRH the Prince of Wales on March 4, 1890.

Balloons, Dirigibles & Airplanes • case 3

Joseph Pennell, 1857-1926.
***Zeppelin Leaving Shed, Leipzig, Germany.* [Lithograph] 1914.**

The development of the zeppelin in Germany was a direct offshoot of the Montgolfier brothers' hot air balloon (see Case 4) and Jean Baptiste Meusnier's hand-propelled elliptical balloon in France. Count Ferdinand von Zeppelin (1838-1917), devised a gas-filled, rigid-sided airship that he hoped would dominate early 20th century air transportation. Technically a type of dirigible, a cylindrically-shaped buoyant balloon with a steering mechanism and powered by a gasoline engine-driven propeller, the zeppelin was unique in that its rigid sides and separate compartments for hydrogen gas within its skin allowed it to travel greater distances and carry heavier loads, including two 16-horsepower engines. Zeppelins could attain speeds in the range of 20 miles per hour, carrying passengers and cargo in either an open or enclosed trolley suspended from the underbelly.

Although blimps, a much simpler dirigible, had been used earlier for military purposes, it wasn't until World War I that the zeppelins were thus employed. The armies of Germany, Great Britain, the United States, and Russia all campaigned to build fleets of zeppelins for warfare. With the evolution of the airplane into a feasible and much more efficient means of flight, supplanting the zeppelin in commercial transportation and in warfare, the zeppelin became a pleasure vehicle. This came to an abrupt halt in 1936 with the tragic explosion of the "Hindenburg" in Lakehurst, New Jersey.

American printmaker and illustrator Joseph Pennell is known for his dramatic and moody depictions of famous landmarks, historical scenes, and book illustrations. Often confining his palette to shades of black and gray, Pennell created several series of prints, including a set of zeppelins in or near their sheds. This illustration, showing a zeppelin emerging from a shed near Leipzig, Germany, gives an impression of the sheer size of these airships and the buildings within which they were built and docked.

Rudolph Ackermann, 1764-1834.
***The Eagle.* [Lithograph] 1834(?).**

After the first successful hot air balloon flight in France in 1783, fancy took flight for many inventors and illustrators. Rudolph Ackermann, a London-based printmaker, publisher, and inventor, is well-known for his aquatints and his 40-volume opus *Ackermann's Repository of the Arts, Literature, Commerce, Manufactures, Fashions and Politics* (1809-1828). In this lithograph Ackermann, who apprenticed as a carriage designer in Basel and Paris, depicts a fantasized passenger-carrying hot air balloon, that can apparently be steered by means of a series of flipper-like appendages.

***Boeing 40-A Crossing Rockies.* [Silver Gelatin Photograph] 1927.**

The first transcontinental U. S. Postal Service route between New York, Chicago, and San Francisco was opened in 1919 by the company that is now known as United Air Lines. By the 1920s, it was becoming clear that there was keen interest in better and faster airplanes to service this route.

Aviation pioneer William E. Boeing, born in Detroit in 1881, converted his Seattle shipyard into an airplane factory in 1910. Under the company name Pacific Aero Products, Boeing worked with engineer Donald W. Douglas to improve upon the groundbreaking work begun by Orville and Wilbur Wright (see Case 4). After becoming the Boeing Airplane Company in 1917, the firm began developing and building planes for the U. S. Navy, eventually evolving into the largest manufacturer of aircraft in the world.

The Boeing 40-A biplane, constructed of steel tubing, wood veneer laminate, and fabric, was the first airplane built for commercial and passenger use. Boeing's fleet of 24 airplanes built for the postal service were powered by air-cooled, 420-horsepower Pratt and Whitney Wasp engines, enabling them to reach a top speed of 128 mph with a range of 650 miles and a ceiling of 14,500 feet. With the capacity to carry 1,200 pounds of mail and 2 passengers, in addition to the pilot, the Boeing was a vast improvement over its predecessor, decommissioned World War I-era De Havilands.

This photograph, taken on May 20, 1927, shows the Boeing 40-A on its inaugural flight between Chicago and San Francisco.

***Interior of the Handley Page Company's "Hannibal".* [Photograph] 1931.**

The Handley Page Aircraft Company, founded in Great Britain in 1909, was a leader in developing aircraft designed to drop bombs during the latter days of World War I. Founder Sir Frederick Handley Page was one of the inventors of the concept of slotted wings, which helped pilots to control lift and drag when taking off and landing. These slots later evolved into flaps on single wing airplanes.

Diversifying into passenger airplanes during the 1920s and 1930s, Handley Page built the four-engine biplane the "Hannibal" (HP 42E), for Britain's Imperial Airways. The luxurious 40-passenger cabin included wall-to-wall carpeting and a bar. It was designed for long-range routes, and flew without a single logged accident in a decade of service.

Balloons, Dirigibles & Airplanes • case 4

Barthélemy Faujas-de-St.-Fond, 1741-1819.
Description des expériences de la machine aérostatique de MM. de Montgolfier, …
Paris: Cuchet, 1783-84.

Le Chevalier De Lorimier (artist), N. De Lauray (engraver).
***Premier Voyage Aérien en présence de M. le Dauphin.* [Engraving] 1783.**

A lawyer, and later, a geologist by profession, Faujas-de-St.-Fond wrote one of the first monographs on the first successful flight in a hot air balloon. The interest and amazement generated by this feat produced an outpouring of essays and artwork.

The successful hot air balloon was designed and built by brothers Jacques-Etienne (1745-1799), and Joseph-Michel Montgolfier (1740-1810). They first experimented with filling paper bags from their father's paper factory with air heated over a fire. After several test flights, one carrying animals, the Montgolfier brothers constructed a balloon of lushly printed taffeta lined with alum-coated paper, with the panels held together by thread and over 2000 buttons. A small iron furnace provided the heated air for the balloon.

On November 21, 1783, standing in a basket suspended under the balloon, Jean-François Pilatre de Rozier and François Laurent, Marquis de'Arlandes, piloted the balloon for 25 minutes. They reached the astonishing height of almost 3000 feet, flying over the rooftops of Paris and landing without mishap 6 miles away.

This hand-colored engraving shows the view of the historic event that Benjamin Franklin, residing in Paris at the time, had of from his terrace.

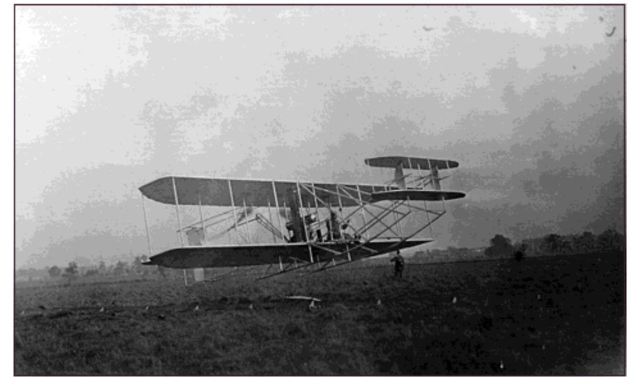
Charles Renard, 1847-1905.
***[Collection of 15 papers published by Charles Renard ... 1886-1914].* Paris: Gauthier -Villars ..., 1886-1914.**

In 1884 Charles Renard and Arthur Krebs, both inventors and officers in the French Army Corps of Engineers, designed and built the first maneuverable dirigible. "La France" was powered by a 7.5 horsepower electric motor and was capable of being steered, in a very light wind, by Renard's addition of a rudder and a sliding weight which could be manipulated to maintain the center of gravity. With Renard at the helm, the airship made it's maiden voyage on August 8, 1884, traveling 5 miles after having returned to its point of departure.

Renard went on to write extensively about his research and experimentation with dirigibles. Many of these pieces were published in *Comptes Rendus des Séances de l'Académie des Sciences, Paris*. Shown here is a letter from Renard to "Monsieur le député" regarding government funding for the dirigible station at Chalais-Meudon, France. The letter is bound in the volume with copies of Renard's publications.

Alberto Santos-Dumont, 1873-1932.
***Santos-Dumont and His Airship "No. 6".* [Photograph] 1901(?). Reproduction.**

Over a century after the success of the Montgolfier brothers, Alberto Santos-Dumont, a Brazilian living in Paris, took his first hot air balloon trip in 1898. Santos-Dumont was keenly interested in air transport and, inspired by Charles Renard's experimental use of small electric engines to power a dirigible's propeller, devised a gasoline engine, based on Gottlieb Daimler's automobile engine, to do the same. On October 19, 1901, with the engine fitted to a soft-sided dirigible, Santos-Dumont flew in a race from Saint-Cloud to Paris and back, just clipping the Eiffel Tower which was the turning point. He had a winning time of 29.5 minutes. For this feat he won the Deutsch Prize, valued at 125,000 francs. In later years, Santos-Dumont experimented with heavier-than-air ships, inspired by the work of Orville and Wilbur Wright, and wrote a book on his inventions and exploits entitled *My Airships* (1904).



The photograph, taken by artist and photographer Valerian Gribayedoff, shows Santos-Dumont preparing to take off, possibly at Saint-Cloud in 1901.

***Orville and Wilbur Wright's Plane Just Leaving the Ground,* [Silver Gelatin Photograph] *Dayton, Ohio, 1909-1911.* Reproduction.**

***Wright Brothers' Plane Coming in for a Landing, (Dayton, Ohio, 1909-1911).* [Silver Gelatin Photograph] Reproduction.**

***Wright Brothers' Plane, (Dayton, Ohio, 1909-1911).* [Silver Gelatin Photograph] Reproduction.**

Considered the fathers of modern aviation, Wilbur (1867-1912), and Orville (1871-1948) Wright began as printshop owners in Dayton, Ohio. Succumbing to the bicycle craze that was sweeping the world, they opened the Wright Cycle Company in 1896. There they honed their mechanical skills and their powers of invention until, avid wheelmen themselves, they eventually designed and built their own bicycle models.

The Wright brothers became aware of the work of German engineer Otto Lilienthal and his work with fixed-wing gliders and applied what they had learned in building bicycles to building gliders. Control in the air, maneuverability, and the ability to land safely were the problems that needed to be addressed as had been done by Menard in his work with dirigibles.

