THE CATALOGUE OF THE CENTENARY EXHIBITION of THE BALTIMORE & OHIO RAILROAD

1927

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BALTIMORE
1927

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THE BALTIMORE AND OHIO RAILROAD COMPANY

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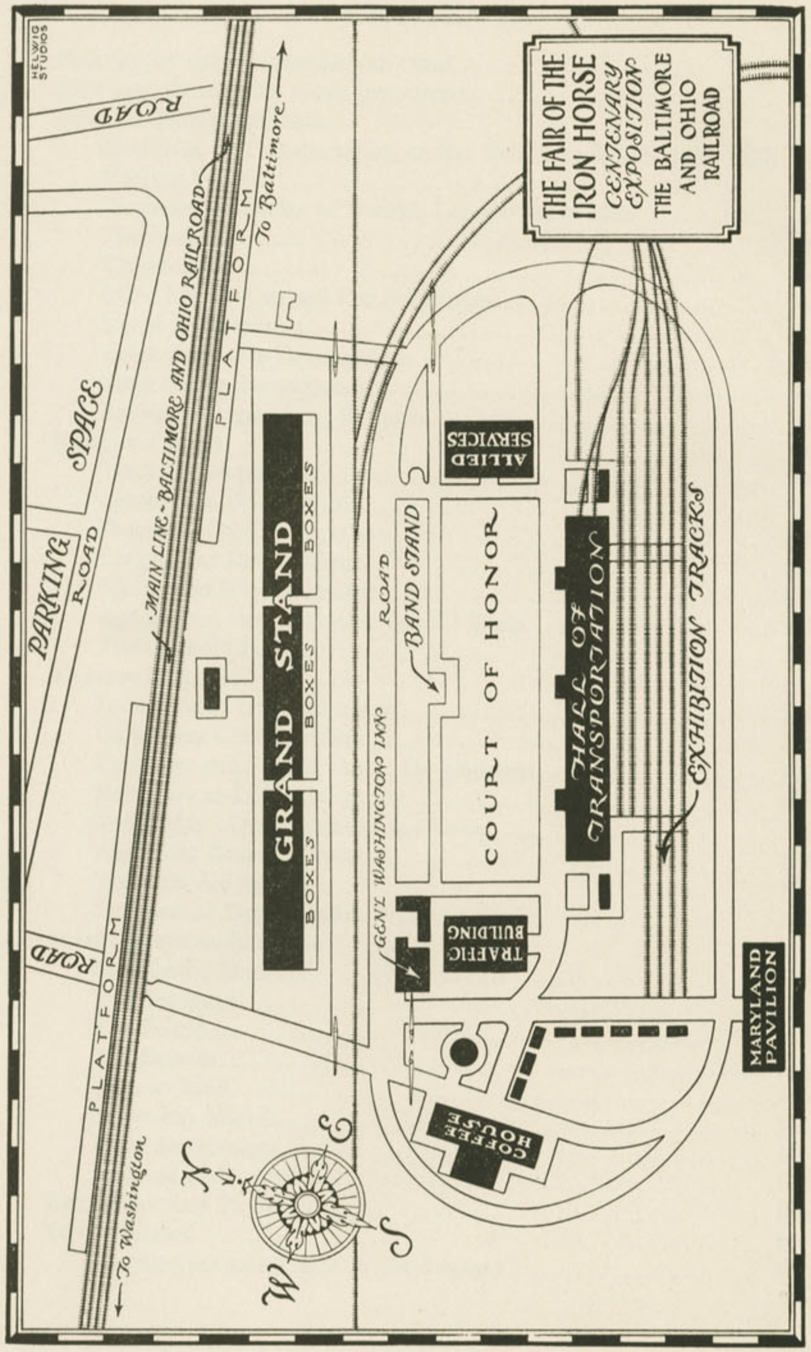


HISTORY OF THE BALTIMORE AND OHIO

SPURRED by the immediate success of the Erie Canal and alarmed by the possible reactions of that success upon their own brisk city, the business men of Baltimore one hundred years ago began to consider the possibilities of constructing their own pathway through to the rapidly expanding country to the west of them. They hit upon the Ohio River, with its water reaches to much of the interior of North America, as the ultimate destination for that pathway. For the path itself, they elected to follow the example of England which was just laying down the first of a series of metal roads which became known as rail roads. The steam locomotive at first was beyond their imagination. They proposed to use as motive power for their rail road, horses—drawing flanged-wheel cars upon its level stretches and operating cableways upon inclined planes where there were grades to be overcome.

The first plans of these men of Baltimore quickly took enduring form. Chartered by the State of Maryland, February 28, 1827, and incorporated on April 24 of that same year, the Baltimore and Ohio Rail Road Company came into existence, with Philip E. Thomas as its president and George Brown as treasurer. The capital stock had been rapidly subscribed and in that very summer of 1827 rough reconnaissances for the new road were begun to the west of Baltimore. There were at that time no schools of engineering in America, save the United States Military Academy at West Point, and so recourse was made to the engineering forces of the Army. These came to the aid of the new railroad. They located its original line and planned many of its earliest structures.

Virginia and Pennsylvania confirmed the charter of the Baltimore and Ohio; the former on March 8, 1827, and the latter on February 22, 1828. This coöperation secured, plans for the actual construction of the new line went ahead, with great rapidity. Jonathan Knight, who had been planning many public works in Pennsylvania, was brought to the aid of the army engineers and remained with the Baltimore and Ohio for many years thereafter; most of them as its chief engineer. He gave vast aid to the project.

Construction work on the new railroad was formally begun on July 4, 1828, when a First Stone was laid in a field near the residence of James Carroll on the then westerly edge of the city of Baltimore. This was made a large public occasion and was preceded by a very pretentious street parade. At the ceremony the Masonic lodges laid the stone, being assisted by the venerable Charles Carroll of Carrollton, the town's chief citizen. In the evening there were fireworks and more rejoicings.

BUILDING THE NEW RAILROAD

It was not, however, until 1830 that the new railroad was ready to begin business as a common carrier. By the beginning of that year its double-tracked line was completed from Baltimore to Ellicotts Mills, fourteen miles distant. Cars had been built and equipped with flanged wheels, horses secured, and on the twenty-fourth of May the regular operation of trains between the two terminals was begun. The road met with instant favor. And preparations went forward with renewed energy toward extending it westward from Ellicotts Mills.

Yet the problem of its motive power remained a vexatious one. There were many who scoffed at the plan to operate it with horses—all the way from Baltimore to the Ohio, three hundred miles distant. Among these was one Peter Cooper, a rich and distinguished citizen of New York, who had made land investments in Baltimore and who was concerned as to the future of the town. Mr. Cooper called the attention of the directors of the railroad to the stream locomotive, which was a recognized device in England and which already had made its appearance here in the United States. When they were reluctant to experiment with this machine, he went to Baltimore and took with him the parts of a tiny locomotive, the *Tom Thumb*, which he set up and operated under its own steam power on the track which had been put down at Mount Clare, in the suburbs of Baltimore.

This was in the autumn of 1829. The *Tom Thumb* was not immediately successful. But Cooper persisted with the engine and in the spring of 1830 he triumphed with it. Even though on one of its earliest tests it raced with a horse-car on the adjacent track and, suffering a momentary breakdown of its mechanism, was beaten by the horse of flesh and bone. But in the long run the iron horse was

to triumph. Gradually the directors gave ear to the man from New York. And presently they were advertising a competitive test for the best locomotive for the Baltimore and Ohio. To which there responded, in the summer of 1831, three engines. One of these, the *York*, builded by Phineas Davis of York, Pennsylvania, emerged an easy winner in the contest and was immediately purchased by the company and placed in its service. Davis was engaged as its chief mechanical engineer. As such he aided in establishing the company's own works at Mount Clare, which have continued from that day to this; building and repairing its locomotives and its cars, as well as performing many other useful services.

The steam locomotive upon the Baltimore and Ohio entered into swift development. In 1832 there emerged from Mount Clare the *Atlantic*, which was a distinct improvement upon the *York*. There followed, in quick succession, the *Traveller*, the *Arabian* and the *Mercury*. Each of these engines represented a distinct advance over its predecessors. But all of them had the upright type of boiler. The road clung tenaciously to this form, even after its compeers had shown the obvious advantages of the horizontal boiler. Eventually it capitulated. The *Lafayette*, which made its appearance upon the line in 1837, was the first engine which in its general form resembled the locomotive of today. After it, there were no more locomotives with vertical boilers built for Baltimore and Ohio.

SLOW PROGRESS AT FIRST

Long before the coming of the *Lafayette*, the Baltimore and Ohio had advanced its rails westward from Ellicotts Mills. By the beginning of 1832 it was at Frederick, sixty miles distant by rail from Baltimore, and on December 1, 1834, it had reached a point directly across the Potomac from Harpers Ferry. Thereafter its progress was not so rapid. Panic came upon the land and most of its enterprises were halted. So it was not until November 5, 1842, that the iron horse first poked his nose into Cumberland. In the meantime—seven long years before—an important side line of the road had been completed; the Washington Branch, extending southwesterly from the Relay House and forming a most important link in the railroad route between New York, Philadelphia and the national capital.

From the very beginning this line was highly profitable. It connected a group of cities already well developed and so capable of maintaining a railroad from the outset.

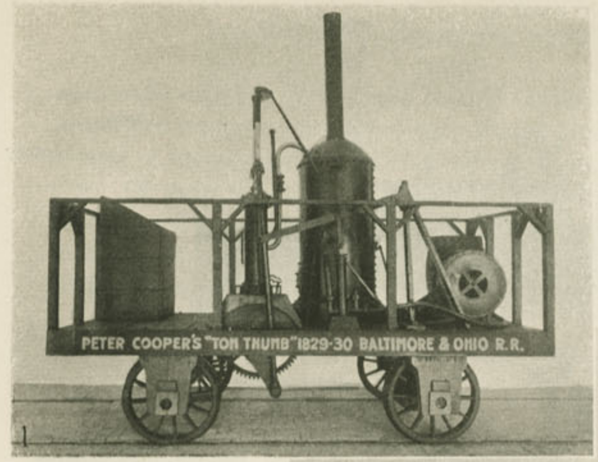
The Main Stem of the Baltimore and Ohio, as presently it became known, had no such sinecure. It was thrusting itself into an undeveloped and little known country. Moreover, it was encountering physical obstacles such as no other railroad in the United States had as yet faced. The crossing of the stiff ranges of the Alleghenies proved to be no simple matter. Long tunnels had to be bored, large bridges builded, heavy embankments and cuttings were a necessity; almost every mile of the way west of Cumberland.

Wonder it not then that it was not until the first day of January, 1853—almost a full twenty-five years after the first breaking of ground for the road—before Baltimore and Ohio actually reached its great objective, the bank of the Ohio. On that day, the first locomotive and train entered Wheeling. There were many rejoicings; and a huge celebration. But this last was eclipsed four years later when three trains of distinguished excursionists left Baltimore and journeyed through to Cincinnati and to St. Louis upon the extended lines and connections of Baltimore and Ohio.

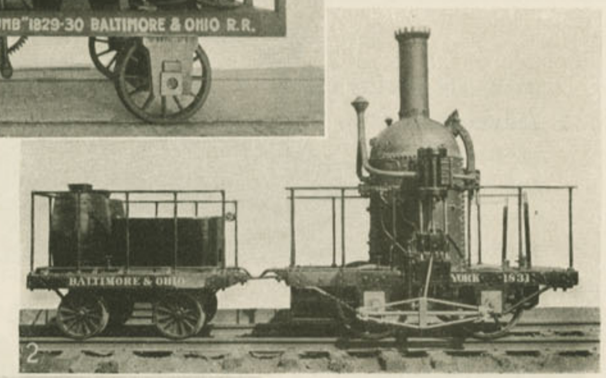
THE EXPANDING RAILROAD

Work upon these had begun even before the completion of the original main stem into Wheeling. They were, chiefly, the Marietta and Cincinnati, the Ohio and Mississippi and the Central Ohio. There were no bridges then across the Ohio and these connections had to be reached from the main stem at Wheeling—and from the newly completed branch from Grafton to Parkersburg—by river steamers and ferries. It was not until after the Civil War that these three connecting railroads were brought into the main Baltimore and Ohio system.

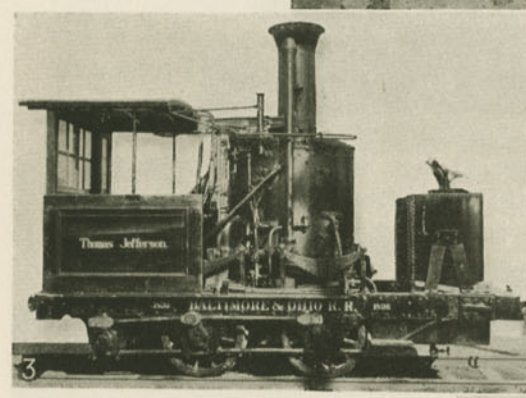
In the great struggle of the Civil War, Baltimore and Ohio, by reason of its location, became the key railroad of the defense of the Union. It formed the most direct route through northern soil between the armies of the Union in the East and those in the West. Because of this, it was under almost constant attack. Repeatedly, its tracks were torn up, its bridges and its buildings burned. There



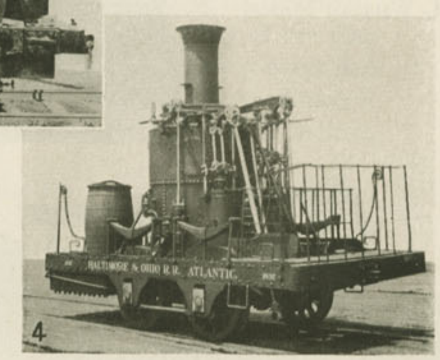
1. Tom Thumb



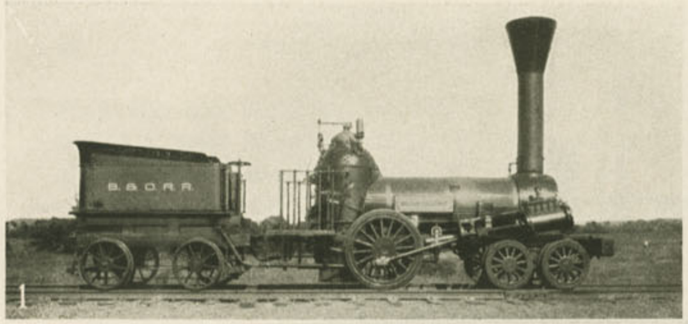
2. York



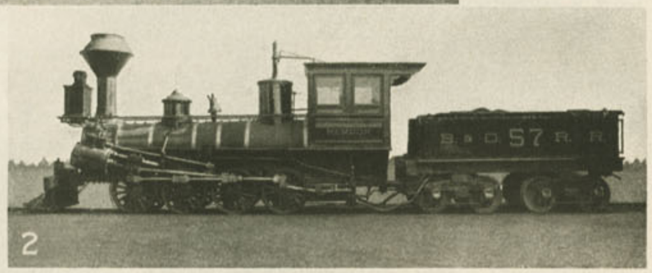
3. Thomas Jefferson



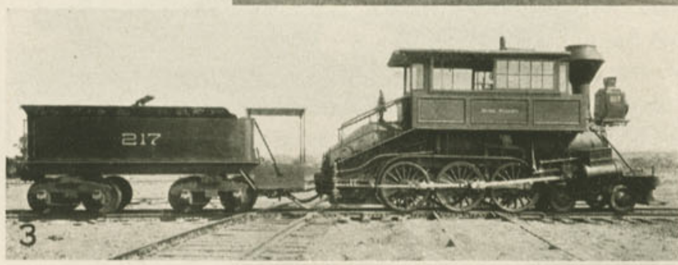
4. Atlantic



1. William Galloway

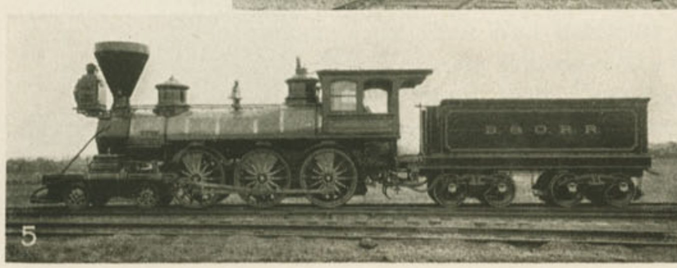


2. Memnon



3. Ross Winans

4. William Mason



5. Thatcher Perkins

were weeks and months when its Main Stem was completely severed. It suffered enormous property loss. But at no time did the men in control of the property lessen their efforts to keep it open and effective. Of these the chief was John W. Garrett—for twenty-six years president of Baltimore and Ohio and one of the great guiding forces of its entire history. Mr. Garrett's aid in the preservation of the Union has never been adequately recognized.

CONTINUED GROWTH

In the years that followed right after the war he bended his efforts to the upbuilding of Baltimore and Ohio into one of the outstanding railroad systems of the United States. He not only brought into the parent company the three western roads, to which reference has just been made, but he extended its lines; in 1871, into Pittsburgh; and in 1874, into Chicago. He greatly upbuilded the property. And one of the final acts of his long term of office as its chief executive was the construction, in 1886, of the Baltimore and Ohio into Philadelphia, which, by connection with the Philadelphia and Reading and Central Railroad of New Jersey system made it possible for the company to operate its through freight and passenger trains in and out of the port of New York. The acquisition of the Staten Island Rapid Transit Company at about this time perfected its freight terminal arrangements there.

In more recent years have come the entrance of the system into Youngstown, Akron, Cleveland and—upon the purchase of the former Cincinnati, Hamilton and Dayton—into Dayton, Toledo and Detroit. Its most recent entrance is, in this year of its centenary, into the important city of Indianapolis. The purchase of the Cincinnati, Indianapolis and Western has not only given it a direct line into the capital of Indiana but also into the capital of Illinois—Springfield—which had heretofore been reached only by its indirect lines.

In the administrations of the last three presidents of the company—Messrs. L. F. Loree, Oscar G. Murray and Daniel Willard—great sums of money have been expended in keeping the road in the forefront of American systems. In the present administration alone (that of Daniel Willard, who became president of the company

January 1, 1910) there has been spent over $400,000,000 or nearly half the present physical value of the property, in the acquisition or rebuilding of lines, bridges, locomotives, cars and the like. Within twenty years virtually a new railroad has been created. Not alone physically. Baltimore and Ohio has a passing pride in the quality of its service. It operates, for instance, two of the finest of American trains—the *Capitol Limited* and the *National Limited*. The basis of the reputation of these trains is not so much upon their swiftness as upon their comfort and dependability; without excessive speed.

So prepared, Baltimore and Ohio enters upon its second century; without fear or without hesitation. It long since accustomed itself to its rôle as servant of the public. As such it endeavors at all times to conduct itself as a railroad, properly equipped, both physically and humanly, for the prompt, safe and efficient carriage of men and their goods. For its past it needs make no apologies; for the future it offers every promise of sustained and increased service and usefulness.

HOW THE CENTENARY CAME INTO BEING

TO PROPERLY celebrate the one hundredth birthday of the first railroad in the United States to engage in the public transport of passengers and of freight was a problem that came to the management of Baltimore and Ohio more than two years ago. After much consideration, it was decided that the centenary of the road should be many-sided. The actual birthday of the company—on the twenty-eighth day of February, 1927—would be marked by a dinner. But the largeness of the occasion demanded something more than this; something in the way of an outdoor exhibition or pageant. The fact that the lifetime of Baltimore and Ohio virtually marks the lifetime of the railroad in America made it fitting that such an exhibition or pageant should tell, simply but graphically, not alone the story of rail transport in the United States, but of all inland transport here since the first settlement of the nation.

February in Baltimore is not ordinarily a propitious month for outdoor celebrations. Therefore the celebration on the twenty-eighth day of the month was limited to a centenary dinner, which was given successfully at the Lyric Theatre, on the evening of that day. More than a thousand guests of the Company gathered to break bread with it, to listen to an excellent address by Mr. Newton D. Baker, and to witness upon the stage of the theatre, three scenes depicting the earliest days of Baltimore and Ohio. These showed the citizens of Baltimore meeting at the house of Mr. George Brown early in February, 1827; the laying of the First Stone of the road, July 4, 1828; and the coming of the steam locomotive to it, in 1830.

At the dinner, announcement was made of the plan for holding the Centenary Exhibition and Pageant this autumn. Gradually plans were developed for the outdoor show. In order not to impede traffic upon the line, it was decided not to attempt any sort of pageant and parade upon rails in daily use. Accordingly a tract of level land, approximately one thousand acres, belonging to the company at Halethorpe, Maryland, was fixed upon as the site for the exhibition and pageant. This site was ideal. Not only is Halethorpe situated upon the main line of the Baltimore and Ohio—in fact, a part of the earliest main line—just west of Baltimore, but it is easily accessible by the main highway between Baltimore and Washington. The exhibition grounds face directly upon this boulevard. The entrance to them is marked by a handsome entrance gate, after the manner of old time Southern plantations.

THE BUILDINGS

In planning the main structures of the exhibition, the chief effort has been to make them simple and dignified, as well as pleasing to the eye. In order to best protect the valuable exhibits that they hold, they have been built of brick and steel and so are fireproof. Yet the materials that have gone into them are all of standard sizes and length so that when they are torn down, if ever they are torn down, they may be easily salvaged; their materials devoted to other uses.

Chief amongst these buildings is the Hall of Transportation, 502 feet in length and 62 feet in width, surmounted by a handsome cupola of colonial type and devoted primarily to an exhibition of the development through a hundred years of the devices that go toward the actual working of the railroads—locomotives, cars, tracks, bridges; a thousand and one lesser devices. The overflow of this exhibit is contained on the tracks that surround the building.