Through trial and error, sometimes dangerous error, the Wrights designed and built a heavier-than-air craft that could be controlled while in the air. Specifically, they developed a wing design and adapted controls that allowed the pilot to *roll* the wings right or left, *pitch* the nose up or down, and *yaw* the nose from side to side.

These three aspects of flying, roll, pitch, and yaw, make it possible to maneuver an airplane in three dimensions. After perfecting an appropriate propeller and building a relatively light, 12 horsepower 4-cylinder engine, the Wright brothers flew the “Flyer” for the first time at Kitty Hawk, North Carolina on December 17, 1903.

> "The first flight lasted only twelve seconds, a flight very modest compared with that of birds, but it was, nevertheless, the first in the history of the world in which a machine carrying a man had raised itself by its own power into the air in free flight, had sailed forward on a level course without reduction of speed, and had finally landed without being wrecked."
> -Wilbur and Orville Wright, Dec. 17th, 1903.

These photographs were taken by Harry F. Baker, a University of Michigan student from 1907 to 1910. Baker worked for the Wright Brothers in Dayton during the summer of 1909 and after he left the university in 1910.

Charles A. Lindbergh, 1902-1974.
***"We", by Charles A. Lindbergh; The Famous Flier’s Own Story of His Life and His Transatlantic Flight, Together with His Views on the Future of Aviation.* New York and London: G. P. Putnam's Sons, 1927.**

The phenomenal impact the Wright Brother’s work had on commercial transportation and modern warfare was profound; the impact it had on the individual adventurous spirit was equally as profound. Both explorers of new frontiers and daredevils alike used the airplane as the means to see just how far a human being could go.

Charles Lindbergh, born in Detroit in 1902, grew up in a world where airplanes were a reality. At a young age he became a “barnstormer” – a daredevil pilot who would perform at exhibitions and fairs. On May 20-21, 1927, he became the first person to pilot an airplane nonstop and alone across the Atlantic Ocean, from New York to Paris. Following a different route, his amazing feat was repeated by Amelia Earhart in 1932.

Lindbergh was feted as a hero and became an international ambassador of aviation. His popularity abruptly ceased in 1941 when Lindbergh publicly voiced his objection to the United State’s involvement in World War II, although he later had a

change of heart and served in the South Pacific.

After his historic flight, Lindbergh wrote his account of the trip in *We*. (The title refers to the author and his plane, the Spirit of Saint Louis, specially manufactured by Ryan Aeronautical Company of San Diego, California.) This limited edition copy was signed by the author and by publisher George P. Putnam.

***Navigator’s Log Book, Airplane No. 25: First Non-Stop Flight Moscow-North Pole-United States of America*. Moscow and Leningrad: State Art Publishers, 1939.**

Historic long-distance flights were not made by just American pilots. Several were made in the years before and after Lindbergh and Earhart, including one sanctioned by the Soviet government. The *Navigator’s Log Book* shown here is a facsimile published to commemorate a transarctic goodwill flight from Russia to the United States made in the summer of 1937. It includes an English translation of the original log kept by navigator Alexander Beliakov. Beliakov was accompanied on the flight by pilot Valery Chkalov and co-pilot Georgiy Baidukov.

The ANT-25 – “Airplane no. 25” – was a long-range aircraft with an extremely long wingspan of 114.8 feet. It was however, unable to make the entire Moscow to San Francisco flight plan; instead, the plane, running low on fuel, landed in Vancouver, Washington. Here are logged freezing temperatures and frozen oranges, poor visibility, and finally, on June 20, 1937, Beliakov writes that the petrol hand-pump won’t work (14.46 GMT). The plane turns back to Portland, Oregon (15.41 GMT), landing in Vancouver at 16.20 GMT. The total time in the air was 63 hours and 16 minutes.

Rumors were started shortly after the flight, and persist to the present day, that not only was the flight a hoax, but also that Soviet leader Joseph Stalin ordered Chkalov assassinated for unspecified crimes.

Early Engineering Books • case 5

Agostino Ramelli, 1531-ca. 1600.
***Le diverse et artificiose machine del capitano Agostino Ramelli ...* . Paris: In casa del'autore ..., 1588.**

An Italian soldier and engineer under Henry III of France, Ramelli was almost da Vincian in his inventive genius, applying himself to devising mechanical solutions for hauling water, lifting and moving heavy objects, and bridging rivers and streams. *Le Diverse et artificiose machine* is a sumptuous book with 194 full-page engraved plates in elaborate framed borders of type ornaments, accented by ornamental tailpieces and corner pieces. In this pre-copyright time, the intricate design of the volume, published by the author, was deliberate in order to discourage corrupt or inaccurate pirated editions while accurately representing his "machines." The majority of the inventions in the book are concerned with hydraulics or mechanics of warfare, although perhaps the most well-known engraving depicts a wheel-like machine that allows for the reading of multiple books without leaving one's seat.

Plate 152 shows one of Ramelli's several solutions for a mobile bridge that would allow an army to quickly cross a river once the paddle-driven platforms were lined up.

John Ogilby, 1600-1676.
***Itinerarium Angliae: or, A Book of Roads, wherein are Contain'd the Principal Roadways of His Majesty's Kingdom of England and Dominion of Wales*. London: Printed by the author, 1675.**

Publisher, Royal Cosmographer, and Master of the Revels (in Ireland) during the Restoration period in England, John Ogilby was responsible for publishing the first set of detailed road maps in Western Europe. His *Britannia*, published in 1675, contained one hundred strip maps of seventy-three major roads and cross-roads drawn

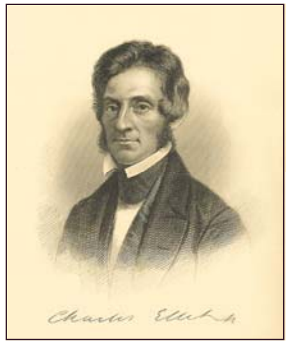
on a uniform scale of one inch to one statute mile (1,760 yards to the mile), and accompanied by a text description. Each page of continuous strip maps covers approximately 70 miles.

As a result of the popularity of *Britannia*, Ogilby published *Itinerarium Angliae* later that same year. Although carrying the same maps, *Itinerarium* lacks the descriptive text. This double-page spread shows a portion of the maps for the road from London to Shrewsbury in the county of Shropshire, near the Welsh border.

***Proposed Aerial Railroad*. [Lithograph] 1836.**

An innovative alternative to crossing the Thames by bridge, this railroad design was inspired by devices used to haul building materials. With its driving force

based on momentum, it's unlikely that this tramway was ever built. Later in the century, with the growing adoption of gasoline engines as a means of propelling vehicles, aerial railroads became feasible as a means of transportation, particularly for short distances.

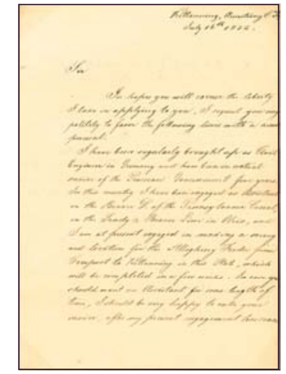


Notable Engineers • case 6

Charles Ellet Jr. (1810-1862)
Correspondence, manuscripts, drawings and artifacts from the Charles Ellet, Jr. Papers, 1825-1864.

Charles Ellet, Jr., 1810-1862.
***Diary, Commenced May 10th, 1830.* [Manuscript]**
Charles Ellet, Jr.'s Drafting Tools, date unknown.

Charles Ellet, Jr. was one of the foremost American civil engineers of the 19th century. He is best remembered for his work in introducing the suspension bridge into the United States, and for his experimentation with different types and configurations of the wire cables used to support them.



Ellet, born in Penn's Manor, Pennsylvania, was a young boy when the Erie Canal was completed in 1825. With little formal education, but a natural aptitude for mathematics, Ellet found work surveying for companies eager to repeat the success of the Erie. After he worked on the planning for the construction of the Chesapeake and Ohio Canal, Ellet set off for Europe. In Paris, he attended lectures at the École Nationale des Ponts et Chaussées (National School for Bridges and Roads) and the École Polytechnique, and traveled to observe the construction of a suspension bridge over the Loire River in France.

Ellet's diary of his trip abroad is a record of his observations and his excitement at witnessing firsthand the techniques of European engineers as they dredged canals and built bridges. The small sketch shown here, perhaps of a river bank, shows the drafting skills he had acquired as a surveyor.

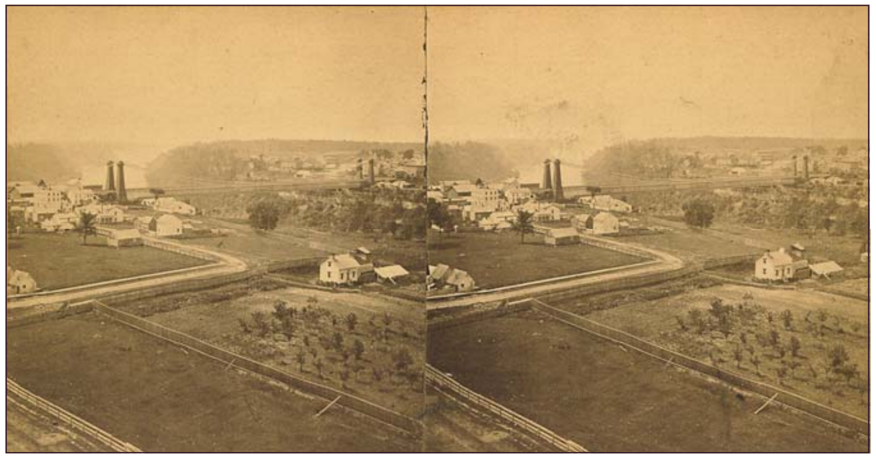
Letter from John Augustus Roebling to
Charles Ellet Jr., July 16, 1838.

By 1837, Ellet had established a reputation as a talented railroad and canal surveyor and an innovative bridge engineer. With his first wire suspension bridge (over the Schuylkill River at Fairmount, Pennsylvania) in the planning stages, interest in his work was high. Prussian-born engineer John Roebling (1806-1869), having emigrated to the United States in 1831, writes to Ellet requesting that he be allowed to work with him. Roebling was interested in Ellet's use of twisted wire cables as part of a bridge's support structure. It's unknown whether Ellet ever wrote back, but the two engineers never worked together. Roebling, who went on to great success is most well-known for his design of the Brooklyn Bridge.

Letter from Robert J. Walker (Secretary of the Treasury, 1845-1849), to Charles Ellet Jr., June 1, 1848.

One of the design and building contracts awarded to Ellet was a bridge to span the Niagara River. The Niagara Falls Gorge Bridge was to be approximately 821 feet in length and situated downstream from the falls. In this letter Robert J. Walker, Secretary of the Treasury under President James Polk, writes to Ellet confirming his commission for the bridge. Ellet built an elegant, single-level carriage and foot bridge linking Canada and the United States for the first time at this location.

Ellet was a voluble and somewhat contentious man, and he soon fell into a dispute over ownership of the bridge and its tolls. Ultimately, Ellet's bridge was torn down and rebuilt by John Roebling. Roebling retained the sturdy anchor piers, but expanded the design of the bridge into a double-level bridge with an upper platform



for foot and horse traffic and a lower platform for trains. In 1883, engineers George S. Field and Edmund Hayes designed and built the first cantilever bridge in the United States, also over the Niagara River, slightly downstream from the Ellet/Roebling bridge.

Charles Ellet, Jr., 1810-1862.
***Elevation of East End [Niagara Falls Gorge Bridge].* [Drawing] ca. 1848.**

One of three of Ellet's pencil ad watercolor drawings of the design for the Niagara Falls Gorge Bridge surviving in the University of Michigan collection.
John P. Soule.

***American Scenery: Niagara Falls and Vicinity. No. 313: Distant View of Suspension Bridge from Monteagle Hotel.* [Stereoview] Boston: John P. Soule, 1863-1880.**

Photographer John Soule created a series of 127 of these small stereoviews, or stereographs, of Niagara Falls and its vicinity. These albumen prints, designed to be looked at through a special viewer in order to produce a three-dimensional effect, show Roebling's bridge but with Ellet's original piers still clearly standing. The falls are a whitish haze in the background.

***Iron Wire Shipped Onboard the "Ivanhoe,"* May 20, 1848. [Manuscript Invoice]**

Account Book (1834-1837), Reused as a Scrapbook, 1848.

The Ellet family retained all records related to the building of the Niagara Falls Gorge Bridge. The invoice shown here attests to the amount of cable required to build Ellet's bridge, and the amount of work and recordkeeping involved for an engineer who was both a designer and a builder. The old account book was recycled to house the laudatory press that surrounded the opening of the bridge in 1848.

Letter to Charles Ellet Jr. from Elvira (Daniel) Ellet, June 14, 1848.

In 1837, Ellet met and married Elvira ("Ellie") Daniel, daughter of a Lynchburg, Virginia judge. In a sea of business records, the letters between Charles and Ellie stand out as warm and loving testament to a happy marriage. Ellie was resigned to the frequent moves necessitated by her husband's commissions and despite which the family (later including children Charles Rivers, Mary, Cornelia, and William) was often separated.

Letter from Charles Ellet Jr. to Elvira (Daniel) Ellet, May 20, 1854.

Though extraordinarily successful as an engineer, Ellet had the misfortune to receive the news that his wire suspension bridge at Wheeling, Virginia had collapsed. Built in 1849, the bridge spanning the Ohio River carried the distinction of being the longest suspension bridge in the world for several years. At 1,010 feet in length, its system of cables were vulnerable in high winds. On May 17, 1854, an extremely strong storm blew through the area causing the bridge to oscillate until the cable bolts attached to the piers gave way.

This and subsequent letters to his wife detail Ellet's disappointment and frustration. After much negotiation, the bridge was rebuilt, parts of which still stand today. Ellet never built another bridge, instead turning his attention to problems associated with the levees at the mouth of the Mississippi River, and later to the battles of the Civil War.

United States. Navy Department, Bureau of Ordnance.
Code of Flotilla and Boat Squadron Signals for the United States Navy, Prepared by Commander Thornton A. Jenkins, By Order of the Hon. Gideon Welles. **Washington: Government Printing Office, 1861.**

At the height of the Civil War, Ellet approached the Union Army and proposed retrofitting ships with reinforced prows and iron rams for assaulting coastal forts and harbors. Ellet was made a Colonel of the Union Army and his "ram ships" were successfully used in battle. This government-issued book lays out signals and protocol for Union warships, with a penciled instruction to destroy the book if captured.

Ellet was wounded by a bullet while commanding one of his ships on the Mississippi River during the Battle of Memphis. He died several days later on June 21, 1862.

Colonel Ellet's Officer's Slouch Hat with Black Silk and Gold Bullion Cord, ca. 1861.

OLIVER EVANS (1755-1819)
Drawings, journals and annotated monographs from the Oliver Evans Collections, 1804-1850.

Oliver Evans, 1755-1819.
Notes and Diagrams on Steam Engines and Other Inventions. **[Manuscript] ca. 1804-1820.**

Brilliant engineer and inventor Oliver Evans was one of the most significant figures in the early development of the steam engine and its various applications. Inspired by early steam engine pioneers Thomas Newcomen (1664-1729) and James Watt (1736-1819), Evans's work had a profound impact on the industrialization of 19th century America.

Born in Newport, Delaware, Evans was first apprenticed to a wheelwright but moved on to work in a mill. While there Evans conceived his first invention: a mechanical automated grist mill, eventually writing a book, the first of several teaching tools he was to produce throughout his life. The book was entitled *The Young Mill-Wright and Miller's Guide* (1795).

The Mechanic.

JULY, 1834.

[For the Mechanic.]
STEAM-CARRIAGES.

[Evans' Steam-Engines. See page 196.]

Having traced the steam-engine from its first invention to the successful application of its power for the purpose of navigation, by Fulton, it now remains for us to continue the subject, by a brief history of its application to land-carriages on common roads, and its superior advantages on railways. Two individuals, in particular, are claimants for the honor of this invention, both of whom also claim the invention of steam-boats; but as all claims to the invention

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In 1801, after having moved to Philadelphia, Evans directed his full attention to the use of steam as a means to power an engine. After studying the potential of harnessed steam for twenty years, Evans was determined to invent an engine that could be used to power a mill, but also one that could be used to safely propel a vehicle on land. In the early 19th century, before the work of George Stephenson and other British engineers, this was considered preposterous. But Evans persevered, in part driven by the fact that he had been granted a patent for a steam-powered land vehicle some years earlier.

The drawing shows one of Evans' early conceptions of a steam engine. Large and unwieldy, it would soon give way to a more refined design. Also included in this volume are calculations and explanations of mechanical processes.

***The Mechanic*, July 1834. Boston: Mechanics Fund Association, 1832-1836.**

Born of the need to dredge the Philadelphia harbor as fears of yellow fever rose during the summer months, Evans designed and built the "Oruktor Amphibilos" (Greek for "Amphibious Digger") in 1805. This hybrid land/water dredging machine employed a high-pressure steam engine. Evans's engine was an improvement on earlier, less powerful engines which were adequate for pumping water but lacked the power to pull or propel a heavy object or vehicle. By scaling down the size of the condensing chambers in the 5-horsepower engine Evans increased the pressure to such an extent that driving rods could be pushed with a great deal of force.

The "Oruktor Amphibilos" (shown here without its dredging apparatus, a series of chained buckets, in an illustration published thirty years later) was considered a success. This barge-like vehicle, 30 feet long and 12 feet wide, paved the way for the steam locomotive which, in 1812, an unusually prescient Evans predicted: " … People will travel in stages moved by steam engines from one city to another almost as fast as birds fly … ".

Oliver Evans, 1755-1819.
***The Abortion of the Young Steam Engineer's Guide*. Philadelphia: Printed for the Author by Fry and Kammerer, 1805.**

Long concerned with the protection of the legal and monetary rights to engineers' inventions, Oliver Evan's was deeply unhappy with contemporary patent laws. His patent for the engine used in the "Oruktor Amphibilos" expired in 1805, and when he was unable to renew it he stopped work on his forthcoming book *The Young Steam Engineer's Guide*. He then decided to publish it anyway, but with an altered title to reflect its incompleteness, and added text decrying patent laws and their lack of concern for the rights of the inventor.

Evans's personal copy of his book includes copious notes and additions inserted

throughout, with notes on Eli Whitney on the flyleaf.

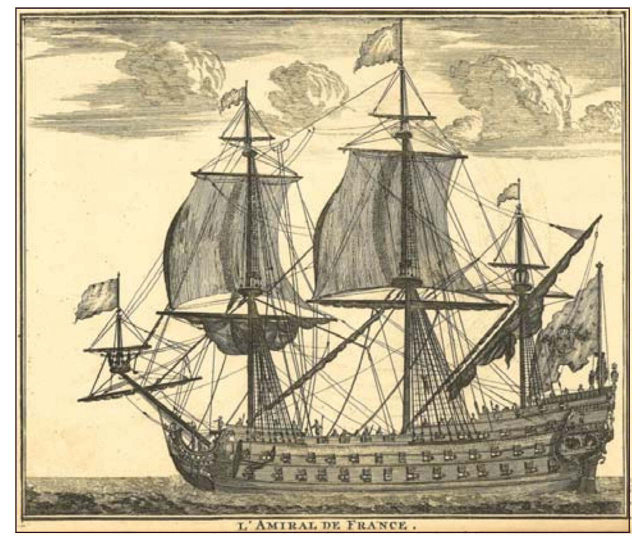
Cadwallader Evans.
***A Treatise on the Causes of Explosions of Steam Boilers, with Practical Suggestions for Their Prevention*. Pittsburgh: Printed by William H. Whitney, 1850.**

Continuing his father's work with the publication of this monograph, Cadwallader Evans addressed the danger of the high pressure steam engine. Suggestions for modifications to steam engines were plentiful, but often resulted in the loss of power.