Flanking the Hall of Transportation and also facing the Court of Honor of the exhibition are two other fireproof structures, also of the colonial type of architecture, named the Traffic Building and the Allied Services Building; and showing the development through one hundred years of phases of railroad operation indicated by their names. In this book one may read in detail of the many exhibits that these three principal buildings hold.

A fourth structure, erected largely to give setting to the pageant of inland transport in America held each afternoon at the Centenary, is the Old Tavern, carefully reproducing the salient features of the ancient inns, that once lined the National Road and other turnpike roads leading out from Baltimore. It serves a practical purpose as a press headquarters as well as housing the administrative offices of the exhibition. A large structure nearby is the Coffee House, which, as its name would indicate, caters to the thousands of hungry folk

who come to the show. There are also about the grounds, a host of smaller buildings and booths to meet every necessity of the occasion.

At the same time the Centenary Exhibition was created, there was organized, as its central feature, the pageant of inland transport in America. In a more dramatic form than the exhibits in the buildings it seeks to show how the railroad came to the United States, as its commercial salvation, and quickly became the veritable backbone of its tremendous national life, social as well as industrial. The pageant of the centenary moves upon a loop of standard railroad track more than a mile long, and the highway which directly parallels it. The remarkable collection of actual locomotives, ancient and modern, which is the property of the Baltimore and Ohio forms the basis of this pageant. To it for this occasion have been added engines from other railroads; the *John Bull*, of the Pennsylvania, the *DeWitt Clinton*, of the New York Central, the *William Crooks* of the Great Northern . . . . many others, not the least of them the huge new *King George V*, sent over by the Great Western Railway of England as its own generous contribution to the Fair of the Iron Horse.

DEVELOPMENT OF THE PAGEANT

How the exhibition gains this colloquial and appropriate name is easily apparent. To the locomotives and their trains, old and new, there have been added to complete the pageant, which is held each afternoon, carriages and highway vehicles of every sort, men on horse-back andon foot and nineteen floats. Four of these—horse-drawn—appear in the reproduction of the parade, by which Baltimore on July 4, 1828, celebrated the laying of the First Stone of its new railroad; the others, self-propelled by gasoline motors and mounted upon the rails of the huge loop-track that encircles the grounds and serves as a virtual stage for theatrical pageant, complete graphically the picture of this development of transportation—through more than two centuries. Five hundred actors give the human touch to it.

In order to permit a great number of persons to view comfortably the pageant each afternoon, a grandstand, 800 feet in length and 24 tiers deep, has been erected on the north side of the loop track, facing the Court of Honor and the Hall of Transportation and containing chairs for 12,024 persons. The central portion of this stand is covered by a canopy of blue and white—the official colors of Baltimore and Ohio. Its seats have been placed—as far as they go—at the free disposal of visitors to the exhibition. Blocks of them have been set aside for organizations and other groups, some of whom have come to Baltimore from afar. The endeavor has been at every corner to provide real comfort for those who visit the Fair of the Iron Horse. Therefore in addition to generous grandstand and restaurant accommodations there are checking-rooms, lavatories, drinking fountains and park benches at different points around the grounds. In asking the world to come to its birthday party, Baltimore and Ohio has tried not to be unmindful of its comfort.

THE HALL OF TRANSPORTATION

Evolution of Transportation on the Baltimore and Ohio, 1830-1927

Scenic model, 250 feet long, showing typical Baltimore and Ohio country from Baltimore to Chicago, and illustrating transportation progress from 1827 to 1927. Against a scenic background, ten working models of locomotives, with baggage, freight and passenger cars characteristic of the respective periods, together with eleven models of bridges, depict the evolution of railroad operation.

At the extreme right of the model the beginning scene shows in greatly condensed form, Baltimore in 1830. It depicts the Carrollton viaduct, a massive single stone-arch bridge over Gwynn's Falls, the first to be built by the Baltimore and Ohio Railroad. In this model one sees the tiny *Tom Thumb*, pioneer engine of the road, and the first locomotive to be built in the United States, with the first crude passenger car. In the background is shown Baltimore with the familiar landmarks and the Washington Monument and the Shot Tower, rising above the roofs and trees of the old-fashioned town.

At the extreme left, the scene presented is the Chicago terminal of the Baltimore and Ohio in 1927. The end of the train shed of the Grand Central Station is shown, with the *Lord Baltimore* and the *Capitol Limited* emerging from it. In the center is the huge bascule bridge which carries the Baltimore and Ohio line over the Chicago River. In the background the artist has shown typical Chicago, including some of its finest structures instead of the actual arrangement of the buildings about the terminal.

The intermediate section of the scenic model does not aim to show the precise scenery between Baltimore and Chicago but rather seeks to depict the general character of the terrain, the rugged mountains of Maryland and Pennsylvania giving way gradually to the rolling country of Ohio and Indiana. In this intermediate scene are shown by means of precisely constructed scale models, the development of locomotives, cars and bridges from the Carrollton viaduct and the *Tom Thumb* to the bascule bridge and the *Lord Baltimore*.

MINIATURE WORKING MODELS OF LOCOMOTIVES AND CARS

Miniature working models of uniform scale, one-half inch being equal to one foot, or $\frac{1}{24}$ full size, are shown in connection with the scenic model depicting the evolution of transportation on the Baltimore and Ohio, 1830–1927.

1829–1830—Tom Thumb. First American built locomotive. Built by Peter Cooper of New York to prove the practicability of steam operation. Ran successfully on the rails of the Baltimore and Ohio, 1829–1830. Thereupon the directors offered a $4000 prize for an engine weighing 3½ tons to haul 15 tons at 15 miles an hour.

A four-wheel open passenger car with longitudinal seats in which the directors rode to witness the demonstration of the practicability of operating the steam locomotive around curves and up grades.

1834—Thomas Jefferson. Built by Davis and Gartner at the Baltimore and Ohio shops at Mount Clare. Cylinders 12 x 22 inches. *Grasshopper* type, of similar but heavier construction to the *Atlantic* but to increase the traction it was improved by extending the crank shaft through to the outside of the frame. Fitted with crank arms to engage connecting rods to cranks on the outer ends of the axles of the two pairs of driving wheels. Driving springs above the main frame over the top of the journal bearings of the driving axles also was an improvement. A vertical type boiler as previously used, enlarged to 52 inches in diameter and 64 inches high with four hundred 1½ inch tubes. An exhaust steam feed water heater, pump and forced draft by a fan were used. Weight, 15½ tons; tractive power 5094 pounds; boiler pressure, 50 pounds. The engine was equipped with a tender for road service, and with tank and coal space provided on the engine, was employed for switching until 1893 at the Baltimore and Ohio Shops at Mount Clare.

Two Imlay coaches, similar in design to the prevailing type of stage coaches used in 1831. They are double deck passenger cars, accommodating passengers on the inside and on the top in the customary manner of the period.

1848—Winans Camelback Locomotive No. 55. 0–8–0 type 8-wheel connected locomotive built by Ross Winans of Baltimore for the Baltimore and Ohio Railroad. Horizontal cylinders, 17 x 22 inches; 43-inch drivers; horizontal boiler on the forward part of the engine and the cab built on top of the boiler. There were three sizes of these locomotives built—small, with 17 x 22 inch cylinders and short firebox; medium, with 19 x 22 inch cylinders with medium firebox; long, with 19 x 22 inch cylinders and long firebox. The engine was used as the principal freight locomotive on the Baltimore and Ohio until 1873.

Two 28-foot, four-wheel, wooden box cars of the period of 1850.

Two three-pot iron hopper cars of the period of 1856, of 10 tons capacity, of self-clearing type, with link and pin continuous couplers. Hand brakes operated on two pairs of wheels.

Two, four-wheel, gondolas or flour cars, with drop sides, developed to take care of the large milling business surrounding Baltimore.

1856—William Mason No. 25. American 4–4–0 type locomotive built by William Mason and Company, Taunton, Mass. Two pair of drivers with four-wheel leading truck; horizontal cylinders, 15 x 22 inches, bolted to cast iron saddle fitted under round smoke box; wagon top boiler 46 inches in diameter at smoke box; rectangular firebox located back of the rear wheels; drivers 60 inches in diameter. Weight 28 tons. A Baltimore and Ohio locomotive and the forerunner of the standard American type passenger engine of the country.

A combination smoker and baggage car of the period of 1855 with open platforms, hand brakes, link and pin continuous couplers.

Two first-class, 41 foot, open platform passenger cars of the period of 1855 with hand brakes and link and pin couplers.

1875—J. C. Davis No. 600. First passenger engine of the Mogul or 2–6–0 type used on the Baltimore and Ohio Railroad. Built by J. C. Davis, master of machinery, of the Baltimore and Ohio railroad at the Mount Clare shops, for hauling heavy passenger trains over the 17-mile grade (116 feet to the mile) over the Alleghany mountains between Piedmont and Altamont. Cylinders 19 x 24 inches; boiler 50 inches in diameter, pressure 110 pounds; 165 tubes 2¼ inches in diameter, 11 feet 10 inches long; firebox 99½ x 34⅝ inches; grate area 23.7 square feet; weight in working order 90,400 pounds; on drivers 76,550 pounds; tractive power, 14,520 pounds. This engine, exhibited at the Philadelphia Centennial Exposition in 1876, was the heaviest passenger engine in existence at that time. It was also exhibited at the World's Columbian Exposition in Chicago in 1893, at the Louisiana Purchase Exposition at St. Louis in 1904 and at the Sesqui Centennial Exposition at Philadelphia in 1926.

A 44-foot baggage car of 1875 with open platform and link and pin couplers.

Two first-class, round window, clear story, open platform passenger coaches, 51 feet 7 inches long, with hand brakes and link and pin couplers.

1926—Philip E. Thomas No. 5501. Mountain type, Class Ta, locomotive designed by George H. Emerson for the Baltimore and Ohio and built at its Mount Clare shops. Cylinders 30 x 30 inches, drivers 74 inches in diameter; boiler pressure 220 pounds; tractive power 68,200 pounds; weight 200 tons; weight on drivers 275,000 pounds; total weight 400,000 pounds; weight of locomotive and tender 659,000 pounds.

An 82-foot, all-steel Pullman Club Car, with six-wheel truck. Equipped with a baggage compartment, bath room with hot and cold water, barber shop, card room, large observation room furnished with leather covered chairs and sofas, tables, reading lamps and writing desk. A train secretary and other special attendants for service to passengers.

A 79-foot all-steel Colonial Diner, equipped with two and four-seat tables accommodating thirty-six people. The interior decoration is in colonial style with side walls in old mahogany, with appropriate windows, upholstery, draperies and carpets, and lighting fixtures.

1922—Pacific No. 5230. Class P-6 Baltimore and Ohio locomotive designed by George H. Emerson and built by the Baldwin Locomotive Works. Cylinders 25 x 28 inches; driving wheels 74 inches in diameter; boiler pressure 200 pounds; tractive power 42,200 pounds; weight, 144 tons.

A 60-foot, 9-inch, all-steel Railway Post Office Car with 60-foot mail facilities and 700 letter boxes, 160 sack racks and 50 paper boxes. Vapor steam heat and electric light.

1926—Santa Fe No. 6200. Class S-1a Baltimore and Ohio locomotive designed by George H. Emerson and built by the Baldwin Locomotive Works. A development of the *Mikado* type for heavy mountain freight service. Cylinders 30 x 32 inches; drivers 64 inches in diameter; boiler pressure 220 pounds; weight on drivers 347,230 pounds; tractive power 84,300 pounds; weight 218 tons.

Ten W-2-a 70-ton, 41-foot, 3-inch, four-door steel hopper cars for hauling coal, coke, ore, sand, crushed stone. Weight, 53,100 pounds. Built in 1926.

One 1–5 24-foot caboose car for train crew. Steel under frame, 8-wheels. Built in 1924.

1919—Mallet No. 7147. Class EL–5a simple articulated Baltimore and Ohio locomotive, converted from compound engine, Class EL–5, from designs by George H. Emerson and built at the Mount Clare shops of the Baltimore and Ohio. Cylinders 24 x 32 inches; 58-inch drivers; boiler pressure 220 pounds; weight 245½ tons; tractive power 118,800 pounds.

Ten M-26-a 50-ton, 46-foot, all-steel box cars. Closed cars for hauling grain and perishable goods. Weight 45,300 pounds. Built in 1926.

Five O-27-a 70-ton, 40-foot, 6-inch, drop end steel gondola cars for open freight and structural materials. Weight 51,000 pounds. Built in 1922.

One 1–5 24-foot caboose car for train crew.

1920—Mikado No. 4400. Class Q-4 latest type *Mikado* locomotive designed by George H. Emerson and built by the Baldwin Locomotive Works. Cylinders 26 x 32 inches; drivers 64 inches; boiler pressure 220 pounds; tractive power, 63,200 pounds; total weight 163½ tons.

Ten M-26-a 50-ton, 40-foot, 6-inch, all-steel box cars. Closed cars for hauling grain and perishable goods. Weight 43,300 pounds. Built in 1926.

One 1–5 24-foot caboose car for train crew.

In order to build accurate reproductions of the earliest as well as the most modern locomotives and cars so that a ready and simple comparison might be made in the growth and development of power on the railroad, the Baltimore and Ohio railroad provided a special shop equipped with precision tools and manned by a staff of expert mechanists under the supervision of H. J. Coventry.

The models are all of uniform scale, half an inch being equal to one foot, or $\frac{1}{24}$ full size, and are operated by individual electric motors contained within the boilers and connected to one axle by means of suitable gearing. All parts of the model are constructed exactly like the full size prototypes, and so exactly reproduced that if steam was used they would function in the same way as the regular steam locomotives. The wheels are cast iron or brass; axles, valve gearing side and main rods of steel; and all other parts are brass, either as castings or sheet metal. The screws are of two sizes; 0.062 inch diameter, 80 threads per inch; and 0.086 inch diameter, 56 threads per inch; about 1500 of each size being used in the set of models. The bolts are of hexagon bar steel.

The motors of the early engines are a special small type, being but 1½-inch diameter over the field. Four hundred detail drawings were made of the modern parts. Some 680 castings were made. To complete the locomotive models 4500 separate parts were manufactured and six skilled mechanics were engaged on the work for eight months.

Tom Thumb—1839. The first American-built locomotive operated on a standard railroad. The electric motor for this model is fitted vertically within the boiler shell, which it completely fills. A worm on armature shaft gearing with a worm on a small countershaft makes connection to the driving mechanism. The frame work, platform and handrailing which were of wood in the original full size engine, are made of brass and oxidized. The weight of the model locomotive with tender is 5 pounds.

Thomas Jefferson—1834. A 15½-ton grasshopper locomotive representing a type first in use on the railroad. The framework, bearing pedestals, wheels, rocker beams and cab are brass castings; all other parts are cut out of steel and brass bar. The electric drive is similar to that of the *Tom Thumb*. The weight of the model locomotive with tender is 9 pounds.

Winans Camelback No. 55—1848. A 24-ton locomotive representing the standard freight locomotive for many years. The double frames of this engine are cut from hard brass plates, riveted together and the correct distance between the plates maintained with spacing collars. The wheels are of cast brass, turned and bored to exact size and pressed on steel axles. The valve motion is complete and built up of bar stock, steel and brass. The electric motor is horizontally placed in the boiler barrel, and drives a vertical shaft by means of bevel gearing. This shaft in turn drives one of the axles through a worm and wheel. The weight of the model locomotive with tender is 17 pounds.

William Mason No. 25—1856. The standard passenger locomotive of the period.

J. C. Davis No. 600—1875. The heavy passenger Mogul locomotive of the day.

These locomotives are similarly constructed and have complete Stephenson valve gears made of steel throughout. The wheels of the correct type of the period are of cast brass, oxidized. The electric drive consists of a horizontal motor in the boiler barrel, driving a set of gears in the fire box which in turn gears to the rear axle.

No. 4400—1920. Class Q-4, latest type Mikado freight locomotive. Weight 163½ tons. Weight of engine model, 34 pounds; tender, 14 pounds; combined weight, 48 pounds.

No. 5230—1922. Class P-6 Pacific type fast passenger locomotive. Weight 144 tons. Weight of engine model, 35 pounds; tender, 14 pounds; combined weight, 49 pounds.

No. 6200—1926. Class S-la Santa Fe type heavy freight locomotive. Weight, 218 tons. Weight of engine model, 34 pounds; tender, 16 pounds; combined weight, 50 pounds.

Philip E. Thomas No. 5501—1926. Class T-A Mountain type heavy passenger locomotive. Weight, 200 tons. Weight of engine model, 41 pounds; tender, 16 pounds; combined weight, 57 pounds.

These locomotives are constructed on the same general principles. All wheels are of cast iron forced on to steel axles running in brass boxes, fitted with oil cellars. Frames are cut from solid steel bar. Cylinders, cylinder heads, truck frames, frame braces are all brass castings. Valve gearing is built of steel as are the crossheads. The electric drive is effected by placing a motor within the smoke box and driving a selected axle by worm gearing through a propellor shaft and universal joint.

No. 7147—1926. Class EL-5a simple cylinder Mallet articulated heavy helping freight locomotive. Weight 245 tons. Weight of engine model, 47 pounds; tender, 14 pounds; combined weight, 61 pounds.

This locomotive consists of two independent engines coupled together by means of a special hinge connection; the back engine being fixed to the boiler and the head engine sliding under and carrying the forward portion of the boiler. The construction follows the same general method employed in building the other modern locomotive models. This model, however, has two motors; one driving the rear axle of the front engine and the other the rear axle of the rear engine.

BRIDGE MODELS

The Carrollton Viaduct. This structure enjoys a unique distinction as the world's oldest railroad bridge now in service. It is built of Maryland granite, in accordance with designs prepared by Casper W. Weaver, and executed by James Lloyd. The work of construction was begun in 1828, the first stone being laid by Charles Carroll of Carrollton, the last surviving signer of the Declaration of Independence, in honor of whom this structure is known as "The Carrollton Viaduct."

A traveler of 1830 describes this bridge as "a work for which the extent, solidity, beauty and even grandeur, has not, we believe, its equal in this country."

During the past century it has borne every type of motive power and rolling equipment developed in American railroad practice, ranging from 15½-ton locomotives of the 30's to the mighty 325-ton engines of today.

The structure has a total length of 297 feet, and the central arch, which spans Gwynn's Falls, has a clear width of 80 feet. The base of rail is 65 feet 6 inches above the bed of stream.

Wooden Truss Bridge. This bridge represents an early type of railroad truss. It was built in 1838–9 to carry the Baltimore and Ohio line across the Patapsco River, at Elysville (now Alberton), Md. The designs were prepared during the summer of 1838 by Mr. B. H. Latrobe, chief engineer of the Baltimore and Ohio Railroad, and the field work was supervised by James Murray, assistant engineer. The material was American white pine. The bridge was covered with wood, and the roof timbers were protected from fire by a sheet-iron ceiling.

The following reference to this bridge is quoted from a treatise on bridge-work, published in London, England, in 1843:

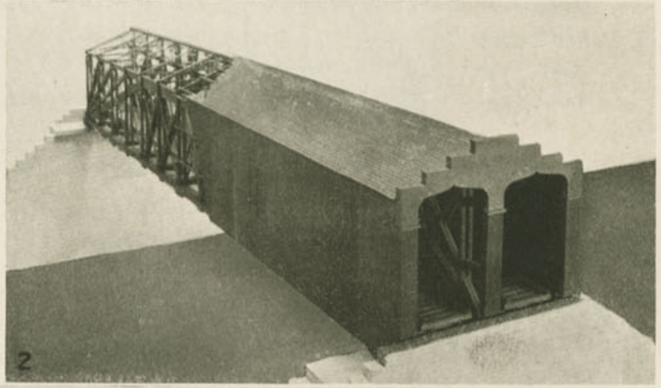
"The first locomotive engine which passed over the upper bridge weighed with its train about 70 tons; this load occupied successively the length of each arch (150 feet), and caused a depression while passing of not more than ¾ of an inch at the middle part of the truss. Since that time both bridges have borne without yielding in any part the daily action of a very heavy traffic passing at speeds of from 10 to 20 miles per hour."

This structure continued to serve its purpose at the Elysville crossing until about 1852, when it was replaced by a metal bridge.

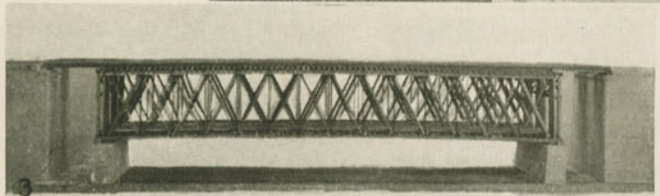
The Howe Truss. The Howe design marks a definite step in the development of the modern railroad bridge. It was the earliest type of simple truss, and was patented in the United States by William Howe in 1840.

The design combines the use of timber and metal. In the earlier trusses of this type, timber was used for the top and bottom chords and diagonal web members, while iron rods served for the vertical

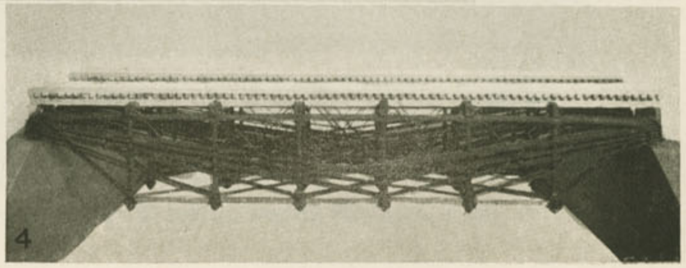
1. Carrollton Viaduct



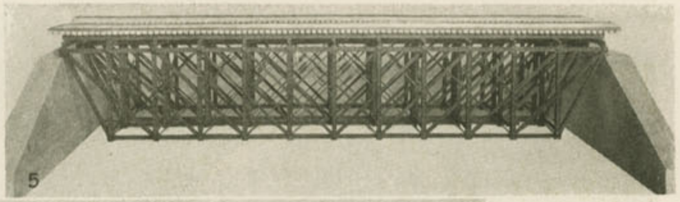
2. Wooden Truss



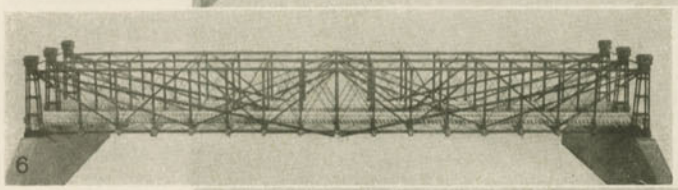
3. Howe Truss



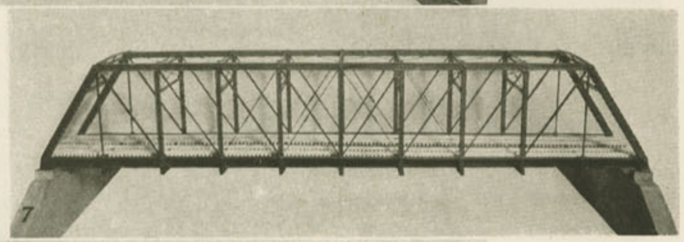
4. Bollman Deck Truss



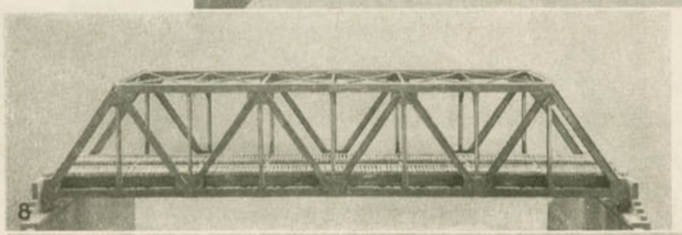
5. Whipple Truss



6. Fink Truss



7. Pratt Truss



8. Warren

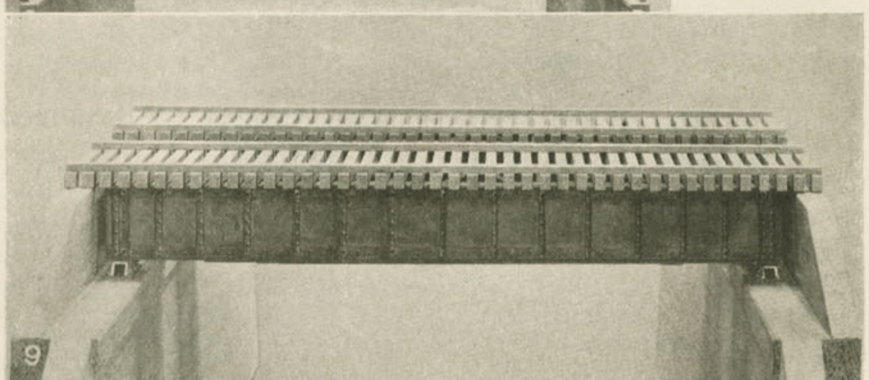


Plate Girder—Deck Type

web members. A later development was the substitution of iron for wood in the bottom chord.

Between 1840 and 1870 bridges of this type were extensively used for railroad purposes, and numerous Howe trusses were installed on the Baltimore and Ohio lines. A notable example of this type was the bridge crossing the Alleghany River, at Foxburg, Penna., where three Howe truss spans, each 177 feet long, were used for the main river crossing, until 1921, when they were replaced by metal spans of modern design.

The Pratt Truss. This type of truss was introduced in 1844 by Thomas and Caleb Pratt, as a modification of the Howe truss.

In its original form, the Pratt truss combined the use of timber and metal, wood being used for the vertical web members. However, few structures of this character were actually built, and, after 1850, the Pratt truss was widely adopted for spans in which metal alone was used. The connections of the members at the panel points were usually made by means of pins.

Between 1880 and 1905 trusses of this type were used almost exclusively on the Baltimore and Ohio Railroad for spans ranging in length from 100 to 200 feet. The Pratt truss, with both pin and rivet connections, is still extensively used for railroad and highway bridges.

Thomas Pratt was born in Boston, Mass., July 4, 1812 (died 1875). He was employed as Civil Engineer by various New England railroad interests, and, for a short time, by the United States Government. In the development of the truss which bears his name, he was associated with his father, Caleb Pratt.

The Whipple Truss. This type of truss was originally introduced by Squire Whipple, in 1847. It is a development of the Pratt truss, involving the use of a double system of web members, each diagonal usually extending over two panels. Trusses of this type were used in wrought iron construction for spans of greater length than the ordinary Pratt truss.

One span of this type, 515 feet in length, and four spans, each 475 feet in length, were used in the original Baltimore and Ohio railroad bridge crossing the Susquehanna River, at Havre de Grace, Md., built in 1886 and replaced with a new structure in 1909. Another Whipple truss, 295 feet in length, was used in the Baltimore and Ohio bridge crossing the Allegheny River, at Wheeling Junction, Pa., built in 1882 and replaced with a modern structure in 1914. A Whipple truss of wrought iron, 147 feet in length, crossing the North River, at Cave Station, Va., on the Valley Railroad of Virginia, remained in service for about fifty years, until its replacement with a modern structure, in 1923.

Squire Whipple was born at Hardwick, Mass., September 16, 1804. During 1830 he was employed for a short period as rodman, and afterwards as levelman, by the Baltimore and Ohio Railroad Company, from which service he resigned to undertake land surveying in connection with the construction and maintenance of the Erie Canal. About 1839 he began the manufacture of engineering instruments, at Utica, N. Y. On April 24, 1841, he appears as the patentee of an iron truss bridge. During the autumn of 1846 he published, for limited circulation, an essay upon a rational method for the computation of stresses in bridges and framed structures. This work attracted wide attention, and, in 1847, the first edition of his composition "Bridge Building" appeared. This was followed by the editions of 1869, 1872 and 1883. Mr. Whipple's contribution to engineering knowledge is of incalculable value, particularly as it relates to the design of bridges, which he transformed from a purely empirical matter of individual judgment and experience to an exact science.

The Bollman Truss. The Bollman truss was introduced about 1850, by Wendel Bollman, and bridges of this type were extensively used for railroad purposes between that period and about 1875. This was one of the earliest types of bridges in which iron was used exclusively. A large number of Bollman truss bridges were constructed on the Baltimore and Ohio system.

A Bollman truss bridge, built about 1852, to span the Patapsco River at Elysville, now Alberton, Md., replacing the early wooden truss structure, is described as follows in "The Great Railway Celebrations of 1857":

"Five miles further and we were at Elysville, where the party alighted to examine the peculiarities of an iron bridge invented by Mr. Wendel Bollman (the head of the "Road Department" of the Baltimore and Ohio Service) spanning the river here with a double track 340 feet in length. The river is again crossed a half mile further on by another of those enduring structures, which are entirely different in their principle of construction from any other, and their various parts are peculiarly adjusted with a view to obviating the difficulty experienced in all other iron bridges from the expansion and contraction of their material, under the influence of changes of temperature. Experience has demonstrated the entire success of this invention, which is working its way into public favor."

One of these structures, crossing the Potomac River, at Harpers Ferry, was abandoned for railroad purposes over thirty years ago, and adapted to highway use. Several large Bollman truss spans, built and erected in 1872–3, remained in service on the Valley Railroad of Virginia, between Harrisonburg and Lexington, until 1923–4, when they were replaced with modern structures.

Mr. Bollman, a native of Baltimore, was a member of the Baltimore and Ohio railroad organization for eighteen years, and was for ten years its Master of Road. The latter portion of his life was devoted to the manufacture of bridges, built in accordance with his patents, and fabricated at Baltimore.

The Fink Truss. This type of truss was invented by Albert Fink, in 1852, while employed in the office of Mr. B. H. Latrobe, chief engineer, Baltimore and Ohio Railroad, at Baltimore.

The Fink truss was widely used for both railroad and highway purposes between 1852 and about 1880. A modified form is still used extensively in the construction of steel roof trusses.

This truss is a development and improvement of the Bollman type, with a view to simplicity, and economy of material. A series of inverted "A" frames is used, and the loads are gradually transferred from the smaller to the larger trusses, and thence to the end supports.

Three Fink truss spans, each 205 feet in length, were used in the original Baltimore and Ohio Railroad Bridge crossing the Monongahela River, at Fairmont, W. Va. This structure, which was built in 1852, receives the following notice in "The Great Railway Celebrations of 1857":

"The great 620-foot iron bridge too, by which the railroad crosses the Monongahela River, a mile east of Fairmont, was pointed out as a remarkably strong and beautiful structure."

The Fink trusses at this point remained in service until 1887, in which year they were replaced with new spans. This second structure was, in turn, replaced with a new bridge in 1912. A Fink truss, 245 feet in length, formed a part of the highway bridge crossing the Ohio River, at Louisville, Ky., built in 1870.

Mr. Fink was born in Lauterbach, Hessen-Darmstadt, Germany, October 27, 1827, emigrated to America in 1849, and was employed by the Baltimore and Ohio Railroad from that year until July, 1857, when he resigned to enter the service of the Louisville and Nashville Railroad. He died on April 3, 1897.

The Warren Truss. This truss, as originally introduced, provided for the use of inclined web members only, but was subsequently modified by the introduction of vertical members. With the improvement of riveting methods it has, in a large measure, superseded the Pratt truss for short spans, and is also extensively used for long-span railroad bridges. A further modification of the Warren truss type is the use of subdivided panels. The largest span of this character on the Baltimore and Ohio system is that crossing the main channel of the Alleghany River, at Pittsburgh, Penna., 434 feet in length, built in 1920. Other examples of the Warren truss on this road are found in the 161-foot span in the Cheat River bridge at Rowlesburg, W. Va., built in 1910, and the 118-foot span crossing the Pennsylvania Railroad as a part of the east approach to the Susquehanna River bridge at Havre de Grace, Md.

Plate Girders. The use of girders for short-span bridges commenced at an early period of railroad development. Wrought iron girders, which, since 1903, have formed a part of the highway bridge crossing the Baltimore and Ohio tracks, near Poplar, Md., were fabricated in England at least eighty years ago, and, after many years service under railroad traffic, were, with some modification, adapted to their present use. The dimensions of plate girders have gradually been increased. For spans up to about 125 feet in length their use is now general, and, at such openings, they have largely superseded truss construction.

Plate girder spans may be of the "deck" type, in which the floor system rests on the top flange, or of the "through" type, in which it is carried by the bottom flange. The plate girder is of sturdy construction, and maintenance charges are low.

Movable Bridges. The construction of bridges across navigable streams subject to water-borne traffic introduces the problem of accommodating both the traffic on the bridge and that on the waterway. This problem has existed from an early time, and attempts at its solution are represented in the development of a variety of movable bridges.

The growing volume of traffic on railroads and the necessity of minimizing interruption to its movement has been marked by a progressive improvement in the design of movable bridges, along the lines of rapidity and certainty of operation. A representative type of the modern movable bridge is that crossing the Chicago River on the line of the Baltimore and Ohio Chicago Terminal Railroad, at Taylor Street, Chicago, Ill., built and equipped in accordance with the designs of the late William Scherzer.

This type is known as the Scherzer Rolling-Lift Bridge, and was developed by Mr. Scherzer in 1893, when retained by the Metropolitan West Side Elevated Railroad, of Chicago, Ill., to design a bridge across the Chicago River, near Van Buren Street, in that city.

Harpers Ferry

Scenic model, 60 feet long, 12 feet deep and 8 feet high. A graphic picture of the beautiful country made famous during the early days of the Civil War, and showing a model of the historic bridge that carried both the Baltimore and Ohio trains and the highway over the Potomac River and the adjoining Chesapeake and Ohio Canal.

The time chosen for this scenic model is 1859, the year in which John Brown of Ossawatomie conducted his epoch-making raid upon the United States arsenal at Harpers Ferry. The arsenal closely adjoined the tracks of the Baltimore and Ohio Railroad. The engine house, which became known as John Brown's Fort, may be recognized.

The chief feature of this model, however, is the combined bridge of the railroad and the highway. The railroad through this bridge, with its sharp curves at both approaches, was long recognized by scientific writers on engineering as one of the most difficult and dramatic bits of railroad location in the world. The bridge itself, some 700 feet in length, to the average man, was more distinguished by the curious fact that in its center it held a complete railroad junction, the main line of the Baltimore and Ohio swerving off sharply to the right, while the line of the branch railroad to Winchester, Virginia, continued straight ahead. This latter branch may be recognized in the model as it passes through the iron Bollman truss bridge, one of the early creations of one of the most famous American bridge builders, Wendell Bollman. The rest of the bridge is of the covered wooden construction for many years familiar upon American highways.

This historic bridge was destroyed by Stonewall Jackson June 14, 1861, as, with the Confederate Army, he evacuated Harpers Ferry, first burning the arsenal.

In more recent years separate bridges have been built at Harpers Ferry for the highway and the railroad, the line of the latter having been much eased and corrected as to curvature. The Chesapeake and Ohio Canal, which can be clearly identified at the foot of Maryland Heights at the right, was abandoned in 1924.

The entire model is surmounted by the seals of the states of Maryland, Virginia and West Virginia, the three states which are shown in the model. These seals in turn separate a large battery of American flags.

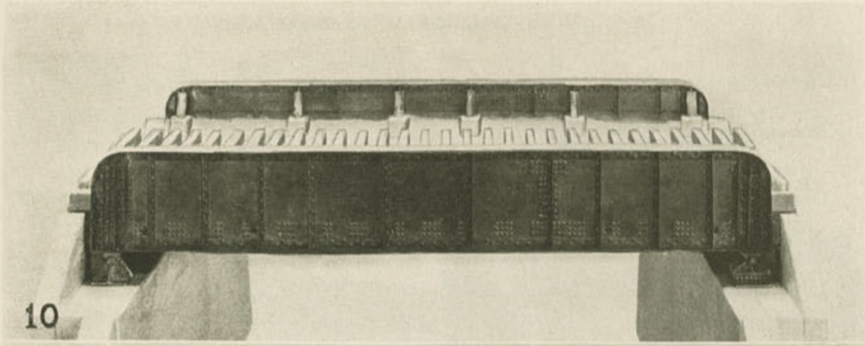
HARPERS FERRY BRIDGE MODEL

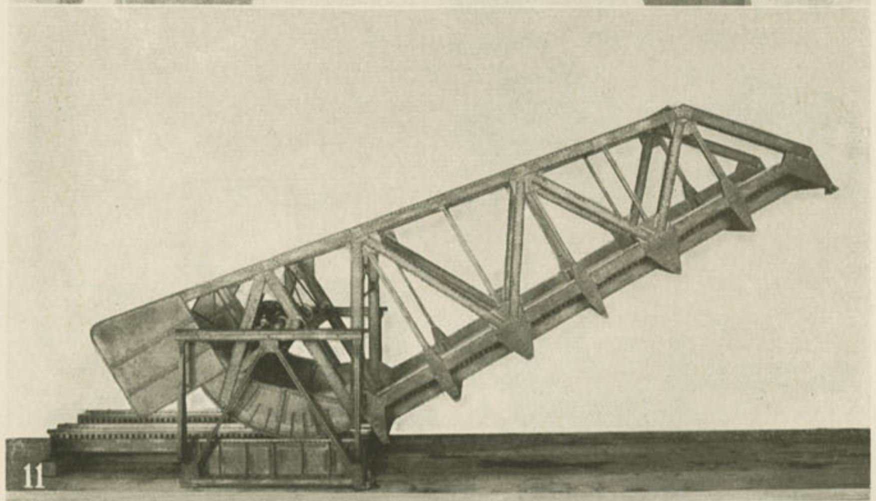
It appears probable that, when the Baltimore and Ohio line was opened to Harpers Ferry, December 1, 1834, the tracks were carried across the Chesapeake and Ohio Canal and the Potomac River on a timber trestle. This was quickly superseded by a series of timber arches, designed by Lewis Wernwag, and completed in 1836. In 1851 the work of reconstructing the bridge in iron was commenced. By the end of May, 1852, the western span had been rebuilt as an iron Bollman truss span. Test of this span, made June 1, 1852, is thus described in the "History and Description of the Baltimore and Ohio Rail Road," published in 1853:

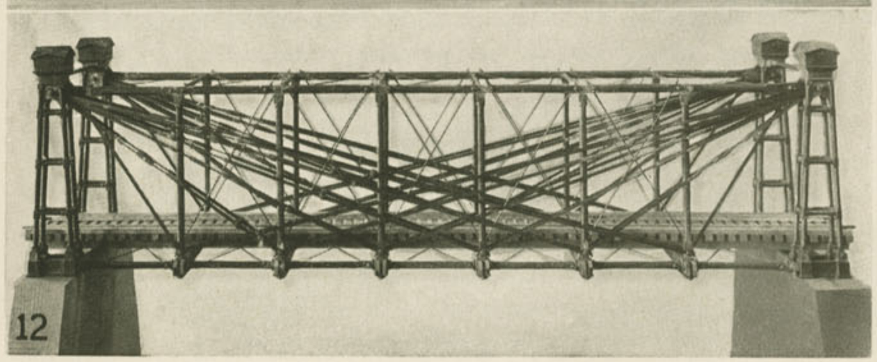
"Three first class tonnage engines with three tenders, were first carefully weighed and then run upon the bridge, at the same time nearly covering its whole length, and weighing in the aggregate 273,550 pounds, or 136.775 (2000 pounds) tons net, being over a ton for each foot in length of the bridge. This burden was tried at about eight miles per hour, and the deflections, according to gauges properly set and reliable in their action, were at centre post $1\frac{3}{8}$ of an inch, and at the first post from abutment $\frac{9}{10}$ of an inch."

Five years later, on June 1, 1857, this bridge was examined by a party of tourists, and receives the following notice in "The Great Railway Celebrations of 1857:"

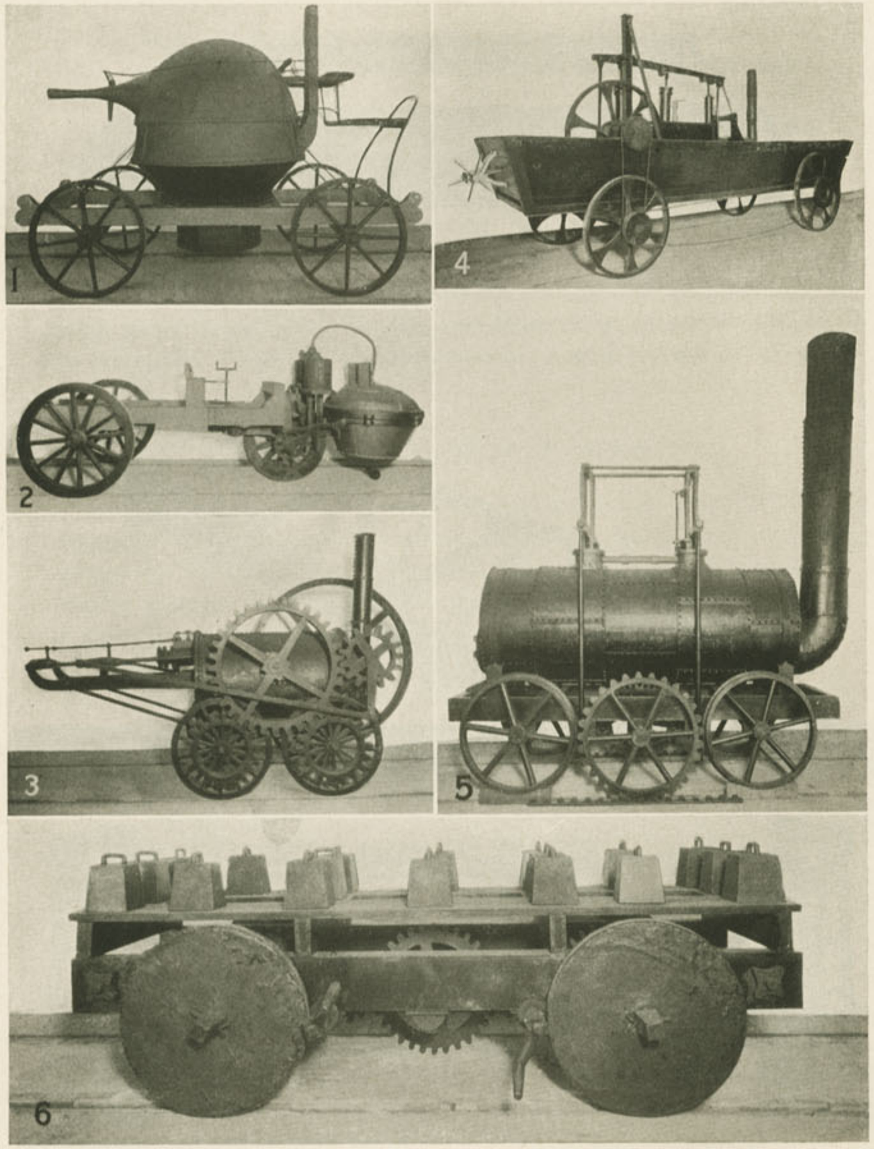
"The bridge is constructed somewhat in the shape of the letter Y, dividing as we approach its western end, the left-hand branch connecting with







10. Plate Girder—Through Type
11. Scherzer Rolling-Lift
12. Bollman Through Truss



1. Newton's Idea
2. Cugnot
3. Trevithick's Newcastle
4. Oliver Evans' Scow
5. Blenkinsopp
6. Hedley's Manual Power

the Winchester and Potomac Railroad, passing up the Shenandoah, and the right-hand carrying the main road, by a bold curve, up the Potomac. The bridge is about 900 feet in length, and consists of six arches of 130, and one arch of 75 feet span over the river, and an arch of 100 feet span over the canal. These arches are all of timber and iron, and covered in, except the western arch connecting with the Winchester Road, which is constructed entirely of iron, on Bollman's plan."