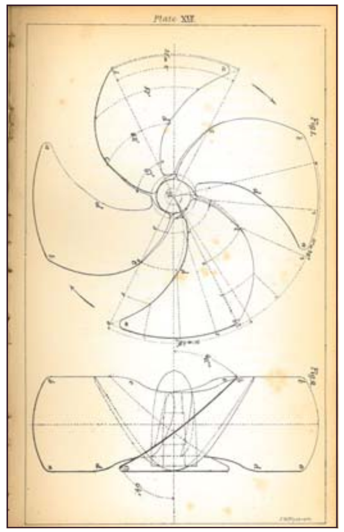
Evans' treatise focuses on rudimentary safety valves designed to prevent the possibility of there ever being a greater pressure than desired in the boilers, while also preventing the water level in the boilers from ever becoming too low or too high. Cadwallader also produced drawings of his father's inventions for later editions of *The Young Mill-Wright and Miller's Guide*.

Ships & Waterways • case 7

***L'Art de bâtir les vaisseaux, et d'en perfectionner la construction; de les garnir de leurs apparaux, les mettre en funin, les manoeuvrer, &c...* Amsterdam: D. Mortier, 1719.**



An important work on ship-building and navigation during the great age of sail, *L'Art de batir les vaisseaux …* (*The Art of Ship Building and How to Perfect Their Construction, with Remarks on Their Fittings and Equipment, How to Rig Such Vessels and Maneuver Them, etc.* …) is a compilation of the writings of the Dutch mariners and shipwrights Nicholaes Witsen (1641-1717), and Cornelius van Ejk (fl. 1697), and cartographer Carel Allard (1648-1706). The Low Countries had a long tradition of shipbuilding and navigation, and in the 17th century, at the height of Dutch dominance of the seas, Witsen wrote his *Architectura Navalis et Regimen Nauticum* (1671) and van Ejk penned *Nederlandsche Scheeps-Bouw-Konst Open Gestelt* (1697). These works provided step-by-step instructions for the shipwright, illustrations of navigational charts and instruments for the crew, and detailed engravings of notable sailing vessels. The original Dutch and Latin texts were excerpted, translated into French, and published by David Mortier in 1719.



On the left is an engraving of a nocturlabe that was used by navigators from the 16th through the 18th centuries. It was used to determine the time during the night, to calculate the moment of high tide and to measure latitude. This was accomplished through training a central opening on the Pole Star (North Star), then manipulating an assortment of movable calendrical wheels to obtain the correct reading. The right hand page of the opening shows the flagship of the Admiral of the French Navy, which was commissioned by Louis XIV in 1689.

John W. Nystrom, 1824-1885.
***A Treatise on Screw Propellers and Their Steam-engines, with Practical Rules and Examples How to Calculate and Construct the Same for any Description of Vessels, Accompanied with A Treatise on Bodies in Motion in Fluid, Exemplified for Propellers and Vessels; also, a Full Description of a Calculating Machine*. Philadelphia: H. C. Baird, 1852.**

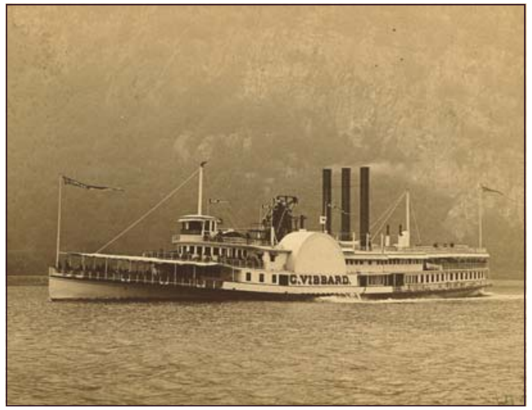
J.C. Bourne (artist), C.F. Cheffins (lithographer).
***The "Robert F. Stockton," Afterwards New Jersey, Captn. Ericsson, 1839.* [Lithograph]**

The Industrial Revolution, ushered in by the invention and subsequent evolution of the steam engine, was mainly focused on the mechanization of manufacturing and the creation of efficient commercial and passenger land transportation. But even the earliest steam engines lent themselves more readily to marine use than to land use. The size and weight of these bulky, belching powerhouses could be more readily accommodated on a buoyant ship and thus steamships became the first self-propelled mode of transportation.

Inventor John Fitch (1743-1798) was granted the first United States patent for a steamboat in 1791. Fitch experimented with a variety of propulsive mechanisms to attach to the engine, including ranked paddles and simple paddle wheels. Side- or stern-mounted paddle-wheels became the standard propulsive mechanism during the early years of the steamship, but with the ships often retaining a full set of sails in their design. By the early 19th century the paddle-wheel consisted of a large half-submerged wheel with blades or boards perpendicularly attached. This model, mounted on the side, was used by Robert Fulton (1765-1815) on the "Clermont" (more accurately the "North River Steamboat"), the first commercially successful steamboat. In 1807 the "Clermont" traveled the Hudson River from New York to Albany in a surprising thirty-two hours, against the tide, logging an average speed of 5 miles per hour.

Fulton's paddle-wheel was efficient, but it was difficult to steer and easily damaged. Swedish military engineer and cartographer John Ericsson (1809-1889) tinkered with steam engine designs and is also credited with developing the first marine screw propeller. Using Archimedes' screw as a basis, Ericsson broadened the flanges and placed the screw horizontally at the stern of the ship, below the water line.

In 1838 U.S. Navy Captain Robert F. Stockton saw a screw-propelled boat designed by Ericsson demonstrated in England. Believing that such a boat would be practical on American canals, he designed and commissioned one which was delivered across the Atlantic the next year, the first iron-hulled vessel to cross the Atlantic. The print on display shows the "Robert F. Stockton" (later re-christened the "New Jersey"). As designed by Ericsson, the boat employed two screws—mounted in line but turning in opposing directions—and a rudder installed forward of the screws, an arrangement that made the boat difficult to control and maintain. In 1840 the boat was turned over to engineers at the Camden & Amboy Railroad for improvement. A new single screw propeller was installed and the rudder was repositioned behind it, enhancing the ship's maneuverability. In this configuration, the "New Jersey" remained in service until 1871, the first commercially successful propeller steamer.



Inventor John W. Nystrom's treatise on Ericsson's screw propeller examines centrifugal force and water displacement. Shown here is a diagram of adjustments to the configuration of the propeller.

William T. Gregg.
The "Chauncey Vibbard" on the Hudson River. **[Albumen Photograph] New York, 1864.**

The paddle-wheel steamboat was well suited for use on canals and rivers, and its use soon grew from a utilitarian means of transporting goods and passengers to include pleasure travel. The "Chauncey Vibbard," one of the flagships of the "Day Line" on the Hudson River, steamed the New York to Albany route

in nine hours, six days a week. Touted in advertisements, timetables and brochures as an adventurous, but comfortable excursion, the "Chauncey Vibbard" boasted a full dining room with fine food and wine. Photographer William T. Gregg's commissioned series of photograph cards with images of the steamships and the beautiful scenery of the Hudson River helped advertise these pleasure cruises.

Robert Fulton, 1765-1815.
A Treatise on the Improvement of Canal Navigation; Exhibiting the Numerous Advantages to be Derived from Small Canals … . **London: I. and J. Taylor at the Architectural Library, 1796.**

In addition to his groundbreaking in steamship design, Robert Fulton also explored the design of canals. First proposed in 1768 as a vital link between Lake Erie and the Hudson River, the Erie Canal posed enormous challenges because of the hilly terrain. Fulton's solution included dragging boats across sections of land through a series of suspended pulleys and using shafts to lower and raise boats from one level to another. The Erie Canal's final construction, however, employed the astonishing concept of using locks to raise and lower the water in which the boats traveled, rather than moving boats up and down.

The Building of the Panama Canal, 1904-1914?. **[24 Albums of Silver Gelatin Photographs]**
From the John G. Claybourn Panama Canal Library

The Panama Canal Pilots' Handbook.
Revised, July 1, 1946. Mount Hope, C.Z.: The Panama Canal Press, 1946.
From the John G. Claybourn Panama Canal Library

Driven by the growth in international business and cross-country commerce, the U.S. Congress created the Isthmian Canal Commission in 1899 to examine the possibilities of a Central American canal to connect the Atlantic and Pacific

Oceans. Such a route would eliminate the lengthy and treacherous sea voyage around South America. In the 1880s France had begun surveying and building the canal at the Isthmus of Panama (at that time a Colombian territory), but plagued by financial difficulties and disease the rights were sold to the United States. By 1904 the United States, rebuffed by Colombia in its efforts to negotiate rights to the land, encouraged Panamanian rebels to declare independence. The new government signed a treaty that leased to the U. S. a 10-mile strip of land bordering the canal for an initial payment of $10 million and an annuity of $250,000 (later adjusted for inflation), beginning in 1913. In 1999, the Canal was formally returned to the jurisdiction of the Republic of Panama.

The Panama Canal, completed in 1914, traverses fifty-one miles of the isthmus, running from Limón Bay at Colón on the Atlantic (actually, the Caribbean Sea) to the Bay of Panama at Balboa on the Pacific. An example of engineering ingenuity, it has twelve locks that raise and lower ships approximately 85 feet through the course of the Canal. Thousands of American and Panamanian workers lived and worked in the Panama Canal Zone during its construction,

many of them losing their lives to malaria, yellow fever, and extremely difficult working conditions. Engineering the Continental Divide-straddling Culebra Cut, shown here under construction, was one of the most dangerous and costly portions of the Canal. Dirt and rock were dynamited and cleared from the Cut's nine-mile strip through landslide-prone, mosquito-infested terrain.

Piloting a ship through the narrow waterway takes skill and expertise. This edition of the *Panama Canal Pilot's Handbook*, published several decades after the completion of the Canal, lays out in detail the configuration of its locks, the twists and turns, shallow sandbars, and the variable tides that a ship's pilot would encounter.