The work of rebuilding the entire bridge in iron proceeded slowly, and was greatly hindered by the Civil War, in the course of which it was badly damaged on several occasions. The work was finally completed in 1869, and the bridge was used for railroad purposes from that time until 1893, in which year railroad traffic was diverted to the new bridge, and the old structure assigned to highway use.

The Pangborn Collection of Wooden Locomotive Models

This collection of full-sized locomotive models, depicting the famous engines of the world, was devised by the late Major J. G. Pangborn, of Baltimore, for the World's Columbian Exposition of 1892 at Chicago and was first shown in the Baltimore and Ohio exhibit there. It was shown again in the railroads exhibit at the Louisiana Purchase Exposition at St. Louis in 1904.

1680—Newton's Idea. Never built, but model was made from Sir Isaac Newton's drawings. Engine propelled by reaction of steam blowing in a horizontal plane against the atmosphere through a steam nozzle.

1769—Cugnot. Built by Nicholas Joseph Cugnot of France. First in the world to move on land by steam. Reproduction of the original in the Conservetoire des Arts et Metiers, Paris.

1804—Evans' Scow. Built in Philadelphia, Pa., by Oliver Evans, a blacksmith and boat builder with a shop near the Schuylkill River. First to run on land in America. Was run to the Schuylkill River on wheels under its own steam, the wheels removed, and then proceeded by water down the river to the Delaware River, being propelled by a shaft extending through the back end, fitted with a paddle wheel.

1805—Trevithick's Newcastle Locomotive. Richard Trevithick, the builder of stationary engines and advocate of higher boiler pressure, built a number of models to demonstrate his theory, which followed with the construction of locomotives. In 1805 he constructed a locomotive at Newcastle, sometimes called the Gateshead Locomotive. This was successfully operated and encouraged the use of steam engines. It consisted of a horizontal boiler with single horizontal cylinder extending forward, from crossheads of which connecting rods engage with a geared crank shaft across the back of the boiler, on which was a large flywheel, the gear engaging with an idler gear, which in turn meshed into two gear wheels attached to driving wheel centers, treads of the driving wheels being flanged, engaging on the inside of a strap rail supported by wooden stringers. Engine had a return tubular boiler with the fire door and stack on the rear.

1812—Blenkinsopp. English engine. Rack rail locomotive, gearing into rack outside of running rail. Two pairs of driving wheels; horizontal boiler and two vertical cylinders. Weight about 5 tons. Built by John Blenkinsopp. Operated between Leeds and the Middleton Colliery, a distance of 3½ miles.

1812—Hedley's Manual Power. English engine. Constructed by William Hedley of Wylam Colliery. With this engine he proved adhesion between smooth periphery of wheels and rails could be employed on locomotive driving wheels in hauling coal trains. The results obtained by this invention proved of great value in the development of the locomotive, dispensing with rack rail drive.

1813—Brunton Steam Horse. Patented by William Brunton, an Englishman. The horse leg locomotive. The rear knuckle rods with their iron shod feet operated by horizontal cylinders like horses' legs. Legs pushed the engine forward. Rate of speed was too slow and lack of adhesion defeated the machine for practical use.

1813—Puffing Billy. The original *Puffing Billy* ran under its own steam at the English Railroad Centennial in 1925 and is the leading locomotive in point of interest at the South Kensington Museum, London. It was constructed at Wylam Colliery by William Hedley, assisted by the enginewrights, one of whom was Timothy Hackworth. The engine had a horizontal tubular boiler with two vertical cylinders located alongside at the rear, connected by beams through the gearing to two pairs of driving wheels.

1814—Stephenson's Blucher. One of George Stephenson's early productions employing transmission of power by gear wheels engaging

gears on driving axles, with smooth tread flangeless wheels on angle rails. Constructed for and used on the Killingworth Colliery. Horizontal boiler 34 inches in diameter, 8 feet long with single 24-inch diameter flue; two 8-inch vertical cylinders, 24-inch stroke, fitted into the center of the boiler shell.

1827-1832—Seguin with Tender and Fans. France. After Lieutenant Nicholas Joseph Cugnot had operated his locomotive on the streets of Paris with serious results in 1769, his machine was taken from him and he was locked up. Later he was released but his treatment discouraged other inventors. In 1827, Seguin invented and patented his multitubular boiler used in his engine, built as chief engineer of the St. Etienne Railway, employing forced draught from the fan on the tender. Vertical cylinders alongside of boiler, driving the two pairs of drivers by means of beams and connecting rods.

1828—Stourbridge Lion. Built by Foster Restrick & Company of Stourbridge, England. The first English locomotive to run on rails in America, on a mine tramway at Honesdale, Pennsylvania, which later became a part of the Delaware and Hudson Railroad. Horatio Allen, the first American engineer, ran this locomotive. Horizontal boiler, vertical cylinders, beams connecting two pairs of drivers. Proved too heavy for the track and was withdrawn from service and never used.

1829—Rocket. Constructed by R. Stephenson & Company, England. Winner of the Ranhill Trials of the Liverpool and Manchester Railway, England. Engine had four wheels—two drivers at front 56½ inches in diameter and two trailing wheels, 34 inches in diameter; inclined cylinders 8 x 17 inches, located at the side at the rear end of the horizontal multitubular boiler. A world famous locomotive. Weight, a little more than 5 tons.

1829—Sans Pareil. Built by Timothy Hackworth of England. Stephenson's competitor in the Ranhill Trial. Unequal to the *Rocket*, however. After the trial it was purchased by the Liverpool and Manchester Railway. Hackworth employed and proved the blast pipe or blower essential in generating steam in a locomotive.

1829—Ericsson's Novelty. English locomotive. Built in the short space of seven weeks by J. Braithwaite and J. Ericsson. A close competitor of Stephenson's *Rocket*, the winner of the Ranhill

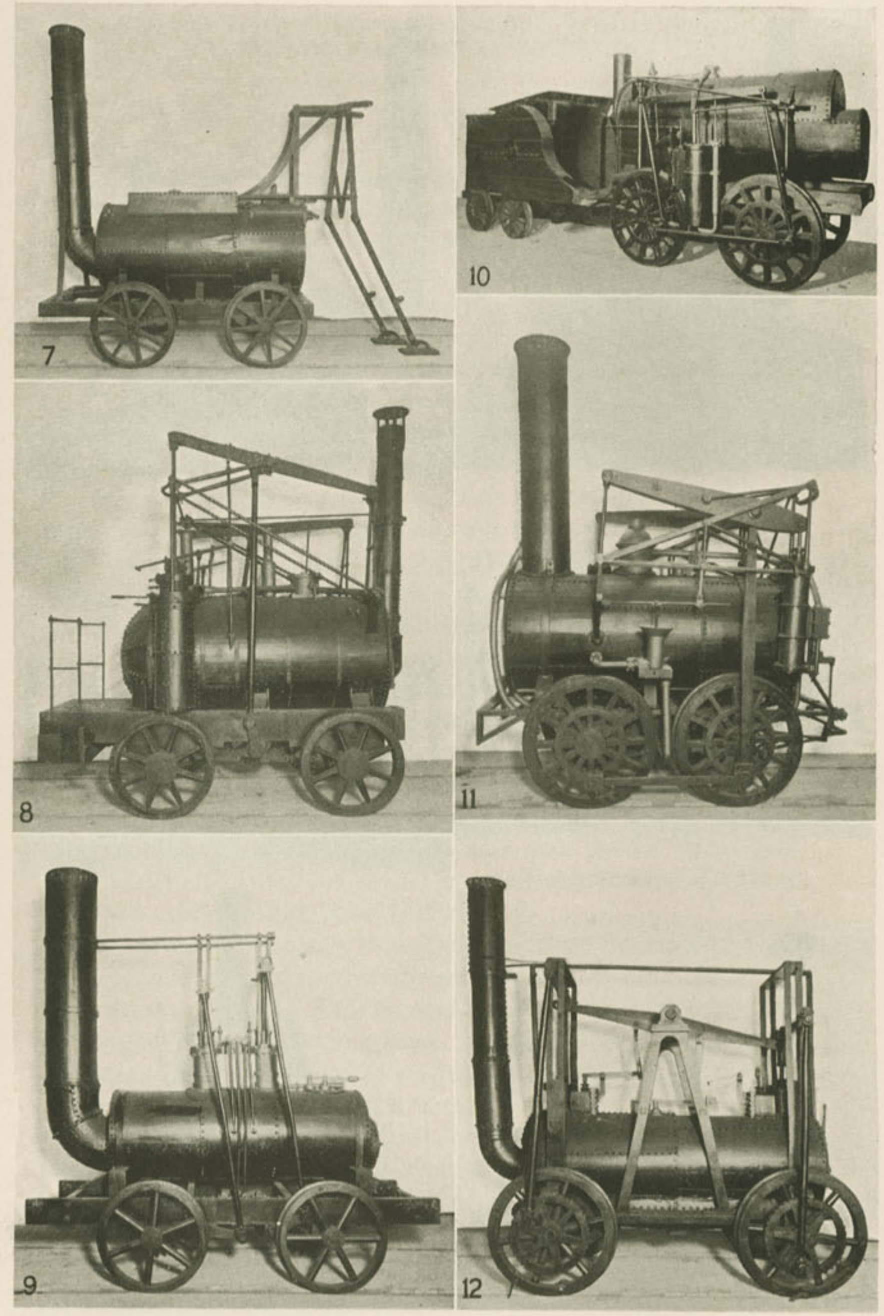
Trial, being awarded second prize. Engine consisted of a boiler with horizontal barrel connecting to upright cylindrical firebox, coal being charged into the top of firebox through removable cover on grate above closed ashpan, supplied with air for combustion by bellows worked by the engine. The two vertical cylinders were placed above the barrel and at the opposite end from the firebox, crossheads working on vertical guides at the outer end; had connecting rods connected to crank axles of driving wheels. The United States *Monitor* of Civil War fame was designed by Ericsson.

1829—Howard. Designed and patented but not built, by William Howard, a civil engineer in the service of the Baltimore and Ohio Railroad, Baltimore, Md. This locomotive had horizontal boiler with vertical cylinders extending into the boiler at the forward and back ends, operating on walking beams, which in turn connected to cross heads, on outer end of which connecting rods extended to crank pins on outside of ratchet wheel located against outside of driving wheel, and in which pawls engaged for transmitting the power to driving wheels.

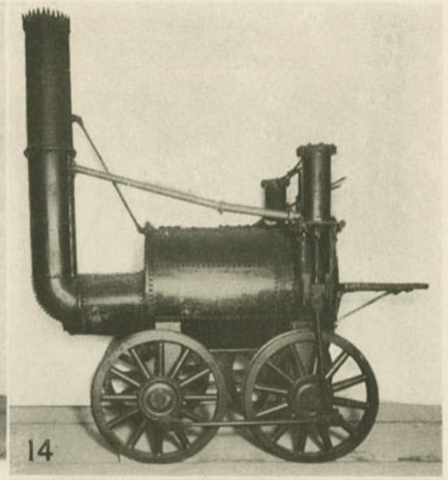
1830—Mercury. 2-2-0 type English locomotive. One pair of drivers with a single pair front carrying wheels in main frame pedestal supported on springs; inside horizontal cylinders and crank axle; valve gear operated by eccentric on main axle. A notable early locomotive built by George Stephenson, it embodies the best features of the Planet type of locomotive which at that time was a popular construction.

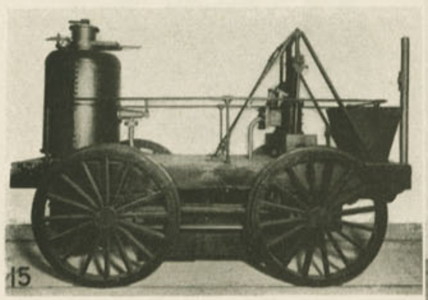
1829–30—Tom Thumb. First American built locomotive. Built by Peter Cooper of New York to prove steam operation. Ran successfully on the rails of the Baltimore and Ohio 1829–1830. Thereupon, in January, 1831, the directors offered \$4000 as a prize for an engine weighing $3\frac{1}{2}$ tons to haul 15 tons on the level at 15 miles per hour.

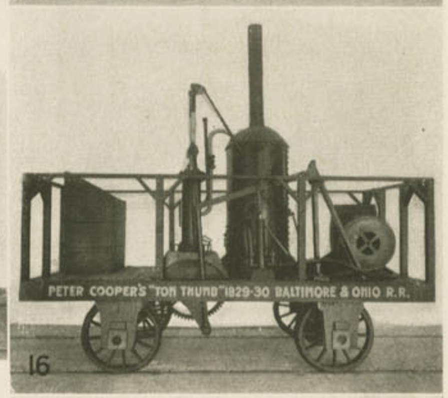
1831—York. The first locomotive built by Phineas Davis, of York, Pa., winner of the \$4000 prize in the Baltimore and Ohio competition at Mount Clare in 1831. Vertical boiler, no tubes, with center flue extending down from the crown to cylindrical drum firebox, carried on a frame supported on two pairs of drivers with outside cranks connected by trussed side bars with connecting rods to vertical cylinders, bolted to the top of sides of the boiler. Engine

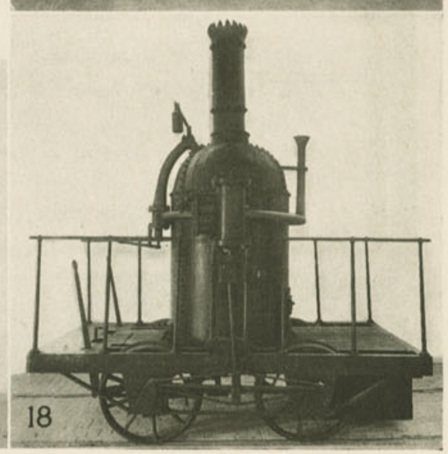


7. Brunton's Steam Horse
8. Puffing Billy
9. Blucher
10. Seguin
11. Stourbridge Lion
12. Howard









13. Rocket
14. Sans Pareil
15. Novelty
16. Tom Thumb
17. Mercury
18. York

weighed $3\frac{1}{2}$ tons and, after experimenting, the *Remodelled York* was designed.

1831—Remodelled York. Representing the *York* as changed by Phineas Davis at Reeder's Shops at Baltimore, Md., in 1831, after the trial trip of the *York*. The cylinders were relocated on the back of the boiler and driving through spur gears on one pair of drivers. This engine proved too light for the grades. Weight $3\frac{1}{2}$ tons.

1831—Johnson. Awarded $1000 prize in Mount Clare competition. Four flanged wheels, horizontal twin rectangular firebox, double flue boiler, twin vertical cylinders at rear of firebox, walking beam, single driver locomotive. Stone stringers and strap rails.

1831—James I. Built in New York. One of five locomotives in the Mount Clare competition. Ran successfully but did not meet conditions. Engine equipped with two vertical cylinders and with link motion valve gear and vertical conical boiler.

1831—Childs. The first turbine. Built by Ezra Childs of Philadelphia. Competed in the Baltimore and Ohio prize contest at Mount Clare. It ran but did not win the prize.

1831—Costell. Competed in the Baltimore and Ohio Mount Clare trial. First locomotive built in Philadelphia. Oscillating cylinders, four wheels, flanged drivers, horizontal boiler. Failed to meet the requirements of the test.

1831—James II. A modification of the *James I* with enlarged boiler, employing inclined cylinders with link motion valve gear. After minor changes it was bought by the Baltimore and Ohio Railroad and used until the latter part of 1836.

1831—Phoenix. Rebuilt from the *Best Friend* by moving boiler from outside of rear drivers to between the drivers. Built and operated on the South Carolina and Hamburg Railroad, now part of the Southern Railway system. Horatio Allen, who was the engineer of the *Stourbridge Lion*, became the engineer of the *Best Friend*.

1832—Jervis Experiment. Built by John B. Jervis of New York. A very successful locomotive. First bogie or front truck, attached to frame by pin and bracket, working on friction rollers. Jervis was later associated with William Norris, the pioneer locomotive builder of Philadelphia.

1832—Old Ironsides. First Baldwin Locomotive Works locomotive. Four wheeled engine modelled essentially on the English practice of the day, i.e. the Planet class. Weight in running order something over 5 tons. Rear driving wheels 54 inches in diameter with crank axle placed in front of firebox. The front wheels are simply carrying wheels and are 45 inches in diameter, on an axle back of the cylinder. Cylinders 9½ inches in diameter, 13-inch stroke, attached horizontally on outside of D-shaped smokebox. Wheels made of heavy cast iron hubs with wooden spokes and rims and wrought iron tires. Wooden frames placed outside of wheels. Boiler 30 inches in diameter, containing 72 1½-inch diameter copper tubes 7 feet long. Tender—four wheel platform with wood sides and back carrying iron box for water inclosed in a wood casing. Valve given motion by a single loose eccentric for each cylinder, placed on driving axle between crank and hub of wheel. Engine reversed by changing position of eccentric on axle by lever operated from footboard.

1833—South Carolina Double Ender. South Carolina Railroad. 2-4-2 type. Firebox in middle of boiler and fired from the side with two barrels extending forward and backward from firebox to smokebox at each end, each surmounted by a stack; single cylinder in each smokebox, located on the center line of the engine attached to crank axles on a single pair of drivers, located ahead and at rear of firebox, each engine consisting of one pair of driving wheels and one pair of carrying wheels, carried on articulated frame, hinged to firebox with roller support in the middle of the frame for carrying the boiler. First articulated locomotive, engineer driving engine from a seat on top of the firebox.

1837—Sandusky. Built by Rogers, Ketchum and Grosvenor, Patterson, N. J. First locomotive built by them. Single pair of drivers and four wheel swivelling truck; inside inclined cylinders; horizontal boiler; square firebox. Built for Mad River and Lake Erie Railroad, later the Sandusky, Newark and Mansfield, now part of the Baltimore and Ohio Railroad.

1837—Hercules. 4-4-0 American type. Built by Eastwick and Harrison of Philadelphia for the Beaver Meadow Railroad, now part of the Lehigh Valley Railroad. One of the famous locomotives of that time. First in the world with equalizing frame and vibrating beam, or equalizer. Inclined cylinders; main rod connecting to rear drivers; valve motion operated by eccentric on rear axle and independent cutoff valve. Weight, 15 tons.

1837—Campbell. 4-4-0 type. Eight wheels. Four drivers and four trucks; inside cylinders; horizontal boiler; roundtop firebox; constructed under patents of wheel arrangement by Henry R. Campbell of Philadelphia, February 5, 1836 and built by Henry Campbell, chief engineer of the Philadelphia, Germantown & Norristown Railroad and Robert Brooks, of Philadelphia. Original of American type of locomotives. First two pair driver engine built.

1848—Winans Camelback. Eight wheel connected. Built by Ross Winans of Baltimore for the Baltimore and Ohio Railroad. Horizontal cylinders; drivers 43 inches in diameter; horizontal boiler with inclined top overhanging firebox; large cylindrical dome on forward part and cab built on top of the boiler. These engines were built in three sizes—small, with 17- x 22-inch cylinders and short firebox; medium, 19- x 22-inch cylinders and medium firebox; long, 19- x 22-inch cylinders and long firebox. Plate frames, solid bushed side rods, equipped with hook motion valve gear. Later converted into Stephenson link motion by A. J. Cromwell, superintendent of motive power, beginning about 1870. These were the principal freight locomotives up to the introduction of the Consolidation type in 1873, and were in operation as switching engines until 1898.

Locomotive and Car Appliance Development

THE BRAKE

Exhibit Prepared in Coöperation with The Westinghouse Air Brake Company

The air brake exhibit includes two racks, the smaller displaying the original air brake equipment of 1869 and the larger the complete air brake equipment as now applied to modern Baltimore and Ohio locomotives and passenger cars. Separate air brake devices are also exhibited with the metal cut away to permit examination of the operating parts.

1869—Original Westinghouse Straight Air Brake. Exhibit showing the original brake equipment as applied to a passenger train, consisting of locomotive, tender and one passenger car. On the locomotive is a small steam operated air compressor which provides a store of compressed air in a storage reservoir. Throughout the length of the train is a continuous pipe leading to a brake cylinder on each car. Two of these are displayed, the first being the tender cylinder; the second, a car cylinder.

The piston rods of the cylinders are connected to the brake rigging so that when compressed air is admitted to the train from the storage reservoir, the pistons of the cylinders are forced out, carrying the shoes against the wheels. A three-way cock, located in the cab, is the engineman's means of controlling the brake. In one position of this cock air is passed to the train pipe and thence to the cylinders; in the second, when he desires to release the brakes, the pressure from the cylinders is drained to atmosphere.

The manner of making connections of the train pipe between the vehicles, and the sturdy construction are important features of this early air brake. They surmounted the difficulties previously responsible for the failure of other brake systems. The well built devices successfully withstood the shocks incident to railroad travel, and the flexible hose connections avoided breakage of the brake line from the normal stretching of a train.

Modern Westinghouse Automatic Air Brake. A complete brake equipment less levers is shown as applied to the modern passenger train of locomotive, tender and one passenger car. The locomotive equipment is located at the left of the exhibit, the passenger car at the right, with the tender between. The units are separated by hose couplings.

In the two large *reservoirs* at the left is stored the air supply. They are located forward of the locomotive firebox, beneath the running board.

The *air compressor* is on the side of the locomotive and compresses the air for storage in the main reservoirs. It does not operate continuously, but is controlled by a *governor* in the steam line. This governor starts and stops the compressor, thereby maintaining a desired pressure in the main reservoirs at all times.