Engineer John G. Claybourn (1886-1967) worked on the construction of the Panama Canal from 1910 through 1923. After leaving his position as Superintendent of the Dredging Division, Claybourn became a staff member of the Governor's Office in the Canal Zone where he remained until his retirement in 1948. In 1965, he donated his library of monographs, serials, maps, and photographs to the University of Michigan's Transportation Library.

Ships & Waterways • case 8

Carleton Watkins, 1829-1916 (photographer).

***The Ferry Boat "Solano".* [Albumen Photograph] after 1879. Reproduction.**

In the course of creating his visual documentation of the route of the railroad across the United States, photographer Carleton Watkins turned his camera to the ferry that provided the last link of the trans-continental railroad. The mammoth steam ship "Solano," operated by the Central Pacific Railroad, was propelled by both star-board and port paddle-wheels, each powered by its own steam engine, and had the capacity to carry forty-eight freight cars or twenty-four passenger cars. The ship ferried railroad cars across the Straits of Carquinez near San Francisco Bay, a distance of one mile. In 1930 a bridge was built to span the straits and the "Solano" was scuttled, ignominiously sunk at the port of Antioch, California to act as a breakwater.

***Steam Navigation*. Engraved by W.H. Lizars; Published by A. Constable, 1824. [Engraving]**

This engraving shows an early British paddle-wheel steamship based on the

design of the *Enterprise*, the first steam-powered vessel to sail from Europe to India. The plate was probably created for the publisher's supplement to the 4th, 5th, and 6th editions of the *Encyclopedia Britannica*. Engraver William H. Lizars (1788-1859) created a number of the illustrations for early editions of the *Encyclopedia*, but is best known for his ten prints in John James Audubon's "double elephant" folio edition of *Birds of America*.

The Car Ferry "Ann Arbor, No. 7".
[Silver Gelatin Photograph] ca. 1925.

The Ann Arbor Railroad Company, formed in 1894, began its car ferry service across Lake Michigan, from Menaumee, Michigan to Manitowoc, Wisconsin, that same year. The ferry dramatically reduced the transit time between Michigan and Wisconsin by eliminating the lengthy route around Lake Michigan. The steam ship "Ann Arbor, No. 7 " was put into service in 1925.

Like the older "Solano" in San Francisco Bay, the "Ann Arbor, No. 7" allowed for the loading of fully-laden railroad cars onto the ship, eliminating the need to unload and reload freight at each port. The newer ferry transported the cars below deck, allowing for passenger and crew quarters above deck. She was one of six nearly identical ferries built by Manitowoc Shipbuilding known as the "six sisters," including the 'City Of Milwaukee," "Grand Rapids," "Madison," "Pere Marquette 21," and "Pere Marquette 22." In 1964 the "Ann Arbor No. 7" was the first railroad car ferry to pass through the Sault Ste. Marie Locks, on her way to Superior, Wisconsin where the steam engines were replaced with four diesel engines and she was renamed the "Viking." The ship was taken out of service in the early 1980s.

William J. Bell, (photographer).
***Views of the Locks at Sault Ste. Marie, Michigan.* [Albumen Photographs] ca. 1895.**

The only connecting waterway between Lake Superior and the lower Great Lakes, the locks at the former Ojibway town of Sault Ste. Marie were first conceived when Congress passed an act in 1852 granting 750,000 acres of land to the State of Michigan as compensation for the construction of locks along the St. Mary's River by the Fairbanks Scale Company. The company, which had extensive mining interests in the Upper Peninsula, completed a system of two locks, in tandem, each 350 feet long, within two years. On May 31, 1855, the locks were turned over to the state and designated the State Lock or the St. Mary's Falls Ship Canal, with boats paying a toll of four cents per ton, until 1877, when the toll was reduced to three cents. Within a few years, commerce through the canal had grown to national importance, and the need for new locks became clear. The funds required exceeded the state's capabilities, and thus, in 1881 the locks were transferred to the jurisdiction of the U.S. Army Corps of Engineers.

There are four locks at Sault Ste. Marie (also known as the "Soo"): Davis, Sabin, MacArthur, and Poe. Together they cover 1.6 miles with a rise and fall of approximately 25 feet, and can accommodate the massive Great Lakes freighters and tankers that surpassed contemporary ocean-going ships in size.

The locks at Sault Ste. Marie have been a tourist attraction since their creation. Local photographer William J. Bell created a numbered souvenir series of photographs of the locks and ships progressing through them, including the three shown here. One of the photographs, taken in July 1891, shows the damage done to the Canadian Pacific Railroad steamer "Athabasca" after colliding with the "Pontiac" just north of the locks.

Detroit & Cleveland Navigation Co.
***Lake Tours via the D & C; Daily Between Detroit & Cleveland.* Detroit: John Bornman & Son, 1899.**

The late 19th century witnessed the era of the steam ship as both a means of commercial transport and as a leisure activity. Plying a route between Detroit, Cleveland and Buffalo, the Detroit and Cleveland Navigation Company provided an alternative form of travel to the railroad. The company's steam ships were built by the Detroit Shipbuilding Company in Wyandotte, Michigan and outfitted with passenger comfort in mind. The pamphlet shown here is similar to promotional materials produced by the railroads. With a beautiful cover illustration of a well-dressed woman standing at ease on deck, the D & C was promoting the comfort and ease of travel by steam ship.

***RMS "Queen Mary".* [Silver Gelatin Photographs] 1936.**

Founded in 1838 by Canadian businessman Samuel Cunard, the Cunard Steamship Company began as a transatlantic mail shipping business. By the first decade of the 20th century, the company had shifted its focus to providing exceptional passenger service between England and the United States, and the construction of the "Queen Mary" represented the zenith of passenger ship building for Cunard. In 1930 Cunard announced plans for a new 1,000 ft, 81,000 ton liner to be built in Glasgow by John Brown & Company Ltd. The keel of the ship was laid down in January 1931, but with the onset of the Great Depression completion was delayed until 1936.

With an emphasis on luxury accommodations and fittings, the first two classes of the "Queen Mary," cabin and tourist, were modeled on the finest hotel rooms. Public rooms were also designed with a scale and ornateness usually confined to bricks and mortar structures. Powered by massive steam turbine engines driving quadruple screw propellers, the "Queen Mary" made its maiden voyage from Southampton, England to New York in May 1936, setting transatlantic crossing records on subsequent voyages.

The onset of World War II saw many privately owned ships called, some involuntarily, into the service of the military. Stripped of its finery and transformed into a troop ship, the "Queen Mary" sailed through the South Pacific and the North Atlantic, moving Australian and American troops to and from the battlefield. At the end of the war, the ship was once again refitted as a passenger ship, but Cunard struggled with financial difficulties, the competition posed by newer and faster vessels, and the growing accessibility of air travel. In 1967 the "Queen Mary" was sold to the city of Long Beach, California, where it is permanently berthed and converted into a hotel and conference center.

Compagnie Générale Transatlantique.
Normandie – Longitudinal Section.
[Brochure] 1935(?).

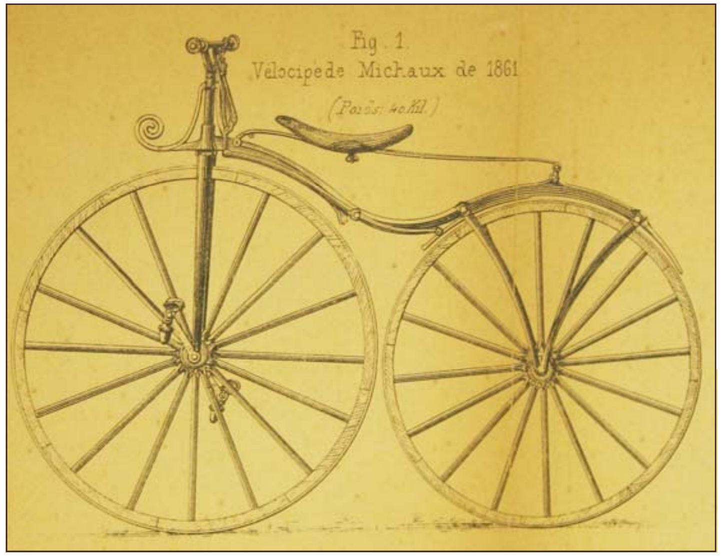
Compagnie Générale Transatlantique.
Normandie – Commemorative Medal 1938.
Gift of Mrs. Richard P. Beaubien

Like Samuel Cunard, brothers Émile and Isaac Pereire began their shipping company in 1855 to accommodate transatlantic mail service. Starting out with paddle-driven steam ships, the Periere's ships routes included ports in Central and South America as well as New York City. By the first decades of the 20th century, the Compagnie Générale Transatlantique, also known as the French Line, was diversifying and venturing into the building and running of transatlantic passenger ships.

The most well-known of these ships was the "Normandie." Designed by Vladi-

mir Yourkevitch and built by Penhöt Shipyards in St. Nazaire, France, the "Normandie" made its maiden voyage in May 1935, sailing from Le Havre to New York in just over four days. Measuring 1,029 feet and weighing 79,280 (later 83,423) tons, the ship was powered by four steam turbo-electric engines driving triple screw propellers. Although the "Normandie" was both the biggest ship to that point, and the fastest (winning the "Blue Riband" prize), she is best known for the beauty of her design and elegant appointments. From Yourkevitch's sculpted bow and slim hull through the sculptures, paintings, tapestries and Lalique light fixtures, the "Normandie" was the epitome of Art Deco design.

In 1938 the Compagnie Générale Transatlantique joined with the Raymond-Whitcomb travel agency to offer a gala cruise from New York to Rio de Janeiro. Advertised as a chance for passengers to experience the speed and luxury of the "Normandie" the trip lasted a total 22 days, including 4.5 days in Rio. This was the first commercial cruise where the point of the trip was being on the ship, with little time spent on shore. To commemorate this trip, a bronze "Normandie" medal housed in a specially printed box was given to all passengers.



As with the "Queen Mary," the "Normandie" was forced into service as a troop ship when the United States entered World War II in 1941. However, the ship was set on fire while undergoing renovation in New York harbor in early 1942 and capsized. Burned beyond repair, and after fruitless attempts to salvage the hull, the "Normandie" was relegated to the scrap yard in 1946.