There are two *brake valves* in the cab with which the engineman applies and releases the brakes. The smaller brake valve controls the locomotive brakes only. The larger brake valve is the controlling device for all brakes, locomotive included.

A *distributing valve* is the medium by which the actual brake action is obtained. By proper manipulation of either brake valve the distributing valve applies or releases the brakes.

Brake cylinders transmit the power of the compressed air into mechanical braking effort. There are two, for braking the locomotive driving wheels. There is also a cylinder to brake the truck. With the introduction of pressure to these cylinders, their pistons are forced outward and, as the piston rods are connected to the brake rigging, the shoes are carried against the wheels. On the tender unit there is one cylinder to brake the tender truck. It, too, is operated from the distributing valve on the locomotive.

The *vent valve,* located on the tender, functions only in emergency brake applications. The speed with which brake application is obtained depends on the time necessary to remove pressure from the train pipe. The vent valve serves to immediately blow this pressure to atmosphere when an emergency application occurs.

Two lines of pipe are continuous through the train, connected between units by hose couplings. The top pipe is the signal pipe and the other continuous line is the brake pipe. Brake control is effected through the latter.

The U-12-B Universal Valve is the most important detail of the car equipment. Its primary functions are three-fold; (a) it charges the group of reservoirs on its right, drawing pressure from the train pipe and storing it in the reservoirs where it is available for brake applications on that particular vehicle; (b) It passes pressure from the reservoirs to the brake cylinder to supply the brakes; (c) It removes the pressure from the cylinder to atmosphere, thus releasing the brakes.

In the performance of these three functions the universal valve must be positive. Regardless of the speed attainable by a locomotive, it could not be safely utilized were it not absolutely certain that a train could be brought to a stop at the will of the engineer. This, in part, accounts for the complicated structure of the universal valve with its various valve mechanisms. And then provisions are included so that the brakes may be gradually applied or released, giving smooth, even braking and eliminating shocks. Brakes must be applied almost simultaneously on all cars to avoid quick run-in between cars; there must be assurance of quick and positive release, else train schedules cannot be met; in emergency there must be a high pressure to bring the train to the shortest possible stop; undesired leakage of pressure into the brake cylinders must be thwarted, or the brakes might creep on, causing the sliding of wheels and resultant delay in schedules and damage to equipment.

The *slack adjuster* also assists materially in maintaining uniformity of the brake system. It is attached to the piston of the brake cylinder. Brake shoes wear and thus drop farther away from the wheels, increasing the distance which the cylinder piston must travel to force the shoes against the wheels. The slack adjuster avoids this condition by automatically tightening up and compensating for this shoe wear, thereby maintaining a uniform travel which makes for uniform brake action.

The *signal system* is the line of pipe at the top of the exhibit. It runs the entire length of the train, each car having a car discharge valve and signal cord, and the cab a signal valve which operates a signal whistle. By pulling the cord the conductor may signal the engineer.

Sectioned Devices

8½-inch C. C. Air Compressor. One or more compressors of this type are installed on the engine for the purpose of supplying compressed air to operate the brakes throughout the train, as well as air operated accessories including bell ringers, sanders, etc.; also train signal and water supply system.

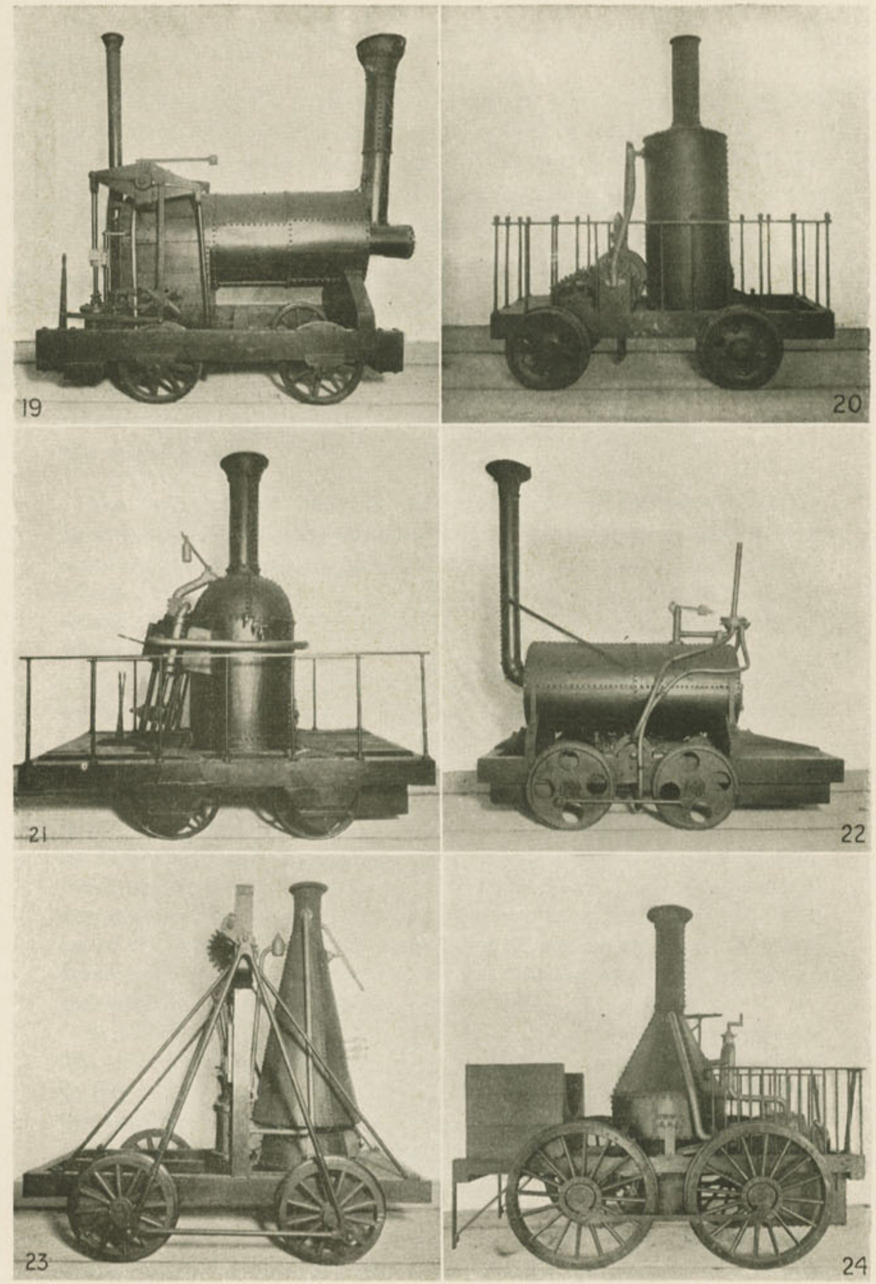
Type "SD" Compressor Governor. The purpose of this device is to automatically control the operation of the air compressor in order to maintain the required air pressures for operation of the brakes.

M-3-A Feed Valve. This pressure regulating device maintains a constant air pressure throughout the entire brake system.

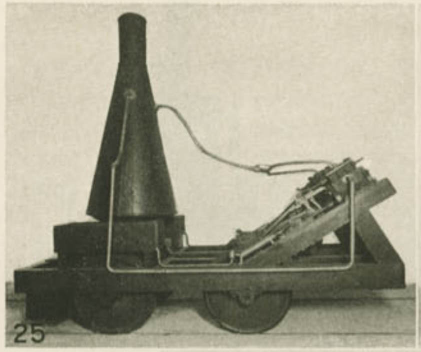
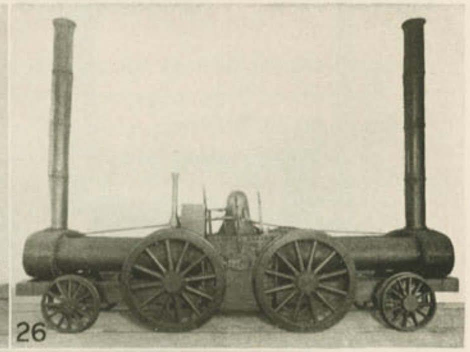
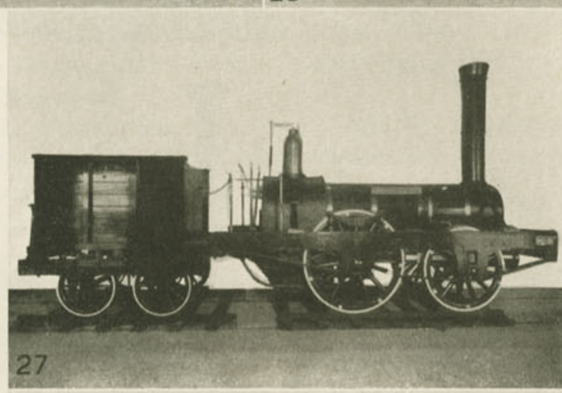
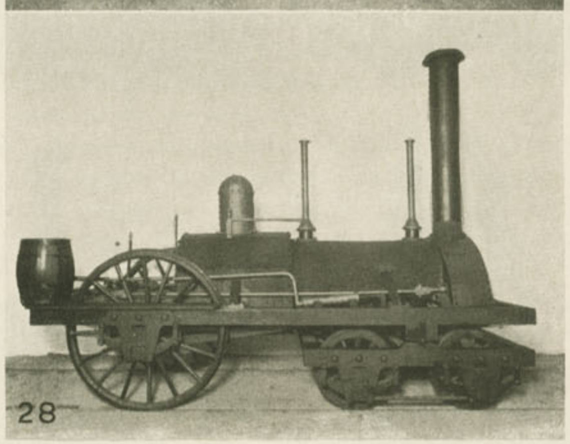
No. 6-E Distributing Valve. This device, actuated by air pressure, permits the flow of air to and from the brake cylinders on the engine and tender in whatever amounts may be required to secure proper control.

H-6 Automatic Brake Valve. This device is installed in the engine cab and, by proper manipulation of the handle, gives the engineman control of the brakes on the locomotive and throughout the train.

S-6 Straight Air Brake Valve. This device is installed in the engine



19. Johnson
20. Childs
21. Remodelled York
22. Costell
23. James I
24. Phoenix

25. James II
26. South Carolina Double Ender
27. Old Ironsides
28. Jervis Experiment

cab and permits the engineman to apply or release the brakes on the locomotive without affecting the brakes on the train.

No. 4 Brake Pipe Vent Valve. This device, installed under the tender, insures a quick rate of brake application throughout the train, as may be called for in an emergency.

U-12-B Universal Valve. This device, installed under each passenger car, controls the admission of air to the brake cylinders according to the manipulation of the brake valve by the engineman.

Type "K" Triple Valve. This device, which is standard for use on all freight cars, is installed under the car and operates to apply or release the brake in response to manipulation of the brake valve by the engineman.

The first years of American railroading saw the development of the locomotive. Engineering activities were centered on the attainment of speed and traction with no consideration of an adequate means of controlling a train. For the "Tom Thumb" and the locomotives of that early period, wooden blocks, forced against the wheels by means of a horizontal lever, afforded sufficient retarding force. The next brake development was a hand wheel, displacing the hand lever, the blocks also being lined with leather which had better friction properties. Later the wooden blocks were replaced by iron shoes.

But train speeds and weights were increasing and hand brakes fast falling into disrepute. Each vehicle in a train was manned by a brakeman, whose duty was to wind the brake wheel when the enginemen whistled for brakes. In an emergency too much time elapsed before the brakemen could get to the platform to perform their duty. Lack of power and uncertainty of hand brakes were the cause of many railroad disasters which led to the demand for a continuous brake—a system whereby a powerful brake could be controlled from a central point and uniformly applied on each vehicle.

By 1855 there were several different types of continuous brakes in general use. One consisted of spiral springs on each car, the power of these coiled springs being utilized to wind up the brake chains and apply the shoes to the wheel, when the engineman pulled a cord. Another was a chain brake system wherein a drum, rotated by a driving wheel of the locomotive, wound the brake chains and forced the shoes against the wheels. These systems also suffered disfavor in that the controlling mechanism was unable to withstand the shock of operation and failed just at the inopportune time. Power brakes also received their initial trial during this period in various forms of steam brakes. These brakes were fairly successful, but were suitable for the locomotive only, so the demand for a reliable continuous brake remained unsatisfied until 1869, when George Westinghouse introduced the "Atmospheric Air Brake." This brake was popularly known as the "Straight Air" Brake and soon attained widespread application.

THE STOKER

Exhibit Prepared in Coöperation with The Locomotive Stoker Company

The stoker exhibit is prepared to show the development of this important appliance of railroad operation. Two full size stokers, the first practical mechanism, and the present day type, are displayed, together with one-third size models of the Duplex Stoker of 1927 and the Coal Pusher, and auxiliary device used on hand-fired locomotives.

Street Locomotive Stoker. 1911–1915. The mechanism consists of a screw conveyor in back of the locomotive tender which conveys the coal forward to a hopper in the back of the locomotive. A bucket chain elevates the coal from this hopper to a point on the upper part of the backhead on the locomotive, from which it is delivered by gravity to three firing points through the backhead. The very fine coal was screened out of the stream of coal delivered by the bucket conveyor and fired through the opening in the center of the backhead above the fire door. Fixed distributors on the inside of the fire box direct the coal over the grate area so that the entire surface was covered without assistance from the fireman other than to regulate the supply and adjust the amounts delivered to either side or center of the fire box as the condition of the fire might require.

This stoker was designed particularly for firing large locomotives with slack coal ordinarily not used for locomotive fuel on hand-fired locomotives, but with the use of the Street Stoker it was possible to fire large locomotives to their capacity, using slack coal very satisfactorily, which could not readily be used for hand firing. It was impossible to use lump coal with these stokers, however, and they were later superseded by the Duplex Stoker.

Duplex Stoker. The mechanism consists of a helicoid screw conveyor in a trough placed underneath the floor of the locomotive tender, the opening into this conveyor in the tender floor being covered with slide plates which are opened successively as the coal is used out of the coal pit. The coal is conveyed forward and passes through a crusher mechanism which reduces the coal in size for suitable elevation to the openings in the backhead of the locomotive by the stoker elevators. The conveyor screw delivers the coal after crushing into a hopper underneath the floor of the locomotive cab, from which it is elevated by helicoid screw conveyors on the right and left side of the backhead of the locomotive to the firing openings, through which it is projected by steam jets over the grate area. Inside of the fire are fixed distributors or fuel directors which spread the coal over the entire grate area. The mechanism is so arranged that coal supplied to the elevators may be regulated by the fireman and the elevators and also the conveyor may be operated separately from each other.

This machine was designed to fire locomotives using the same sizes and kinds of coal ordinarily supplied to locomotives for hand firing. It represents a very modern form of mechanical firing and has been applied to some 7500 locomotives in the United States.

Duplex Stoker on Locomotive Boiler. A one-third size model of the Duplex Stoker applied to the locomotive boiler and locomotive tender, showing a general arrangement of locomotive boiler, fire box, tender and coal pit. The controls are all shown and illustrate the way in which the fireman is able to control delivery of the coal to the locomotive fire box. The parts of this model are complete in every detail and it is an exact reproduction of the full-sized machine. It is demonstrated in operation.

Coal Pusher. A one-third size model of the mechanical device for bringing the coal forward on hand-fired locomotives. The mechanism is placed below the coal on the back sloping sheet of the coal pit in the locomotive tender and after the fireman has shoveled away the coal within easy reach, the coal pusher is then operated to bring the coal forward for his convenience. It is a simple but powerful device and is applied to locomotives which are fired manually, but which are not of sufficient size to require mechanical stokers.

Supplementary Items

Painting showing a locomotive being fired by hand.

Original certificate of the Panama-Pacific Gold Medal Award for the Duplex Stoker.

Original certificate of the Sesqui-Centennial Gold Medal Award for the Duplex Stoker.

Drawing showing sectional view of a locomotive with the Duplex Stoker applied.

OTHER LOCOMOTIVE AND CAR APPLIANCES

The vast range of devices, large and small, simple and complicated, is shown in the space devoted to the locomotive and car devices upon the Baltimore and Ohio Railroad. To perfect this showing recourse was had to the remarkable collection of early patent models owned by the Smithsonian Institution and the Eastern Railroad Association, both of Washington, D. C.

Miniature models of early locomotives and cars as well as of their component parts are shown in great profusion. Some of the items are extremely picturesque as, for instance, the gaily colored headlights used upon early American locomotives. In contrast to these is shown by a miniature model an even earlier method of announcing the oncoming train in the darkness of the night. On a flat car which was pushed ahead of the locomotive was carried a rousing bonfire whose glare was sent ahead along the track by means of a crude tin reflector.

This interesting early device is shown on a half-size model of an early flat car, being pushed by a half-size model of the locomotive *Arabian*, which came into use upon the Baltimore and Ohio in 1834. The small model of the *Arabian* was built for and shown at the New Orleans Exposition of 1886.

The other portions of the exhibit are perhaps less picturesque, but they show the development of still other devices applied to the rolling stock of the railroad such as couplers, trucks, platforms and similar items.

Locomotive Patent Models

2660. Original model of Ross Winans steam engine, known as crab engines patented in 1837. No. 305.

2661. Patent Office model of S. Wright four wheel lead truck, single drive locomotive, patented in 1837. No. 540.

2662. Dotterer and Jackson incline railway locomotive, patented in 1839. No. 1108.

2663. Gustavus A. Nicolls locomotive, patented in 1848. No. 5787.

2664. Winans and Winans locomotive fire box—double top fire box stoker chutes, patented 1854. No. 10901.

2665. Ross Winans boiler for locomotive engines, patented in 1858 No. 20117.

2666. Ross Winans 8 wheel connected locomotive with bury boiler, patented in 1846. No. 4812.

2667. G. E. Sellers boilers and gearing of locomotive for working heavy grades, patented in 1850. No. 7498.

2668. Locomotive with double four wheel truck, truck supporting twin vertical cylinders.

2669. R. H. Long double swivelling engine. Forward portion pivoted under boiler, rear pivoted under tender, patented in 1868. Number unknown.

2670. Milholland water tube grate fire box, patented in 1864, No. 41316.

2671. J. E. Wootten locomotive with wooden fire box, patented in 1877. No. 192725.

2672. J. N. Page watering column, patented in 1880. No. 223607.

2673. J. P. Woodbury condensing double end engine, patented in 1871. No. 112001.

2674. W. P. Henszey, equalizing spring rigging for trailer trucks, patented in 1880. No. 227778.

2675. J. C. Peterson steam boiler and valve gear for locomotives patented in 1858. No. 22198.

2676. J. Dykeman variable exhaust nozzle for engine, patented in 1860. No. 28976.

Headlights

2600. In early railroading, trains were not run at night; when darkness came they stopped running. It was not long before they were inconvenienced by being overtaken by darkness, and the need of artificial light was made manifest. The earliest known system used in the United States was a light made by pine knots placed on sand on top of flat car with an iron plate standing vertically at the rear to keep light from engineer's vision. This plan is represented by a half size model of a grasshopper engine pushing a flat car with a fire of pine knots. It was not long until patents began to be taken out for locomotive headlights and a number of the patent models are shown.

2601. Model of a locomotive headlight by Snook and Hill, patented in 1852. No. 9490.

2602. Model of a locomotive headlight by J. Radley, patented in 1866. No. 59650.

2603. Model of a locomotive headlight by E. L. Hall, patented in 1867. No. 67192.

2604. Model of a locomotive headlight by Maxon and Radley, patented in 1869. No. 95498.

2605. Model of a locomotive headlight by T. S. Ray and C. T. Ham, patented in 1875. No. 165426.

2606. Model of a locomotive headlight by Mills F. Bell and James Carey patented in 1876. No. 171834.

2607. Model of a locomotive headlight by C. T. Ham, patented in 1877. No. 197932.

2608. Model of a locomotive headlight by Wm. Forsyth, with side illuminated numbers, patented in 1877. No. 210313.

2609. Model of a locomotive headlight by Dressell Heinrich and J. G. Voth, with side illuminated numbers and headlight curtain, patented in 1878. No. 202711.

2610. Model of a signal for a headmotive attached to a headlight goggle by William Kelley, patented in 1878. No. 209405.

2611. Model of a signal light with cylindrical lamp tube obscured by sliding cylinder for Morse signaling, by Charles D. Oatman, patented in 1879. No. 222303.

Injectors

2629. Cabinet of locomotive injectors with models. Giffert 1860 to Sellers 1927, and a working model showing injector lifting water.

2630. Model of Henry Giffert feed water apparatus for steam boilers. Patented in 1860, No. 27979.

2631. Model of a James Milholland injector, patented in 1862, No. 35575.

2632. Model of a William Sellers injector, patented in 1863, No. 38313.

2633. Model of a J. Gresham injector for boilers, patented in 1868 No. 74346.

2634. Model of a William Sellers injector, patented in 1868, No. 75059.

2635. Model of a H. B. Murdock injector, patented in 1883, No. 281389.

2636. Model of a J. S. Bancroft injector, patented in 1885, No. 331178.

2637. Model of a James Jenks injector, patented in 1885, No. 314533.

2638. Model of a W. B. Macks injector, patented in 1886, No. 334124.

2639. Model of a John Desmond steam injector, patented in 1889, No. 404262.

2640. Model of a J. N. Derby steam injector, patented in 1892, No. 484306.

2641. Model of a J. N. Derby steam injector, patented in 1892, No. 484303.

Car Couplers

2650. Original bull nose link and pin coupler.

2651. Model of a lock and link coupler by A. E. Bradburg and V. B. Barstow, patented 1878.

2652. Model of a Geo. W. Prescott buffer for locomotive tenders, applicable to link and pin couplers, patented in 1878, No. 210467.