Bicycles, Carriages & automobiles • case 9

J. Paloque.
***Étude sur la bicyclette.* Paris and Nancy: Berger-Levrault & Cie., 1896.**

The first bicycle was said to have been invented in 1817 in Germany by Baron Karl Drais von Sauerbronn, although American inventor W. K. Clarkson, Jr. is also credited with developing a wheeled cycle during the same time period. These early bicycles (also called velocipedes or hobby horses) consisted of two wheels, a resting bar, and handlebars, all made of wood, with the rider's scooting feet providing locomotion. A substantial development occurred in 1863 when Pierre Michaux and Pierre Lallement invented the bicycle pedal, attaching it to the spoke of the front wheel. Further developments included chains and gears attached to a centrally located set of pedals, wire-spoked pneumatic tires, and a braking mechanism.

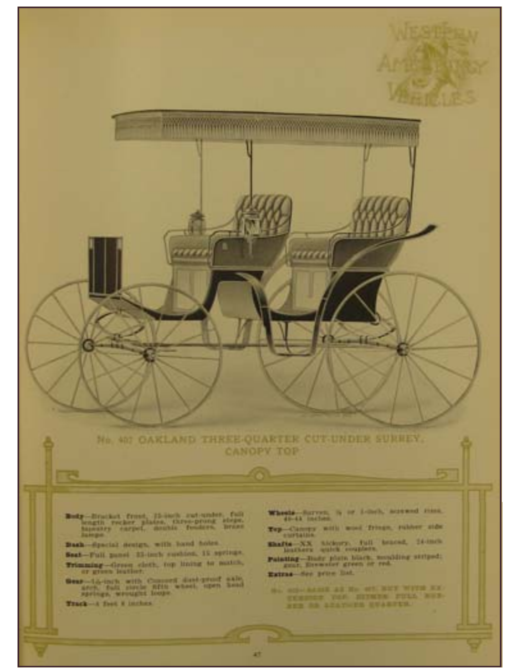
The invention of the bicycle created an explosion of interest by the 1870s. The cycling frenzy in France, which spread to England and the United States, is said to have prompted the League of American Wheelmen to form the "Good Roads Movement." This movement advocated for paved roads or paths to replace the rutted muck and mire of contemporary carriage routes. As automobiles became more plentiful at the turn of the century the movement shifted to automobile manufacturers and enthusiasts and the number of bicycle manufacturers dropped by two-thirds as even the smallest companies turned to designing and building automo-

biles, or, in the case of the Wright Brothers, airplanes.

Walter A. Bettesworth (illustrator), 1856-1929.
***What They Think About It.* London: Iliffe & Son, ca. 1890.**

Considered a scandalous mode of transportation by some, and particularly so for women due to the possibility of hiked-up long skirts exposing ankles and calves, numerous pamphlets and broadside were published questioning the morality of bicycle riding. Of course, there was also the question of the danger of accident and injury. With the bicycle's immense popularity in the 1890s their sheer numbers on the sidewalks of cities and towns caused a flurry of laws restricting their use.

League of American Wheelmen. Michigan Division.
Road Book of the Michigan Division, League of American Wheelmen; Also Through Routes to Buffalo, Pittsburg, Chicago, Cincinnati, etc.
Detroit: E. N. Hines, 1898.



By the end of the 19th century bicycles had grabbed the fancy of Americans. , The League of American Wheelmen was formed on May 30, 1880 and by 1900 counted an astonishing 150,000 members. As a means of inexpensive transportation, bicycles became a way to transport people for work and for pleasure. The Michigan Division of the League of American Wheelmen boasted hundreds of members by 1898. Its *Road Book* provided practical mechanical advice, advertisements for bicycles and bicycle parts, and detailed maps and routes for short and long road trips.

***Panorama Parisien ou Indicateur général de toutes les nouvelles voitures pour Paris, les environs, et les départemens*. Paris: Le Normant Fils, 1829.**

***The Mirror of Literature, Amusement, and Instruction*. [London], March 30, 1839. "The Accelerator."**

Much as artists and illustrators were fascinated with the design possibilities for a hot air balloon, a similar fascination existed towards carriages. *Panorama Parisien*, published briefly in Paris, was devoted to showing the latest trends in carriage design, including some improbable oddities. The gravity-defying coach depicted here would be capable of delivering a large number of people to their destinations, and possibly alluded to the need for mass transportation in those very early days of the railroad .

London was awash in radical political journals and newspapers until a repressive tax was levied in 1819. As a result, publishers then produced inexpensive general interest journals, one of which was *The Mirror of Literature, Amusement, and Instruction*, published from 1822 to 1847. Prominently displayed on the journal's cover, "The Accelerator" illustrates British ingenuity in designing new modes of transportation. The large and small spoked wheels suggest James Starley's 1871 "Penny Farthing" bicycle with its efficient design of a large front wheel and smaller rear wheel.

***Album: Voitures (en couleurs)*. Paris: Leperelle, 1840.**

Pontiac Buggy Company.
***The Present Day of Pontiac*. Pontiac, Mich.: Pontiac Buggy Co., 1907.**

Founded in Pontiac, Michigan, as the Pontiac Spring and Wagon Works Company in 1899 by Albert G. North and Harry G. Hamilton, the company was renamed Pontiac Buggy Company and merged with Oakland Motor Car Company in 1907. By 1909, General Motors had purchased the company, retaining the Pontiac name as one of its marques.

This was the last catalog of Pontiac buggies and carriages. Though horse-powered vehicles were still being manufactured in 1907, it is interesting to note that the Studebaker catalog for that year consists solely of gasoline-powered automobiles.

***General Catalogue and Illustrated Hand Book of Carriages, Buggies, Wagons, etc. made by Studebaker Bros. Mfg. Co., General Office and Factories (World's Fair Edition)*. South Bend, Ind.: 1892-1893.**

***Hand Book of Gasoline Automobiles, for the Information of the Public Who are Interested in Their Manufacture and Use*. New York: Association of Licensed Automobile Manufacturers, 1907.**

The first self-powered road vehicles were run by steam engines, notably French engineer Nicolas Joseph Cugnot's vehicle built in 1769 and Oliver Evans's somewhat more successful "Oruktor Amphibilos" thirty-six years later. The concept of the modern automobile is more accurately attributed to the work of Gottlieb Daimler and Karl Benz in Germany in 1885-1886. Both men invented highly successful and practical gasoline-powered internal combustion engines to power their vehicles.

With Henry Ford's adoption of the engine and the refitting of his factory to assembly line production techniques to replace the expensive and time-consuming handbuilt process, the modern age of the automobile began. Production of the Model T Ford was inaugurated at the Piquette Avenue Plant in Detroit on October 1, 1908. Over the next nineteen years Ford built 15,000,000 automobiles with the Model T engine and basic body design.

These two booklets visually document the dramatic leap that occurred in individual transportation during the fifteen years between 1892 and 1907. Studebaker was one of the many companies that changed from horsedrawn carriages to gasoline-powered automobiles. Located in South Bend, Indiana, the Studebaker Manufacturing Company was founded by brothers Henry and Clement Studebaker in 1868 and introduced a model with an electric engine in 1902. Within two years the brothers produced their first gasoline-engine automobile, and then moved production to Detroit which was fast becoming the automotive capital of the world. After returning to South Bend, Studebaker bought the foundering Pierce-Arrow Company, briefly merged with Packard Motor Car Company, and finally closed its doors in 1966.

***Automobile Guide and List of Registered Cars [Michigan].* N.p.: A. W. Dean. 1913.**

Despite the growing number of automobiles in 1913, ownership was still limited to those with the means to buy and maintain the vehicle. This annual guide covering southwestern Michigan, is a combination social register and advertising tool for the swiftly growing automotive industry. Along with the owner's name and address, the make of car is also listed.

***Automobile Garments and Requisites: Imported and Domestic Models For Men and Women.* New York: Saks and Co., 1904.**

Automobiles were not fully enclosed in the early years of their design and production. Although the windshield had appeared on late 19th century automobiles (a necessity due to the greater speed of travel compared to carriages), side enclosures and roofs were not standard. In order to protect the driver's and passenger's person and clothing, Saks and Co. (later Saks Fifth Avenue) designed and sold a line of expensive protective gear. Included in the catalog are hats, goggles, masks, gloves, boots, and an array of coats, capes and jackets constructed for adaptability to conditions, maximum coverage, and style.

Pierce-Arrow Motor Car Company Scrapbook, 1903-09.
From the Pierce-Arrow Car Company Archive, 1900-1938

For 38 years, the Pierce-Arrow Motor Car Company of Buffalo, New York, produced fine automobiles and was the benchmark for what comprised a luxury vehicle. Pierce-Arrow supplied cars to the White House and sold cars to the royal families of Japan, Persia, Saudi Arabia, Greece, and Belgium. From its humble beginnings as the G.W. Pierce Company, known for the quality of its ice boxes, birdcages, and bicycles, it became the manufacturer of the opulent and elegant Dual-Valve Six Pierce-Arrow Series 36 with embroidered upholstery and gold interior trim in the Roaring Twenties. Much of the material from the company's advertising firm, Calkins and Holden, of New York City, survives in the Library's collection and shows

the care, talent and expense that went into promoting these vehicles.

In the Great Depression the market for luxury automobiles waned and Pierce Arrow was purchased by Studebaker, which shortly thereafter went into receivership. Always built by hand, never by assembly-line methods, the Pierce-Arrow insistently held to its luxury status until closing its factory in 1938.

Pierce-Arrow Engine Block, 1913. [Silver Gelatin Photograph]
From the Pierce-Arrow Car Company Archive, 1900-1938

The six-cylinder Pierce-Arrow 66 was the largest stock engine ever designed for an automobile. The powerful cast aluminum 66-horsepower machine could attain a surprising top speed of over 80 miles per hour.

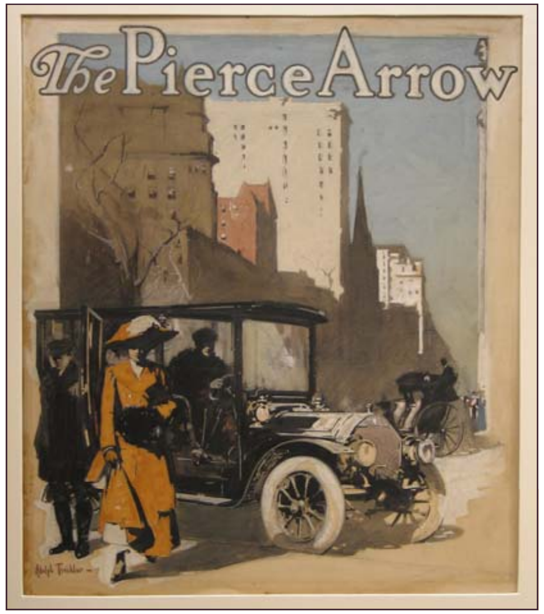
Clark Gable and His Duesenberg Roadster, 1935.
[Silver Gelatin Photograph]
From the J. Herbert Newport Collection, 1922-1991

In the automotive world the name Duesenberg has long been associated with luxury and unique design, a reputation to which designer/engineer J. Herbert Newport (1906-1978) made a significant contribution. In 1933, after stints with Brunn and Company (Buffalo), Floyd-Derham, Inc. (Rosemont, Pennsylvania), General Motors (Detroit), and Studebaker Corporation (South Bend, Indiana), Newport was hired to create custom body designs for August and Fred Duesenberg in Indianapolis, Indiana.

The Duesenberg automobile had already acquired its reputation as a powerful and stylish car, and Newport's designs were unusual and sometimes even flamboyant, as was fitting for the extraordinary Duesenberg chassis. With 32 valves, double overhead camshafts, and a detachable head, the eight cylinder engine was the most advanced engine in the United States, and even with a weight of 5,400 to 6,700 lbs., these cars could reach speeds of 115-120 m.p.h. The framework was designed in such a way that a variety of body designs could be accommodated. Custom body designs coupled with a powerful engine made the Duesenberg the status vehicle of European royalty, wealthy businessmen, and movie stars.

Only two automobiles of this muscular yet sleek design were built: for well-known Hollywood stars Clark Gable (shown here), and Gary Cooper.

Ab Jenkins in the "Mormon Meteor," 1930s.
[Silver Gelatin Photograph]
From the J. Herbert Newport Collection, 1922-1991



This record-breaking race car was designed by Newport and built by the Duesenberg Co. for race car driver David Abbott "Ab" Jenkins of Salt Lake City, Utah. Newport's aerodynamically designed body was placed on a standard Duesenberg chassis, with the engine modified to increase the output to 390 horsepower. In 1935, Ab Jenkins set records when he reached a top speed of more than 160 mph while driving the Mormon Meteor on the Bonneville Salt Flats outside Salt Lake City. Newport called the Meteor his "masterpiece," relishing the fact that not only did he design the race car, but he was able to oversee its construction from start to finish at the Duesenberg factory in Indianapolis.

Bicycles, Carriages & Automobiles • Case 10

Adolph Treidler, 1886-1981.
***The Pierce Arrow*. [Tempera and Watercolor Painting] 1909(?).**
From the Pierce-Arrow Car Company Archive, 1900-1938

Noted commercial artist and illustrator Adolph Treidler had a long and productive relationship with Pierce-Arrow and its advertising firm. Treidler was a master at capturing the elegance of the automobiles and the appropriate milieu in which to place them. This painting, essentially a mock-up for a magazine advertisement, shows Treidler's manipulation of the figure of the woman. Painted separately, the figure was cut out and glued in place in a strategic spot next to the automobile. Not considered a piece of art for display, this work was subsequently photographed and then published with advertising copy. In later years, Treidler created posters for the U.S government during World War I and World War II.

Brunn & Co.
***Sport Cabriolet, Design No. 2409*. [Wiring Diagram] 1930.**
From the Brunn & Co. Archive, ca.1920-1940

Hermann A. Brunn (1874-1941) began his career in his uncle's carriage manufacturing company, honing his skills with drafting and engineering coursework in New York City and apprenticeships in other shops. He opened the doors of Brunn & Co. in Buffalo, New York, in 1908, and by 1912 had become established as one of the premier coachbuilders in the country. Geared to the luxury market, Brunn & Co. bodies were designed for Packard, Stearns-Knight, Reo, Lincoln, Cadillac, Pierce-Arrow and Duesenberg, with many one-of-a-kind models created for members of European royal families, notable politicians, and American actors of the stage and screen.

Hermann Brunn learned about electrical wiring when he worked for the Columbia Electric Car Company of New Haven, Connecticut. Although he designed gasoline-engine chassis, Brunn lent his expertise to the configuration of the automobile's electrical system in addition to the design of the body. Shown here is a schematic drawing of the 1930 Sport Cabriolet.

Brunn & Co.
The Cabriolet Town Car Fabric and Paint Samples, 1930s.
From the Brunn & Co. Archive, ca.1920-1940

Of a classic and timeless elegance, Brunn's models for the luxury car trade were much sought after. Joined in the business by his son, Hermann C. Brunn (1908-1989), the Brunn coach was finely appointed with hand-tooled fittings and expensive materials. This page from an oversized catalog outlining choices of color and fabric for the Cabriolet Town Car was probably assembled for the Packard 12-cylinder model 1608 and 1708 chassis built in the late 1930s.

Roads & Highways • Case 11

John Loudon McAdam, 1756-1836.

***A Practical Essay on the Scientific Repair and Preservation of Public Roads*. London: Printed by B. McMillan, 1819.**

Relatively even and navigable roads have long been a goal of engineers and government officials, but this interest became more urgent with the growth of the postal service in Europe and England. John Loudon McAdam, businessman and administrator of roads in Scotland and England, recommended road construction using well-drained subsoil and leveling that included a very slight rise at the road's midpoint. Stones were incorporated into the roadbed for stability and longevity.

The stones, broken with hammers into rough pieces approximately one inch square, were laid to a depth of 10 inches and compressed by workmen. The stones were consolidated by traffic into a compact mass which only improved over time. These techniques were both simple and effective. From the 1820s on, the term "macadam" (an alternate spelling of McAdam's name) or "macadamized" came to mean a good road surface, achieved by the judicious use of stone. By the turn of the 20th century the growing number of automobiles demanded an even firmer surface, and thus the application of tar to pounded stone road surfaces gave rise to the term "tarmacadam" and later "tarmac".

Robert Dale Owen, 1801-1877.
***A Brief Practical Treatise on the Construction and Management of Plank Roads*.**
New Albany, Indiana: Kent & Norman, 1850.

Prior to the development of 20th century paving surfaces, and when not employing the relatively expensive macadam, road surfaces were either rutted dirt or paved with wood. The quicker and cheaper "corrugated" or "corduroy" roads, with tree branches laid down lengthwise across the road, eventually evolved into the use of sawn planks of wood. This much smoother road surface presented a less bone-jarring ride, but was more expensive to build; thus most plank roads were toll roads.

Robert Dale Owen was an abolitionist, free-thinker, social reformer and co-founder of the community of New Harmony, Indiana. As a Congressman from the state of Indiana, he was appointed chairman of the congressional Committee on Roads and Canals in 1843. In this book Owen provided guidance for the construction of wood-paved roads to ease the passage of farm traffic while placing the toll receipts back into the pockets of residents. Anti-capitalist and socialist in spirit, Owen's ideas were never fully embraced. It also became evident that the construction and maintenance of plank roads was ultimately as, if not more, expensive than macadam surfaces, and plank roads all but disappeared by the late 19th century.

Samuel Nicolson, 1791-1868.
The Nicolson Pavement, Invented by Samuel Nicolson of Boston, Mass. **Boston: Printed by Dutton and Wentworth, 1855.**

Massachusetts inventor and businessman Samuel Nicolson is best known for his improvements in the mechanics of the steering-rudder systems on steamships and his invention of a wooden-block method for paving roads. A much more complex and costly road than the plank road, the Nicolson method involved laying cut blocks of wood in a frame placed on top of a prepared road surface. Nicolson roads were built along short stretches of streets in Chicago and Boston, where they provided a smooth driving surface and suffered less from the warping problems of plank roads, but in the end they proved impractical for long distances and rural roads.

Equipment and Methods for Modern Highway Building. **Portland Cement Association, 1925.**

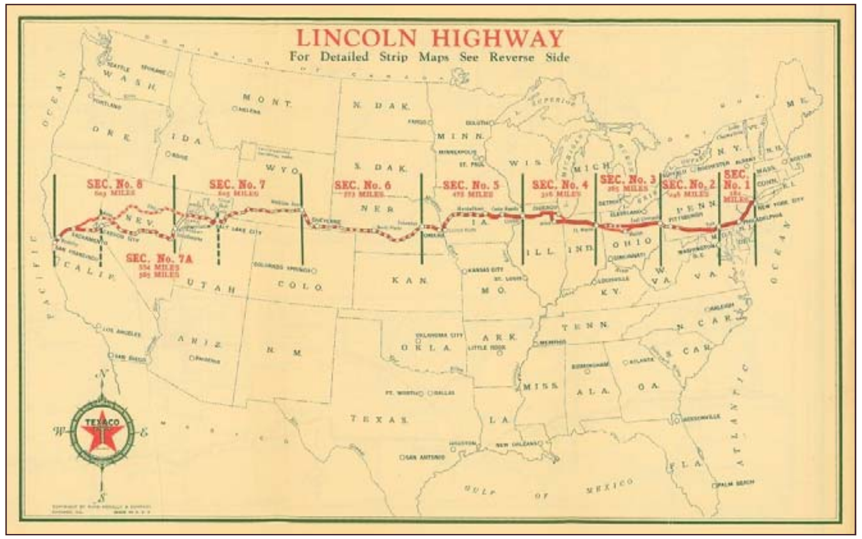
The quest for smooth navigable road surfaces has intrigued inventors since the Romans. Many different impractical and often labor-intensive methods were finally replaced, for the most part, with the invention of cement-paved roads. In 1824 British stone-mason Joseph Aspdin created the first cement-like formula. Patents were granted to Aspdin and several other inventors and by the 1850s, German roadbuilders were experimenting with cement surfaces. However, it wasn't until the early 1900s, driven by the growing number of automobiles, that the mixture known as Portland cement was perfected. Relying on a specific blend of finely ground minerals and ores, cement production depends on the natural occurrence of these materials in quarried rock. The name "Portland," taken from building stone quarried in Britain on the Isle of Portland, can only be used when the proper mixture of elements is used and represents a durable, long-lasting, strong but flexible building medium. When Portland cement is mixed with gravel, sand, and water, concrete is

produced, and it is this mixture that led to the great road and highway boom of the 20th century.