2653. A. Hiram L. Preston column release, link and hook bull nose coupler, patented in 1879, No. 216889.

2654. A F. G. Arter and J. G. Blocher coupler, patented in 1880, No. 226955.

2655. Major M. C. B. automatic top and bottom release automatic coupler.

2656. Simplex M. C. B. automatic top lift link coupler.

2657. Short shank engine pocket coupler.

Car Wheels

2677. J. H. Congdon cast iron chilled car wheel. Patented in 1878, No. 210671.

2678. Double plate flanged reinforcement.

2679. S. G. Baker Car Wheel Mold. Patented in 1879, No. 214747.

2679A. Full Size, half section, standard A. R. A. chilled cast iron wheels.

2680. Wooden model of a Baltimore and Ohio 40,000 pounds capacity car, wooden frame and sheave, bull nose coupler, continuous draft gear.

Hand Lamps

2612. Baltimore and Ohio Kerosene 22″ oil headlight with centre draught lamp parabolic copper reflector, standard in use prior to electric headlight.

2613. Model of J. H. Rohrman's hand lantern with flat glass and protecting rib, patented in 1857. No. 18105.

2614. Model of hand lantern used by conductor on first train over the Ohio and Mississippi Railroad.

2615. Model of H. Fowler's flat frame, glass globe hand lantern, patented in 1863. No. 40401.

2616. Model of W. Westlake lantern with removable globe, patented in 1870. No. 102896.

2617. Model of Clarke and Sykes three color signal lamp used on English railroads, patented in 1873. No. 140015.

2618. Model of H. E. Pond signal lamp with adjustable chimney support, patented in 1877.

2619. Model of John Grillig, square case, flat glass, hinged front hand lamp, patented in 1879. No. 215449.

2620. Model of D. W. F. La Grange hand lamp with removable signal glass, patented in 1880. No. 231702.

2621. Baltimore and Ohio trainmen's square hand signal lamp, used in the early days of railroading on the Baltimore and Ohio and manufactured by the Company's shops.

Water Coolers

2590. Wooden bucket containing water and ice—wooden top cover with tin cup.

2591. Cast iron double cylinder water cooler, ice and water contained in one compartment. Water drawn by a faucet.

2592. Sanitary drinking cooler with separate compartment for ice and for water. Blatimore and Ohio Company's design. The water compartment protected with a double insulated wall surrounding the ice chamber. Water drawn by a faucet.

2593. Latest type of drinking water cooler for passenger equipment by Henry Giessel.

2594. Individual drinking cup machine.

SIGNAL DEVELOPMENT

Exhibit Prepared in Coöperation with The Union Switch and Signal Company and The General Railway Signal Company

An exhibit showing what has been accomplished on American railways in safeguarding and expediting the movement of trains through railway signaling.

Drawings and photographs, artistically colored, illustrate in chronological order the development of signaling from the crude signal of 1834 to the highly perfected signal systems of the present day. Signals of full size are also shown in operation representing the four types of present-day signals—the semaphore and the three "daylight" light signals: the color light, the position light and the color-position light signals. Highway crossing signals in full size are also shown—the flashing light type and the wig wag type.

Fixed Signals

Signals of fixed location indicating a condition affecting the movement of a train. Train order, block and interlocking signals are types of fixed signals. The purpose of fixed signals is to convey information to the engineman for the government of his train. The aspects displayed by the signals show when, where and how to go and when and where to stop.

(1) *Fixed Signals.* Historical sketch of the development of the fixed signal.

(2) *Crossbar and Lamp Signal of 1834.* Type of the first railway signal. Put in use in 1834 on Liverpool and Manchester Railway, England. At first used only at night.

(3) *Ball Signal of 1837.* Put in use in 1837 on Great Western Railway, England. This type of signal used for many years in the United States as a railway grade crossing signal. Now obsolete; superseded by interlocking.

(4) *Semaphore Signal of 1841.* Introduced on railways of England

by C. H. Gregory in 1841 and soon became the standard signal on English and American railways.

(5) *Tilting (Crossbar) Signal of 1857.* This type of signal introduced in 1857; was used for many years in the United States as a railway grade crossing signal. Obsolete; superseded by interlocking.

(6) *Gate Signal of 1860.* This type of signal used for many years in the United States as a railway grade crossing signal. This gate signal when placed across the track indicated stop. Obsolete; superseded by interlocking.

(7) *Banner Box Signal of 1863.* Type (enclosed disc) of the first manual block signal put in use in the United States in 1863 between Philadelphia and Trenton.

(8) *"Smashboard" Draw Bridge Signal of 1868.* This type of signal was successfully used for many years for the protection of drawbridges. The stop indication was displayed by lowering the large red board to a position over the track where it would strike the stack of the locomotive should the engine man overrun the signal.

(9) *Banjo Signal of 1871.* Type (enclosed disc operated by electricity) of the first automatic block signal introduced on railways of the United States by Thomas S. Hall in 1871.

(10) *Disc Signal of 1872.* Type (enclosed disc, operated by electricity) of automatic block signal installed at Irvineton, Pa., by Dr. William Robinson. The first automatic block signal to be controlled by the closed track circuit. This installation marked the beginning of automatic block signaling now in general use on the leading railways of the world.

(11) *Clockwork Signal of 1879.* Type (exposed disc, operated by weight-driven clockwork) of automatic block signal first installed on railways of the United States in 1879. This type now obsolete.

(12) *Semaphore Signal of 1881.* Type (electro-pneumatic operation) of first automatic semaphore block signal. Operated by air pressure controlled by electricity. Introduced on railways of the United States in 1881. Used also as an interlocking signal.

(13) *Semaphore Signal of 1893.* Type (electric operation) of first automatic semaphore block signal operated and controlled by electricity. Introduced on railways of the United States in 1893. Used also as an interlocking signal.

(14) *Semaphore Signal of 1908.* Type of semaphore signal of a

new design. A marked improvement over the previous types. Introduced on Baltimore and Ohio Railroad by F. P. Patenall in 1908. Adopted as standard by the American Railway Association for use on American railways both as a block and interlocking signal.

(15) *Color Light Signal of 1910.* Type (electric light) of light signal displaying colored lights for both day and night signal indications, using separate lens and light for each color. First used on electric railways in the United States in 1908, and now in use on many steam railways as an automatic block and interlocking signal.

(16) *Position Light Signal of 1915.* Type (electric light) of position light signal displaying rows of light yellow lights for both day and night signal indications. Introduced on the Pennsylvania Railroad by A. H. Rudd in 1915 and used both as an automatic block and interlocking signal.

(17) *Color Position Light Signal of 1921.* Type (electric light) of color position light signal displaying rows of colored lights for both day and night indications. Introduced on the Baltimore and Ohio Railroad by F. P. Patenall in 1921. Used both as an automatic block and interlocking signal.

Train Dispatching

The art of directing and supervising the movement of trains. Transportation efficiency depends largely upon an efficient system of train dispatching. On American railroads, train dispatching has been brought to a high state of development.

(1) *Train dispatching.* A brief description of the history and present state of the art.

(2) *Train dispatching.* Crude system of visual signals for signaling the movement of the train used on New Castle and Frenchtown Railroad in 1832, twelve years prior to the introduction of the electric telegraph.

(3) *Train dispatching.* Monument erected on Erie Railroad at the station where the first train order was sent by electric telegraph in 1851. The beginning of train dispatching.

(4) *Train dispatching.* Baltimore and Ohio Train Dispatcher's Office at Camden Station, Baltimore. A modern office.

(5) *Train dispatching.* Baltimore and Ohio Train Order Station, displaying signals for train order.

(6) *Train dispatching.* Train Dispatcher's or Controller's Office on a railway in India, showing the dispatcher using a graphic train sheet.

(7) *Train dispatching.* A graphic train sheet as used in train dispatcher's office in India. Reproduction of an actual graphic train sheet.

Manual Block System

A series of consecutive block sections governed by block signals operated manually upon information by telegraph or telephone. The primary function of the manual block system is to reduce the collision hazard by providing a *space* interval between trains.

(8) *Manual block system.* Brief description.

(9) *Manual block system.* First installation in America in 1863.

(10) *Manual block system.* Baltimore and Ohio block signal station.

Automatic Block System

A series of consecutive block sections governed by block signals, automatically operated by a train or by conditions affecting the use of a block section. The primary function of an automatic block system is to reduce the collision hazard by providing a *space* interval between trains.

(1) *Automatic block system.* Brief description and a statement of its economic value.

(2) *Automatic block system.* Its fundamental feature, the closed track circuit.

(3) *Automatic block system on Atlantic Coast Line.* Semaphore type.

(4) *Automatic block system on New York Central Lines.* Semaphore type.

(5) *Automatic block system on Seaboard Air Line.* Color Light type.

(6) *Automatic block system on Great Northern Railway.* Color Light type.

(7) *Automatic block system on Pennsylvania Railroad.* Position Light type.

(8) *Automatic block system on Chicago and Northwestern Railway.* Color Light type.

(9) *Automatic block system on Baltimore and Ohio Railroad.* Color-position Light type.

(10) *Automatic block system on Baltimore and Ohio Railroad.* Color-position Light type.

Mechanical Interlocking

An arrangement of switch and signal appliances so interconnected (interlocked) that their movements must succeed each other in a predetermined order. The movement of the levers of an interlocking machine by means of man-power will operate the switches and signals through the medium of pipes or wires. The purpose of interlocking is to provide a *safe path* for the movement of trains through switches, junctions, railroad grade crossings, through terminal stations and over drawbridges.

(1) *Mechanical interlocking.* Descriptive text.

(2) *Mechanical interlocking.* First installation in England at Bricklayer's Arms Junction in 1843.

(3) *Mechanical interlocking.* First installation in America of an American machine at Spuyten Duyvil, New York, in 1874.

(4) *Mechanical interlocking.* First installation in America of a Saxby & Farmer machine with latch locking at East Newark Junction, New Jersey, in 1875. Three views as follows:

a. "Diagram of Signals."

b. "Saxby & Farmer Machine. Latch Locking Type." (This machine is still in existence.)

c. "Interior of the East Newark Junction Cabin." (From an old woodcut.)

(5) *Mechanical interlocking replaced by electric interlocking.* Installation at Spuyten Duyvil, New York, of a G. R. S. electric interlocking, operating the extensive layout of switches and signals at Spuyten Duyvil, New York, now an important junction on the electrified division of New York Central Railroad. This installation on the site of the mechanical interlocking installation of 1874.

(6) *Mechanical interlocking replaced by electro-pneumatic interlocking.* Installation at Manhattan Transfer, New Jersey, of a U. S. & S. electro-pneumatic interlocking, operating the extensive layout of switches and signals at Manhattan Transfer, Pennsylvania

Railroad. This installation on site of the mechanical interlocking installation of 1875 at East Newark Junction, New Jersey.

(7) *Mechanical interlocking replaced by electric interlocking.* Another view of the G. R. S. electric interlocking at Spuyten Duyvil, New York.

(8) *Mechanical interlocking replaced by electro-pneumatic interlocking.* Another view of the U. S. & S. electro-pneumatic interlocking at Manhattan Transfer, New Jersey.

(9) *Mechanical interlocking.* Installation on Baltimore and Ohio Railroad.

(10) *Mechanical interlocking.* Installation on Baltimore and Ohio Railroad.

Electro-Pneumatic Interlocking

An arrangement of switch and signal appliances so interconnected (interlocked) that their movements must succeed each other in a predetermined order. In this system man-power is replaced by compressed air power for moving the switches and signals, and electricity is used to control the compressed air valves. Power operation as a labor saving device has marked advantages over manual operation. The purpose of electro-pneumatic interlocking, as in mechanical interlocking, is to provide a *safe path* for the movement of the train.

(1) *Electro-pneumatic interlocking.* Machine, signals and tracks of an early layout. Isometric drawing dated 1895.

(2) *Electro-pneumatic interlocking.* One of the first electro-pneumatic machines.

(3) *Electro-pneumatic interlocking.* Pennsylvania Station, New York.

(4) *Electro-pneumatic interlocking.* Washington Union Station, Washington.

(5) *Electro-pneumatic interlocking.* Chicago Union Station Chicago.

(6) *Electro-pneumatic interlocking.* Chicago Union Station machine.

(7) *Electro-pneumatic interlocking.* Central Railroad of New Jersey. Newark Bay Draw.

(8) *Electro-pneumatic interlocking.* Original electro-pneumatic switch movement installed at Jersey City Station, 1891 and switch and lock movement "A1" type.

(9) *Electro-pneumatic interlocking.* Chesapeake and Ohio Railroad, West Ashland, Ky.

(10) *Electric interlocking.* Baltimore and Ohio Railroad, Laughlin Junction, Pa.

Electric Interlocking

An arrangement of switch and signal appliances so interconnected (interlocked) that their movements must succeed each other in a predetermined order. In this system man-power is replaced by electric power for moving the switches and signals and electricity is used to control their movement. Power operation as a labor saving device has many marked advantages over manual operation. The purpose of electric interlocking, as in mechanical interlocking, is to provide a *safe path* for the movement of the train.

(1) *Electric interlocking.* Descriptive text.

(2) *Electric interlocking.* First installation of electric interlocking of the Taylor type, made in 1889. Baltimore and Ohio Southwestern Railroad, East Norwood, O.

(3) *Electric interlocking.* Machine at La Salle Street Terminal, Chicago.

(4) *Electric interlocking.* La Salle Street Terminal, Chicago, 1903.

(5) *Electric interlocking.* Early and modern type of electrically operated switch.

(6) *Electric interlocking.* Early and modern type of electrically operated signal.

(7) *Electric interlocking.* Machine of 400 levers, installed in 1913 at Grand Central Terminal, New York.

(8) *Electric interlocking.* Grand Central Terminal, New York, Upper Level.

(9) *Electric interlocking.* Chicago Northwestern Terminal, Chicago.

(10) *Electric interlocking.* Baltimore and Ohio Railroad, Washington, D. C.

Electro-Mechanical Interlocking

An arrangement of switch and signal appliances so interconnected (interlocked) that their movements must succeed each other in a predetermined order. The machine of this system is a combined mechanical and electric interlocking machine. The mechanical interlocking part of the combined machine is used for moving the switches, and the electric interlocking part of the combined machine is used for moving the signals. The purpose of electro-mechanical interlocking, as in other types of interlocking, is to provide a *safe path* for the movement of the train.

(1) *Electro-mechanical interlocking.* Baltimore and Ohio Railroad, Halethorpe, Md.

(2) *Electro-mechanical interlocking.* Pennsylvania Railroad, New Brighton, Penna.

(3) *Electro-mechanical interlocking.* Baltimore and Ohio Railroad, Halethorpe, Md.

(4) *Electro-mechanical interlocking.* Long Island Railroad, Manhattan Beach Junction, N. Y.

Remote Power Switches

Isolated or outlying switches operated by power switch machines controlled from train order, block or interlocking stations. The distances from the switches to the stations controlling them vary from a few feet to many miles. Remote power switches economically provide for the operation of switches which otherwise would require operation by the trainmen of the trains using the switches, the trains stopping for this purpose. Remote power switches by keeping trains moving through eliminating the stopping of trains to throw switches, have not only decreased the hazard of train operation but have also shown their great economic advantages.

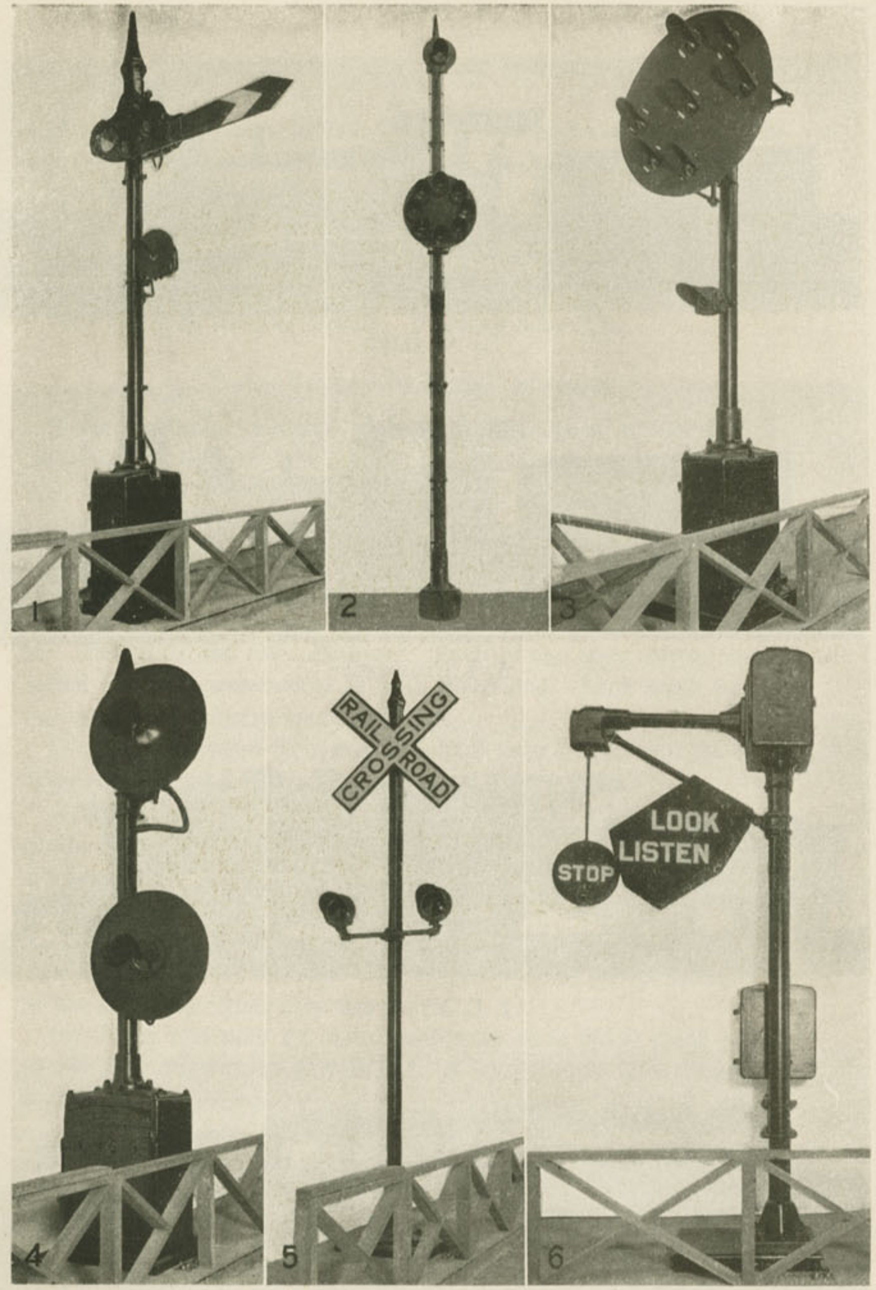
(5) *Remote power switches.* Description and statement of their economic value.

(7) *Remote power switches.* Telegraph office with table interlocking machine and views of four remote power switch installations.

(9) *Remote power switches.* Switch layout with dual-control selector for hand operation by trainmen.

Highway Crossing Signals

Audible or visual signals of the bell, disc, horizontal swinging red light or flashing red light type used at the grade crossing of highways

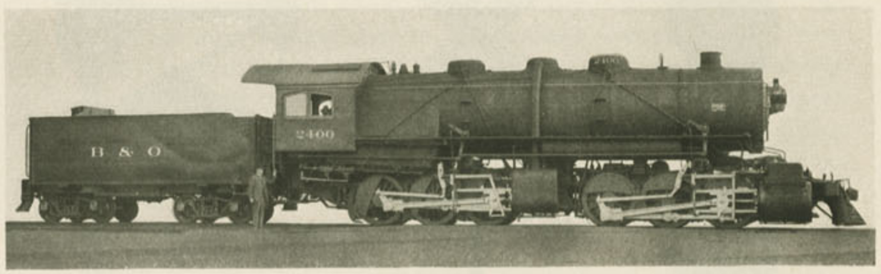


RAILROAD SIGNALS

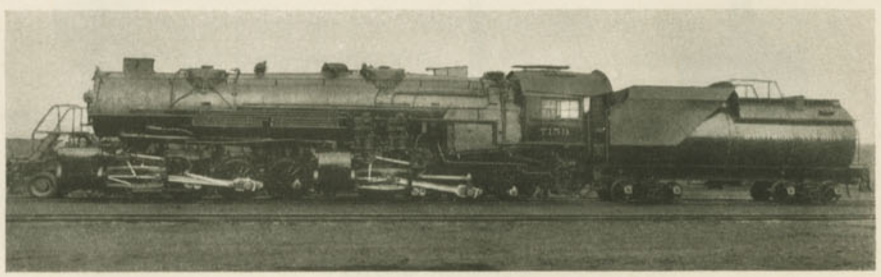
1. SEMAPHORE
2. COLOR POSITION LIGHT
3. POSITION LIGHT
4. COLOR LIGHT
5. HIGHWAY FLASHING LIGHT
6. HIGHWAY WIGWAG

J. C. Davis

A. J. Cromwell



J. E. Muhlfeld



No. 7151. Simple Mallet

with railroads to give advance warning to highway traffic of the approach of trains. The purpose of highway crossing signals is to protect the movement of highway traffic at railway grade crossings.

(6) *Highway crossing signals.* Descriptive text.

(8) *Highway crossing signals.* Horizontal swinging red light or wigwag type.

(10) *Highway crossing signals.* Flashing light type.

Train Operation by Signal Indication

Train operation by signal indication is a method of directing the movement of trains by the indication of the fixed signals without the use of written train orders. A system of operation that has two marked advantages: increased safety, decreased operating costs.

(1) *Train operation by signal indication.* Description of the method and its economic advantages.