The Portland Cement Association, based in Skokie, Illinois, continues to this day to monitor the integrity of cement production while supporting the development of new formulas and mixtures for a variety of uses.

Wayne County, Michigan. Road Commission. The Davison Freeway, 1944. [Silver Gelatin Photographs]

As road surfaces improved and automobiles became more powerful, city planners and engineers began to look at how to more efficiently move the growing number of vehicles through cities. The Davison Freeway, in Highland Park, a suburb of Detroit, was the first depressed or below-grade freeway in the United States. An ingenious solution to the problem of how to eliminate the slowdown caused by cross traffic, engineers proposed a paved multi-lane depression with grade-level overpass bridges to handle the traffic on "surface streets". Built in 1944, the Davison Freeway ushered in the modern urban and ex-urban freeway.



The Lincoln Highway Association.
***Preliminary Prospectus of the Lincoln Highway Association*, May 1913.**
Items shown are from the Lincoln Highway Association Archive, 1912-1939.

The Lincoln Highway Association was formed in 1913 by businessman and promotional genius Carl G. Fisher (President of the Prest-O-Lite Co. and founder of the Indianapolis Speedway), along with Frank A. Seiberling (President of Goodyear Tire and Rubber Co.) and Henry B. Joy (President of Packard Motor Co.) in Detroit, Michigan. The organization's goal was to plan, fund, construct, and promote the first transcontinental highway in North America, running from New York to San Francisco following the most direct route possible and covering approximately 3,400 miles.

The non-profit organization and its mission to build the Lincoln Highway present an interesting mix of promoting capitalist enterprises (Packard, Goodyear Tire and Rubber, Portland Cement) while also seeking to provide toll-free accessible roads through some of the most beautiful countryside in the country for the general populace to use.

The Lincoln Highway Association closed its doors after the National Highway Act of 1928 showed the federal government's intentions to take the lead in providing good roads, but the formation of the Federal Highway Administration and the Interstate Highway System can be seen as the culmination of efforts by the Lincoln Highway Association.

The Association was re-formed in 1992, with a mission of preserving and promoting the remnants of the Lincoln Highway. With active chapters in each state along the route, the Association holds annual meetings, publishes the quarterly *Lincoln Highway Forum* and various newsletters, and works with the National Park Service to designate portions of the highway as National Heritage Corridors. At the 2006 conference in Cedar Rapids, Iowa, the University of Michigan's Special Collections Library was designated as the official repository for the archive of the Association.
***The Complete Official Road Guide of the Lincoln Highway*. Third Edition. Detroit: Lincoln Highway Association, 1918.**

The Lincoln Highway Association published five editions of the *Official Road Guide* over the course of building the highway. The guides include maps, advertisements for hotels, restaurants and gas stations, and a detailed narrative description of the specific route through each state.

This copy of the third edition belonged to Field Secretary, Gael Hoag. It is a specially bound copy intended to be used by him or any other board member who chose to drive the route, and features a softbound cover for flexibility and blank lined pages for observations and notes to be incorporated into subsequent editions.

Lincoln Highway Association Officials Austin F. Bement and Henry B. Joy, 1915. [Silver Gelatin Photograph]

Austin Bement (Field Secretary) and Henry Joy (President and later Vice-President of the Association) are shown on an early scouting trip in their Stutz automobile in the Sierra Nevada Mountains in California. Association members made numerous reconnaissance and planning trips which were documented in the over 3000 photographs now preserved as part of the Lincoln Highway Association Archive. These images depict beautiful scenery as well as construction work and portraits of national and local officials.

Eastern Terminus: Lincoln Highway Marker on Lamp Post on 42nd St., New York City, 1917. [Silver Gelatin Photograph]

Western Terminus: Lincoln Park in San Francisco, California, 1925. [Silver Gelatin Photograph]

The route of the Lincoln Highway began in New York City (note the small Lincoln Highway logo on the post) and ended in Lincoln Park in San Francisco. Following the most direct route possible, the highway wends its way through New York, New Jersey, Pennsylvania, Ohio, Indiana, Illinois, Iowa, Nebraska, Wyoming, Utah, Nevada and California.

Dixie Highway Association.
William S. Gilbreath Scrapbook, 1915-1916.
From the William S. Gilbreath Dixie Highway Collection.

Carl Fisher's other contribution to the development of the United States highway system was the Dixie Highway. In it, complementing the east-west route of the Lincoln Highway, Fisher focused on a north-south route. Less direct, and with more feeder routes than the Lincoln Highway, the Dixie Highway covered over 5,000 miles, running from Ontario, Canada to Miami, Florida. Fisher was an early developer of resort properties in Florida, and this highway eased the trip of the growing number of automobile owners in the northern states as they traveled south in the winter months.

Following the model of the Lincoln Highway, Fisher formed the Dixie Highway Association in 1915 and proposed linking existing roads with newly paved sections. Also like the Lincoln Highway, the Dixie Highway Association solicited support and funds from townspeople, businesses and municipalities along its route because it lacked the support of the federal government until the Federal Road Aid Act

(1916) released funds in 1922. The highway was considered complete in 1926.

Roads & Highways • Case 12

William S. Gilbreath.
Dixie Highway Fundraising Flyer, 1920s.
Items shown are from the William S. Gilbreath Dixie Highway Collection.

Indianapolis businessman William S. Gilbreath was the indefatigable Field Secretary for the Dixie Highway Association, having gained experience promoting the Lincoln Highway in its early days. Gilbreath tirelessly drove the route encouraging support, both financial and philosophical, from officials and citizens in Ontario, Michigan, Indiana, Ohio, Kentucky, Tennessee, Georgia and Florida.

William S. Gilbreath (center), and Edgar Lewis in the Dixie Highway Packard, with Nance O'Neil, 1916. [Silver Gelatin Photograph]

Gilbreath, by most accounts a charismatic and engaging man, took advantage of opportunities to advertise and promote the highway. This photograph was taken when motion picture director Edgar Lewis was filming *The Flames of Johannis*, which starred notorious B-film actress, Nance O'Neil.

***The Dixie Highway*. Michigan and Florida Covers. Volume 9, nos. 2-3 (Feb.-March, 1924).**

In lieu of the more expensive Lincoln Highway road guides, the Dixie Highway Association published a magazine publicize its route. In addition to reports on improvements to the road, the magazine included articles promoting travel by automobile and highlighting roadside attractions and comfortable accommodations. Frequent illustrations of lush Florida palm trees and sandy beaches were used to lure northerners to vacations in the south.

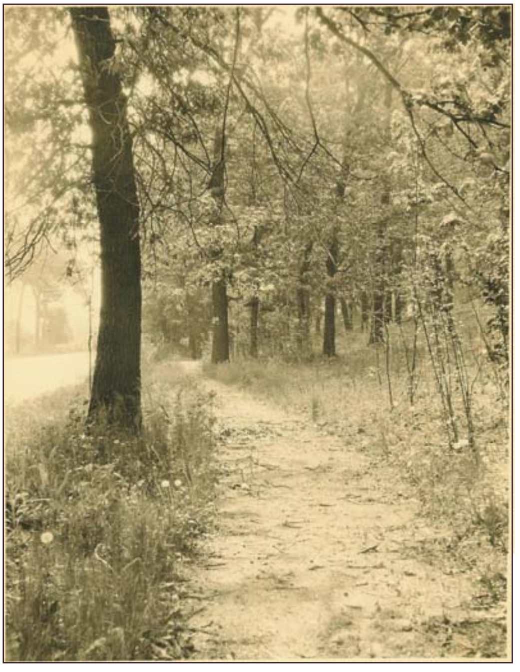
Jens Jensen, 1860-1951.
Details for Camp Site—Ideal Section, May 1924. **[Drawing]**
Items shown are from the Lincoln Highway Association Archive, 1912-1939.

Jens Jensen, a Danish-born landscape architect, has long been considered the dean of the Prairie style of landscape architecture, in part due to his close association with Frank Lloyd Wright. He is also remembered as a significant social reformer in Chicago. In 1924 Jensen was asked to submit designs for a roadside campsite to be built adjacent to a section of the Lincoln Highway near Dyer, Indiana, and for the landscaping flanking each side of this 1.33 mile section of highway.

One of several pencil drawings Jensen made for the proposed site, this one shows the elevation of the structures. To the right of the exhibit case is a large drawing of the layout of the campsite. Jensen's oversized sketch shows a sensitive placement of facilities and a respect for the existing landscape, ensuring that the campsite blends in to the countryside. Due to the growing expense and inadequate local funding, the campsite was never built, but Jensen's conception of the roadside plantings and paths was executed.

Letter from Jens Jensen to Gael Hoag, March 24, 1928.

The Ideal Section, near Dyer, Indiana: Footpath and a Portion of the Highway, 1923. [Silver Gelatin Photograph]



The Unimproved Road Near the Ideal Section, Dyer, Indiana, 1922. [Silver Gelatin Photograph]

Lincoln Highway Association.
Some Facts About the Ideal Section.
[Typescript] 1910s.

The Ideal Section was conceived as an exemplar of what a road

Next Exhibit:

Diversity in the Desert: Daily Life in Greek and Roman Egypt

June 11-August 17, 2007

Featuring the University of Michigan's
collection of ancient Egyptian papyri