(2) *Train operation by signal indication on a three-track section of the Chesapeake and Ohio Railroad.* Each of the three tracks is signalled for train movements in both directions. Each track can be operated at maximum track capacity.

(3) *Train operation by signal indication on a single track line of the Western Maryland Railway.*

(4) *Train operation by signal indication on a single track section of the New York Central Railroad.* Machine at Fostoria, Ohio, for the centralized control of traffic over a single track line, 40 miles in length. The switches and signals all operated from this machine.

(5) *Train operation by signal indication on a double track section of the Illinois Central Railroad.* The signals provide for operating both of the tracks in either direction.

(6) *Train operation by signal indication on a single track section of the New York Central Railroad.* A northbound train passing a southbound train under signal indications controlled from the machine at Fostoria.

(7) *Train operation by signal indication on the Chesapeake and Ohio Railroad.*

(8) *Train operation by signal indication on the New York Central Railroad.* Showing a section of the double track controlled from the machine at Fostoria.

(9)–(10) *Train operation by signal indication on the Baltimore and Ohio Railroad on a three-track section of the Cumberland Division.* This installation, made in 1916, has effected a substantial annual saving in operating charges. (Two illustrations.)

Automatic Train Control

A general term describing apparatus to aid in spacing or controlling trains. To secure the desired results, there must be apparatus on the track, properly coördinated with that on the train. Train control when effective at certain definite points along the roadside is called "intermittent." When it is exercised constantly it is termed "continuous." Usually the controlling points on the roadside are at the signals. Train control in its simplest form acts to cause an application of the brakes at such points as necessary to produce a stop if one is required. Train control may be extended to include "speed control" apparatus used to apply the brakes when a certain speed is exceeded, or to maintain the speed under a definite rate over a certain distance. Audible or visual signals in the cab, indicating the conditions on the track the same as is done by the roadside signals, may also be a part of the apparatus.

(1) *Automatic train control.* Descriptive text.

(2) *Automatic train control.* Graphic chart showing the number of locomotives and miles of track equipped with train control.

(3) *Automatic train control.* Four views:

a. The Vogt train stop in use in 1889.

b. Boston Elevated Railroad, Boston. Automatic electro-pneumatic block signal with train stop attachments.

c. Pennsylvania Railroad. Hill automatic train stop in use in 1910 between New York Terminal and Manhattan Transfer.

d. Norfolk and Western Railway. Locomotive equipped with electric speed governor for three-speed operation.

(4) *Automatic train control.* Four views:

a. Atchison, Topeka and Santa Fe Railway. Interior of locomotive cab showing cab indicator, speed recorder, etc., as used with three-speed continuous train control.

b. Pittsburgh and Lake Erie Railroad. Locomotive equipped with intermittent inductive train stop.

c. Union Pacific Railroad. Train 18 "Pacific Limited" locomotive equipped with two-speed continuous train control with pneumatic governor.

d. Pittsburgh and Lake Erie Railroad. Inductor, receiver and relay box of the intermittent train stop type.

(5) *Automatic train control.* Intermittent inductive system.

(6) *Automatic train control.* Continuous inductive system.

Car Retarders

An arrangement of power operated track brakes applied to the tracks of freight classification yards to control the speed of freight cars entering these tracks by gravity. The track brakes reduce the speed of the cars so that they come to a stop without damage to the cars or to their contents. Where car retarders are not used, the speed of freight cars is controlled by car riders applying the hand brakes. The purpose of car retarders is to reduce the expense and to eliminate the hazardous occupation of the car rider. Car retarders by speeding up the work of classifying freight cars, tend to eliminate delays, thus expediting freight service.

(7) *Car retarders.* Descriptive test.

(8) *Car retarders.* Illinois Central Railroad. Markham Yard, Chicago. Airplane view, northbound and southbound yards.

(9) *Car retarders.* Illinois Central Railroad. East St. Louis Yard.

(10) *Car retarders.* Illinois Central Railroad. Markham Yard, Chicago. "Hump" at northbound yard.

FIXED SIGNALS

In addition to the illustrations of fixed signals showing the development of railway signaling from the crossbar and lamp signals of 1834 to the types of present day signals, four full size fixed signals are shown in operation, representing the four types of power operated signals in use on the railways of the United States.

(1) *Semaphore Signal* electrically operated, displays each of its indications by day by the position of the semaphore arm and by night, by colored lights:

"Stop"—the semaphore arm in horizontal position and at night, a red light.

"Approach" or "Caution"—arm in diagonal position, and at night, a yellow light.

"Clear"—arm in vertical position, and at night, a green light.

Electro-pneumatic operation of semaphore signals was first introduced in 1881; electric operation, introduced in 1893.

(2) *Color Light Signal* electrically operated, displays each of its indications by a colored light for both day and night use:

"Stop"—red light.

"Approach" or "Caution"—yellow light.

"Clear"—green light.

Color light signals were first used in the United States in 1908 on electric railways; in 1910, on steam or electrified railways as block and interlocking signals.

(3) *Position Light Signal* electrically operated, displays each of its indications by rows of pale yellow lights for both day and night use. Each row of lights arranged to correspond to a position of the semaphore arm.

"Stop"—row of lights in horizontal position.

"Approach" or "Caution"—row of lights in diagonal position.

"Clear"—row of lights in vertical position.

Position light signals were first introduced on the Pennsylvania Railroad by A. H. Rudd in 1915 as automatic block and interlocking signals.

(4) *Color-Position Light Signal* electrically operated, displays each of its indications by a pair of colored lights for both day and night use. Each pair of lights arranged to correspond to a position of the semaphore arm.

"Stop"—two red lights in horizontal line.

"Approach" or "Caution"—two yellow lights in diagonal line.

"Clear"—two green lights in vertical line.

Color-position light signals were first introduced on the Baltimore and Ohio Railroad by F. P. Patenall in 1921 as automatic block and interlocking signals.

Fixed signals play a most important part in the movement of trains. Their indications guide the engineman and tell him when, where and how to go and when and where to stop. They guide him in safety along the road, around curves, through tunnels, over switches and through fogs and storms. Fixed signals are the guardians of the rail and symbols of safety.

HIGHWAY CROSSING SIGNALS

Two full size signals are shown in operation, representing the two types of highway crossing signals recommended by the Signal Section of the American Railway Association for the protection of highway crossing traffic at grade crossings with railroads.

(1) *Wigwag* highway crossing signal, electrically operated, displays its warning indication by the swinging movement of its disc and light.

(2) *Flashing Light* highway crossing signal, electrically operated, displays its warning indication by the lights flashing alternately, thus giving the appearance of a swinging light.

Track Appliance Development

Hand Car. Used about 1850.

Hand Car. Design of 1927.

Gasoline Motor Cars. Section and Light Inspection cars of 1927.

Modern Motor Cars. The type used in 1927 for transporting trackmen to and from their work.

Straw Ballast Distributor. A device for the economical distribution of ballast when unloading cars.

Ballast Fork. A specimen of the first tool used for cleaning ballast.

Zepp Ballast Screen. The first labor saving device used for cleaning ballast.

McWilliams Mole. A self-propelled machine running between tracks, digging the ballast from in front of the machine, cleaning it, and depositing the cleaned ballast in the rear and the dirt in receptacles for handling over the bank.

Tamping Bar. Tamping Trowel. Tamping Pick. Obsolete types used in the early days of railroading for tamping ballast under the ties in surfacing the track.

Pneumatic Tie Tamping Machine. A modern labor saving device composed of a gasoline driven air compressor which tamps the ballast under the ties with a pneumatic hammer.

Electric Tie Tamping Machine. A modern labor saving device for tamping ballast under the ties and surfacing the track. The machine consists of a gasoline driven electric generator which furnishes current for running an electric hammer.

Bonding Machine. Device for drilling holes in the rail for placing bond wires in connection with track circuits on automatic signals.

Power Bonding Machine. Modern labor saving device for doing the same work as the simple bonding machine.

Hand Ratchet Drill. Used for drilling bolt holes at the end of rails for placing joint fastenings.

Hand Operated Drilling Machine. Used for the same purpose as the Hand Ratchet Drill. A labor and time saving device for drilling bolt holes.

Power Drilling Machine. Another type drill for piercing bolt holes.

Other labor saving devices and methods of performing track maintenance work, tie and timber preservation methods and a rail sawing plant for reconditioning old rails, are demonstrated by photographs.

Time Service Development

The development of time service upon the railroad in the United States is shown in an exhibit of watches and clocks showing the progress of time service in general throughout America during the past one hundred years; also rules and regulations for time service and watch inspection on the Baltimore and Ohio railroad; standard clocks used by conductors, enginemen and other employes for comparison with their watches before starting out upon their runs; also a number of old Swiss and English watches, some of which were made a hundred years before the coming of the railroad. Many of these last antedate the manufacture of watches in America.

In the time service booth at the Centenary Exhibition are, among other items the following:

A collection of ancient watches, chiefly Swiss and English, many of them in use long decades before the coming of the American railroad and the American watch. (This historical display by courtesy of the Horological Institute of America and John J. Bowman, president of the Bowman Technical and Horological School, Lancaster, Pa.)

Four-foot photograph, showing rules and regulations for time service and watch inspection, Baltimore and Ohio railroad.

Standard clocks, by which conductors, enginemen and other employes must make comparison with their own watches before starting out on their runs. (By courtesy of the E. Howard and Seth Thomas clock companies.)

Watches, old and new. (Dueber Hampden Watch Company.)

The making of a watch. Motion picture, running continuously and demonstrating the manufacture of a modern watch, from its beginning to the finished product. Early watches. Railroad grade, 60-hour watches. (Illinois Watch Company.)

Old and new models of railroad watches; also a large sized model of a railroad watch and escapement. (Ball Watch Company.)

Evolution of a watch. (Elgin Watch Company.)

A large model of a watch movement, 12 inches in diameter. A tryptich frame showing old and new Baltimore and Ohio locomotives. A replica of an ancient sundial, and an instrument used for keeping time about 1650. An assortment of modern railroad watches. (Hamilton Watch Company.)

A watch of 1855. Six latest model railroad watches. (Howard Watch Company.)

A large model 23-jewel vanguard movement, 14 inches in diameter. Twelve newest model railroad watches. One key-wind model watch. Eighteen full-sized watches manufactured about seventy-five years ago. Other watches, old and new. (Waltham Watch Company.)

Old style gold-filled cases; new style gold and gold-filled cases, metal watch bands, belt buckles, etc. Modern railroad grade watch cases. (Wadsworth Watch Case Company.)

Old model cases; some as heavy as 8 ounces. Modern watch cases. (Keystone Watch Case Company.)

Oldtime regulator, used in railroad service seventy-five years ago. Modern railroad clocks. (E. Howard Clock Company.)

A clock of 1812, later used upon a railroad. Tower clock movement. No. 70 regulator mercury pendulum, 60 beat. No. 3 red oak, 72-beat, which is used as standard clock by Baltimore and Ohio employes to make daily watch comparisons. Brass lever clock for use in cars. No. 8 lever clock, for use on bridges, etc. (Seth Thomas Clock Company.)

Time-keeping upon the American railroad began in a crude way not long after the railroad itself was under operation. A book of rules, printed in 1845, allowed engineers and trainmen to wait five minutes at a passing point to compensate for the variation in watches. Each railroad made its own official time, which generally was set at its chief headquarters and, after the invention of the telegraph, transmitted daily by wire to each station on its lines. In at least one instance (on the old Rome, Watertown & Ogdensburgh) the president himself found the exact time; on sunny days by the use of a sextant.

Baltimore and Ohio was a pioneer in systematizing and supervising its time service—including all the clocks at its stations and operating points and the watches carried by its employees. Gradually this was perfected until today employees are not allowed to carry watches that will vary more than 30 seconds a week. The clocks along the road are even more perfectly adjusted. A constant and rigorous system of inspection and repair insures this high degree of accuracy. A general supervisor of time service, with his assistants, and watch inspectors out along the lines, keeps chary eye upon the 23,000 watches and the several thousand clocks in the service of the railroad. These are held strictly to the Washington meridian time as sent out by telegraph each day precisely at noon.

The present system of standard time upon all the railroads of North America, in which the entire United States for time purposes is divided into four zones, each different just sixty minutes from its adjoining neighbor, came into existence in November 1883. At that time the old five-minute variation rule, which had led to many misunderstandings and to at least one fatal wreck, was forever abandoned. The limits of the four time zones, Eastern, Central, Mountain and Pacific, have been slightly altered since then, but the system which long ago proved its worth, has been permitted to stand steadfast.

Railroad Development Pictures

Evolution of the Baltimore and Ohio Locomotive

63. *1829—Evan Thomas' Sail Car* (*Aeolus*). Four-wheeled sail car on wooden stringer and strap rails.

64. *1830—Horse Locomotive.* Treadmill drive.

65. *1830—Railroad Passenger Car.* Horse drawn, T-rails.

66. *1829-1830—Peter Cooper's Tom Thumb.* The first locomotive built in America. Four-wheeled locomotive, flanged drivers, stone stringer, iron strip rails.

67. *1830—Imlay Coach.* Four-wheeled passenger coach.

68. *1830—Davis' York.* First practical American built locomotive. Four drivers, beam connected, vertical cylinders, upright boiler, flanged drivers, stone stringer and strap rails. Winner of Baltimore and Ohio trial.

69. *1831—James I.* In Baltimore and Ohio trial. Four-wheeled, vertical cylinders, vertical conical boiler, link motion valve gear locomotive.

70. *1831—Childs.* In Baltimore and Ohio trial. Four-wheeled. The first turbine locomotive.

71. *1831—Costell.* In Baltimore and Ohio trial. First locomotive built in Philadelphia. Oscillating cylinders, four-wheeled, flanged drivers, horizontal boiler.

72. *1831—George W. Johnson.* In Baltimore and Ohio trial. Four flanged wheels, horizontal boiler, rectangular firebox, twin vertical cylinders, walking beam, single drive locomotive. Stone stringers and strap rails.

74. *1831—Davis' York* (*Remodelled*). Four-wheeled, single driver, exhaust steam fan blast, vertical boiler, rear vertical cylinders, locomotive, stone stringer and strap rails, after remodelling by Phineas Davis at Reeder's Marine and Machine Shop, Baltimore, Md.

89. *1832*—Freight Car. Four-wheeled; roller bearings. Flour car.

93. *1832—Atlantic.* Four-wheeled, vertical boiler, vertical cylinders, single driver, walking beam Grasshopper type locomotive. Phineas Davis, builder.

96. *1838*—Passenger Car. Four-wheeled trucks on T-rails.

99. *1833—Traveller.* Four-wheeled, vertical boiler, vertical cylinders, walking beam, Grasshopper type locomotive on T-rails. Phineas Davis, builder.

112. *1837—Norris' Lafayette.* Six wheels, single driver locomotive. Horizontal outside cylinders, horizontal boiler, square firebox, T-rails.

113. *1837—Mazeppa.* Winans' original crab locomotive. Four drivers, horizontal cylinders with double spur drive, vertical boiler, T-rails.

117. *1837—Eastwick and Harrison's Hercules,* built for Bever Meadow line. The first with equalizing beams, 4-4-0, inclined cylinders, T-rails.

118. *1838—Philip E. Thomas.* 4-4-0, inclined cylinders, horizontal boiler with haystack firebox, T-rails.

121. *1840—Baltimore and Ohio Railroad passenger car.* Fourteen windows, two four-wheel trucks.

123. *1842—Eastwick and Harrison's Mercury.* 4-4-0, inclined cylinders, inside frames, cutoff valve.

124. *1844—Ross Winans' Mud Digger.* 0-8-0, horizontal cylin-

ders, direct connected to overhead rear crank shafts gearing into rear axle of eight connected drivers.

127. *1846—Ross Winans' Youghiogheny.* 0-8-0 connected, low horizontal cylinders; first locomotive of its kind.

133. *1848—Dragon.* M. W. Baldwin. 0-4-4-0, with four front drivers mounted on swiveling truck.

134. *1848—Ross Winans.* Eight-wheel connected camel locomotive with short firebox and hook motion. Principal Baltimore and Ohio type for years.

148. *1853—Camel.* Hayes' 10-wheel passenger engine No. 139. Inclined cylinders, Winans camel type boiler. 4-6-0.

153. *1852—Dutch Wagon, No. 207, 4-4-0.* Murray and Hazelhurst, Baltimore and Ohio and Manchester Manufacturing and Machine Company inside connected passenger locomotive.

165. *1865—No. 117.* Perkins' 10-wheel passenger locomotive.

177. *1875—No. 600.* Davis' *Mogul* 2-6-0 passenger locomotive for heavy mountain service.

181. *1880—Class I-1.* Cromwell extended firebox, eight-wheel passenger locomotive, 4-4-0, built at Company shops at Mount Clare.

187. *1887—Class I-4, No. 830.* 4-4-0, Cromwell's improved extended firebox, eight-wheel passenger locomotive, built at Company shops at Mount Clare.

188. *1888*—2-8-0, consolidation engine, *No. 545.* Standard freight locomotive. Built at Company shops at Mount Clare.

222. *1904—Class DD-1.* 0-6-6-0, First Mallet, articulated locomotive, built and operated in the United States. American Locomotive Works.

234. *1926—Class U.* 0-10-0, ten-wheel switcher, converted from *Class S Santa Fe* at Mount Clare Shops.

223. *1905—Class E-27-b.* 2-8-0, consolidation engine, Walschaert valve gear, piston valve, radial staybolt firebox.

233. *1919—Class D-30.* 0-6-0, six-wheel switcher, U. S. R. A. locomotive. Baldwin Locomotive Works.

224. *1906—Class P.* 4-6-2, Pacific type, high speed passenger locomotive.

230. *1927—Class E-27-x.* Consolidation 2-8-0 locomotive with water tube firebox boiler. Built and applied at Company shops at Mount Clare.

231. *1927—Class E-27-j.* Consolidation 2-8-0 locomotive with Caprotti Poppet valve. Converted at Mount Clare Shops.

219. *1896—Class B-14.* 4-6-0, high speed ten-wheel passenger locomotive; 78-inch driving wheels, underslung spring rigging.

225. *1916—Class Q-7-f Mikado* type. 2-8-2, high speed freight locomotive, built by Baldwin Locomotive Works.

220. *1900—Vauclain Four-Cylinder Compound Locomotive. Class A, Atlantic* type, 4-4-2 locomotive built by Baldwin Locomotive Works.

227. *1926.—Class S-1-a.* 2-10-2 *Santa Fe* type, heavy mountain freight locomotive built by Baldwin Locomotive Works.

227A. *1926—Class P-6.* 4-6-2 type for mountain service. Built by the Baldwin Locomotive Works.

226. *1919—Class EL-5.* 2-8-8-0 compound *Mallet* articulated locomotive, built by Baldwin Locomotive Works.

229. *1927—Class P-7.* 4-6-2 Pacific type locomotive. High speed President series, built by Baldwin Locomotive Works.

Evolution of the Locomotive

1. *1680—England. Sir Isaac Newton.* Four-wheeled road vehicle. The first idea of propulsion by steam on land in history.

2. *1765—Holland.* Wind power period. *Stephinus.* Four-wheeled double sail car. Road vehicle.

3. *1769—France.* Roadway period. *Cugnot.* Three-wheeled road vehicle.

4. *1784—England.* Roadway period. *Murdoch.* Three-wheeled vertical cylinder steam road vehicle.

5. *1786—England.* Steam carriage period. *Symington.* Three-wheeled road steam carriage with horizontal boiler, horizontal cylinder and ratchet drive.

6. *1790—America.* Roadway period. *Nathan Read.* The first idea of a steam wagon in America. Four-wheeled road vehicle.

7. *1800—England.* Roadway period. First effort of Richard Trevithick, the father of the locomotive. Three-wheeled, single vertical cylinder traction engine.

8. *1801—England.* Trevithick. *Captain Dick's Puffer.* Single vertical cylinder within horizontal boiler. Four-wheeled traction engine.

9. *1803—England.* Tramway period. Trevithick. Wooden tramway, horizontal boiler, four-wheeled spur driven, single horizontal submerged cylinder tramway locomotive.

10. *1803—England.* Steam carriage period. Trevithick. Four-wheeled coach. Horizontal underhung boiler containing single horizontal cylinder. Spur driven road vehicle.

11. *1804—America.* Roadway period. Oliver Evans' *Oruktor Amphibolis.* The first practical propulsion by steam on land in America. A scow for land and water travel.

12. *1806—England.* Tramway period. *Trevithick.* Horizontal single flue boiler, single vertical submerged cylinder, direct drive four-wheeled steam locomotive. Smooth driving wheels on cast iron rails.

13. *1808—England.* Tramway period. Trevithick's *Catch-Me-Who-Can.* Later development of engine of 1806.

14. *1812—England.* Tramway period. Brunton's *Horse Leg Locomotive* or *Mechanical Traveler.* Wooden sleeper on iron strap rails.

15. *1812—England.* Tramway period. *Blenkinsopp.* Double rack rail locomotive.

16. *1813—England.* Tramway period. Hedley *Model.* Proving adhesion on smooth rails and wheel treads.

17. *1813—England.* Tramway period. Hedley's locomotive *Puffing Billy.* Horizontal boiler, twin vertical cylinders, walking beam, spur driven, four-wheeled locomotive. Angle bar rail with wheels tracking on bottom flange.

18. *1814—England.* Tramway period. Hedley's locomotive *Wylam Dilly.* Four-wheeled engine. T-head rails and chairs and flanged drivers. Later development of *Puffing Billy.*

19. *1814—England.* Tramway period. Hedley's locomotive *Wylam Dilly* on eight wheels. A later and simplified development of *Wylam Dilly.* T-head rails and chairs and flanged drivers.

20. *1814—England.* Tramway period. Stephenson's first locomotive, *Blucher.* Horizontal boiler, twin vertical cylinders, spur gear drive, four-wheeled locomotive on wooden tramway.

21. *1815—England.* Tramway period. *Stephenson.* Early four-wheeled twin vertical cylinder locomotive. Direct drive to flanged drivers on T-head railway.

23. *1821—England.* Steam carriage period. *Griffith.* Three-wheeled carriage on roadway. Rear suspension boiler on engine.

24. *1822—England.* Steam carriage period. *David Gordon.* Hollow drum driven roadway carriage with internal carried engine and boiler.

25. *1823—England.* Steam carriage period. *James.* Four-wheeled; double flanged drivers on iron T-rails with with vertical twin forward cylinders, toggle drive and horizontal boiler.

26. *1824—England.* Traction power period. *Snowden.* Four-wheeled, horizontal boiler, vertical cylinder, slot rail, rack driven engine.

28. *1824—England.* *Steam Carriage.* Burstall and Hill. Four-wheeled, bevelled gear driven steam carriage.

29. *1825—England.* Tramway period. Stephenson's locomotive *Killingworth.* Four-wheeled, submerged twin cylinders, direct drive, single flue horizontal boiler, flanged drivers, cast iron fishbelly rail. Successfully operated.

31. *1825—England.* Tramway period. Stephenson's *Locomotion* No. 1. Stockton and Darlington Railroad. Four-wheeled, submerged twin vertical cylinders, horizontal flue boiler, T-rails set in chairs. A larger development of *Killingworth.*

32. *1825—England.* Tramway period. *Easton.* Horizontal boiler, twin vertical submerged cylinders, direct drive, spur geared, rack rail locomotive.

33. *1826—England.* *Sailing Carriage* Pocock. Four-wheeled vehicle with umbrella sail.

34. *1826—England.* Steam carriage period. *Gurney.* Six-wheeled carriage.

35. *1827—England.* Steam carriage period. *Hancock.* Three-wheeled oscillating cylinder steam carriage.

36. *1827—France.* *Seguin.* Second locomotive built in France. Two pairs flanged driving wheels, horizontal return tubular boiler, vertical cylinders and walking beam. Forced draft by twin tender fans.

37. *1827—England.* Tramway period. Hackworth's *Royal George.* Six-wheeled, connected flanged drivers, twin vertical cylinders on fishbelly rail.

38. *1827—England.* Steam carriage period. *Burstall.* Six-wheeled steam carriage, haystack suspension boiler.

39. *1827—England.* Tramway period. Stephenson's *Twin Sisters.* The first double vertical boiler locomotive. Six-wheeled, connected flanged drivers, inclined cylinder locomotive on fishbelly rails.

42. *1828—America.* Steam carriage period. *Johnson.* Four-wheeled inclined cylinder, vertical rear suspension boiler.

43. *1828—America.* Tramway period. The *Howard,* Baltimore. The first locomotive patented on the American continent. Four-wheeled, twin cylinders, walking beam, ratchet driven, flanged drivers, T-rail locomotive. Designed for the Baltimore and Ohio-Railroad.

46. *1829—England.* Liverpool and Manchester Railway Competition. Stephenson's *Rocket.* Four-wheeled locomotive on T-rails. Renowned as winner of Ranhill Competition.

47. *1829—England.* Liverpool and Manchester Railway Competition. Hackworth's *Sans Pariel.* Horizontal boiler, vertical twin cylinders, flanged drivers on T-rails. Withdrawn after competition. First engine to use exhaust steam blast into stack.

48. *1829—England.* Ericsson and Braithwaite's locomotive *Novelty.* Liverpool and Manchester Railway Competition. Twin cylinders, combined horizontal and vertical boiler, flanged drivers on T-rails. Withdrawn after competition. Ericsson later designed and built the *U. S. S. Monitor,* in successful combat with the C. *S. S. Merrimac.*

49. *1829—England.* Foster and Rastwick locomotive *Agenoria.* Four-wheeled horizontal boiler, vertical cylinders, walking beam connected to flanged drivers on fishbelly rails.

50. Picture of George Stephenson, Timothy Hackworth, Horatio Allen, Ross Winans, Matthius W. Baldwin.

51. *1829—England.* Steam carriage period. *Anderson and James.* Four-wheeled enclosed passenger carriage.

53. *1829—England.* Horse power period. Brandreth's *Cycloped,* in Liverpool and Manchester competition of that year. Four-wheeled horse treadmill car, flanged wheels on T-rails.

55. *1829—England.* Tramway period. Stephenson's *America.* First locomotive ordered in England for use in America, at Honesdale, Pa., and never used. Four wheeled, flanged drivers, inclined cylinders, horizontal boiler locomotive on T-rails.

56. *1830—England.* Tramway period. Hackworth's locomotive *Middleboro* No. 9. Six-wheeled, inclined cylinders, horizontal boiler, connected flanged drivers, on T-rails.

58. *1830—England.* Stephenson's locomotive *Mercury.* Planet type. Four-wheeled, single pair flanged drivers, horizontal boiler, inside connected cylinders, fishbelly rails.

59. *1830—England.* Air power period. *Mann's Carriage.* Four-wheeled carriage.

60. *1830—America.* Wind power period. South Carolina Railroad. Four flanged wheels, single mast sail car on wooden stringer strap rails.

61. *1830—England.* Hackworth's locomotive *Globe.* Four-wheeled flanged drivers, horizontal boiler, fishbelly rails.

62. *1830—England.* The *Bury* locomotive. Designed by James Kennedy, built at Bury Works for Stockton and Darlington Railroad. Four-wheeled, six-foot driver, horizontal multitubular haystack firebox boiler, inside connected cylinders and frames, fishbelly rails. Speed 58 miles per hour with twelve wagons.

73. *1831—America.* Special type. *Best Friend* locomotive. Four flanged drivers, inclined cylinders at rear of drivers and overhanging vertical boiler ahead of drivers. South Carolina Railroad.

75. *1831—England.* Stephenson's *Samson.* Four-wheeled, inside cylinders, crank axle locomotive. Flanged drivers on fishbelly rails.

76. *1831—America.* Camden and Amboy Railroad *Passenger Car.* Four-wheeled horse drawn vehicle on wooden stringers and strap rails.

78. *1831—England.* Stephenson's *Rocket* Remodelled, locomotive. Single pair drivers, low inclined cylinders, fishbelly rails.

79. *1831—America.* West Point Foundry locomotive *West Point.* South Carolina Railroad. Four-wheeled, flanged drivers, inclined cylinders alongside firebox, horizontal boiler, square firebox, T-rail-locomotive.

80. *1831—England.* Steam carriage period. *Hancock.* Four wheeled steam carriage.

81. *1831—America.* South Carolina Railroad. Four-wheeled high drivers, inclined cylinders, horizontal boiler, firebox ahead of rear drivers. Wooden stringers, strap rails.

82. *1831—England.* Tramway Period. *Dodd.* The first locomotive built in Glasgow. Four flanged drivers, horizontal boiler, vertical cylinders, T-rails in chairs.

83. *1831—America.* West Point Foundry. *Phoenix.* Four flanged drivers, vertical boiler suspended between two pairs drivers, inclined cylinders, wooden stringer strap rails. South Carolina Railroad.

84. *1831—England.* Steam Carriage Period. *Napier.* Four-wheeled steam carriage.

87. *1832—America.* Jervis' *Experiment.* 4-2-0, inside cylinders, single driver, horizontal boiler, swivelling truck, T-rail, locomotive. Mohawk and Hudson Railroad.

88. *1832—America.* Horatio Allen's *South Carolina.* South Carolina Railroad. Father of the double boiler type of the world. 2-2-2-2, articulated locomotive. Two single driver engines; four bolted metal firebox; twin smoke boxes, on T-rails.

90. *1832—England.* Steam Carriage Period. *Redmond.* Four-wheeled steam carriage.

91. *1832—England.* George Stephenson's *Design.* Four-wheeled baggage car. Wooden stringers, strap rails.

92. *1832—England.* Hackworth's *Wilberforce.* Six-wheeled locomotive, vertical rear cylinders, horizontal boiler, flanged drivers, forward coal and rear water tenders, T-rails.

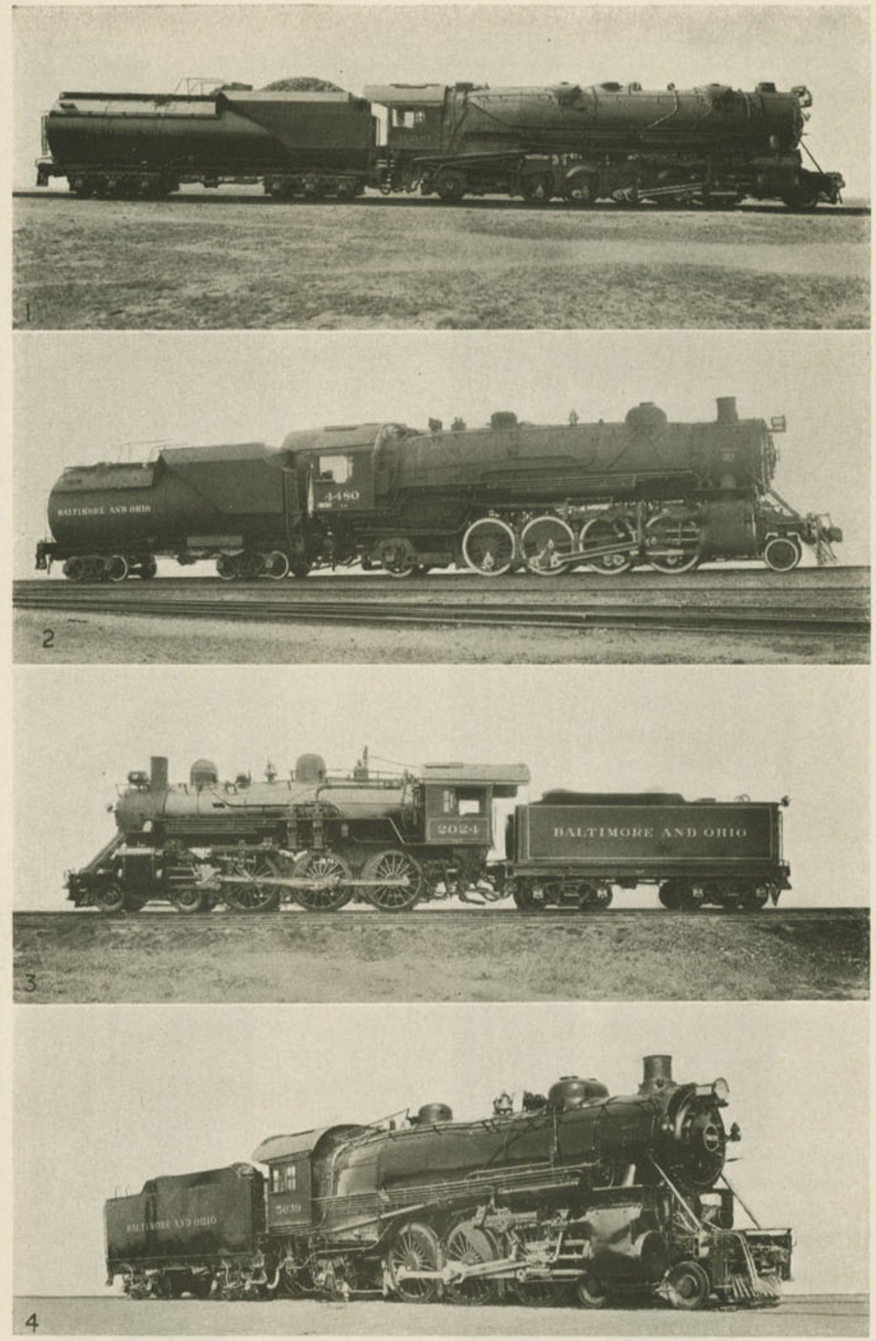
95. *1832—America.* Baldwin's first locomotive, built for Philadelphia, Norristown and Germantown Railroad, *Old Ironsides.* 2-2-0, outside cylinders, horizontal boiler, square firebox, flanged drivers on T-rails.

100. *1833—England.* Steam carriage period. *Maceroni.* Four-wheeled steam carriage.

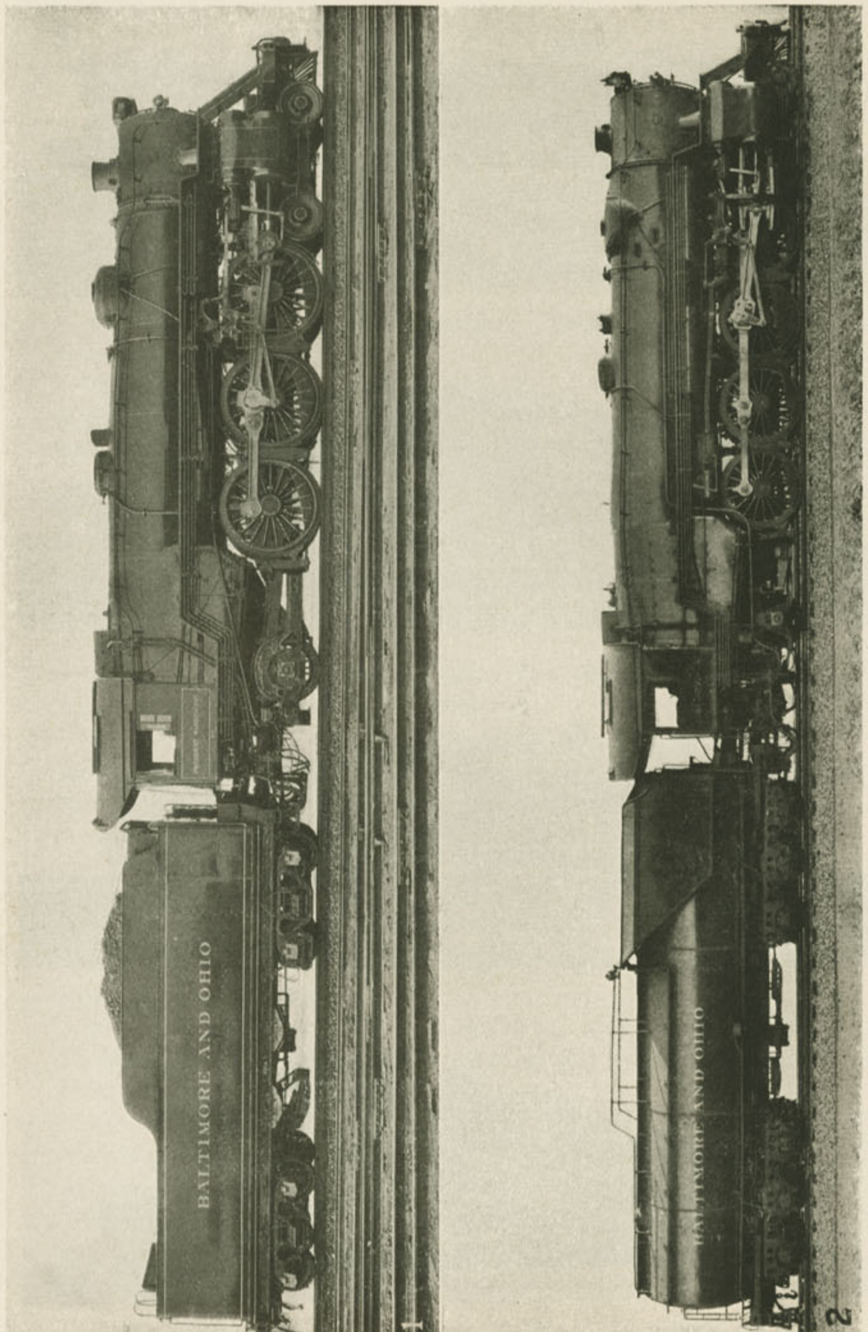
101. *1833—Scotland.* *Earl of Airlee.* J. and C. Carmichael. Six wheels, single driver, bell crank drive, vertical cylinder, horizontal boiler, T-rail locomotive.

103. *1833—England.* Stephenson's *Patentee* with steam brake. Six wheels, single driver, horizontal boiler, square firebox locomotive on fishbelly rails.

104. *1834—America.* Locks and Canal Company. Four wheels, single driver, inside cylinders, horizontal boiler, square firebox, T-rail locomotive.



1. No. 6200 Santa Fe Type 2. No. 4480 Mikado Type
3. No. 2024 Modernized Passenger Locomotive
4. No. 5039 Pacific Type



1. President Washington

2. Philip E. Thomas

105. *1834—America.* *E. L. Miller*, locomotive built by M. W. Baldwin for Charleston and Hamburg Railroad. Six wheels, single driver, swivel truck, horizontal boiler, haystack firebox, inside inclined cylinders, T-rails.

106. *1834—England.* Special type. *Hicks.* Four wheels, single driver, vertical cylinder geared locomotive, fishbelly rails.

107. *1834—England.* Forrester's locomotive *Swiftsure.* Six wheels, single driver, horizontal outside cylinders, horizontal boiler, square firebox, T-rails.

108. *1836—America.* The *Campbell.* Eight wheels, four drivers, and four truck wheels, inside cylinders, horizontal boiler, haystack firebox, T-rails. Built by Henry S. Campbell, chief engineer of Philadelphia, Germantown and Norristown Railroad and Robert James Brooks of Philadelphia. Original of American type locomotive and patented by Campbell in 1836.

109. *1836—America.* Norris' locomotive *George Washington.* Built for incline of Columbia Railroad, Philadelphia. 4-2-0, single driver, inclined cylinders, horizontal boiler, haystack firebox, T-rails.

111. *1836—America.* Norris' *Philadelphia*, locomotive for Birmingham and Gloucester Railroad. Six wheels, single driver, inclined outside cylinders, horizontal boiler, haystack firebox. Tested on Lickey Incline, 1 in 37, 2 miles long.

114. *1837—America.* The *Sandusky.* Rogers' first locomotive. 4-2-0, inside inclined cylinders, horizontal boiler, square firebox. Built for Mad River and Lake Erie Railroad, later the Sandusky, Newark and Mansfield, now part of the Baltimore and Ohio Railroad.

115. *1837—England.* Special type. Harrison's *Hurricane.* Single driver, horizontal cylinders, horizontal boiler, T-rails.

116. *1837—England.* 2-2-2, Gooch's *North Star.* 7-foot gage, T-rails. Great Western Railway of England.

119. *1839—America.* Hinkley and Drury *Lion*, Boston and Maine Railroad. 0-4-0, outside cylinders, outside frames, T-rails.

120. *1840—America.* Hogshead or Barrel Car *Jasper.* Run on South Carolina Railroad. Two four-wheel trucks with roller side bearings, T-rails.

122. *1840—America.* The *Gowan and Marx*, locomotive. Eastwick and Harrison for Reading Railroad. 4-4-0, inclined cylinders, inside frames, cylindrical center beam engine truck.

126. *1846—England. Great Western Express.* 4-2-2 locomotive.

128. *1846—America.* Hinkley and Drury locomotive for Boston and Maine Railroad. 4-4-0, 5-foot 6-inch drivers, outside frames, outside inclined cylinders, independent cutoff valve.

129. *1846—America.* Winans *Delaware.* 0-8-0 locomotive. Low horizontal cylinders. Reading Railroad.

130. *1847—England.* Trevithick's *Cornwall,* for London and North Western Railroad. Eight-foot six-inch diameter single driver, 2-2-2 locomotive. Remodelled by Ramsbottom.

131. *1847—America.* The *Chesapeake,* for Reading Railroad. Norris' first 10 wheeler. 4-6-0, outside inclined cylinders, haystack firebox.

132. *1847—America.* Special type, locomotive *Sellers.* 4-4-0. Built by George E. Sellers for Middle Road in Panama. Twin inclined cylinders, bottom cylinders connected with drivers and top cylinders to friction gear shaft, engaging inside head of rail.

135. *1848—England.* Crampton's *Liverpool.* 6-2-0, single driver, outside frames, outside horizontal cylinders.

136. *1848—America.* Nichols' *Novelty.* Reading Railroad. 0-8-4-4 locomotive. Forward locomotive frames surmounted with a condensing tank, boiler carried on four wheel truck frame back of engine.

137. *1849—England.* Wilson's *Jenny Lind.* 2-2-2, inside cylinders. Six-foot single driver locomotive.

138. *1849—America.* Norris' *Lightning.* Utica and Schenectady Railroad. First locomotive in America with wrought iron wheels. 6-2-0 single driver.

139. *1849—America. Victory.* Rogers, Ketchum and Grosvenor. Introduction of link motion in American locomotive practice. 4-4-0, inclined cylinders, haystack firebox.

140. *1850—England.* McConnell's Bloomer. *Trentham No. 894,* 2-2-2. A rebuilt Bloomer, London and North Western Railroad locomotive.

141. *1850—Canada.* Special type. *Pioneer.* St. Andrews and Quebec Railroad. Built by Robert Stephenson and Company, England. From original drawing. 0-4-0 inclined cylinders.

142. *1851—America. Eddys, No. 21.* Western Railroad of Massachusetts. 4-4-0, Stephenson link motion.

143. *1852—America. No. 375.* 4-4-0, outside frames, outside inclined cylinders. Boston Locomotive Works.

144. *1852—America.* James Millholland. Philadelphia and Reading Railroad. *Illinois,* 4-4-0, long stroke outside link motion locomotive.

145. *1853—America. Enterprise,* 4-4-0, Stephenson link motion. Wm. Mason and Company.

146. *1853—America.* 4-4-0, locomotive with Phlegler water table and water grate boiler, and Stephenson link motion. Built by Richard Norris and Son for the Reading Railroad.

147. *1853—England.* Bristol and Exeter Railway. 4-2-4, 8-foot single driver, 7-foot gage, inside cylinders.

150. *1855*—America. *Pioneer,* 4-4-0. Manchester Locomotive Works, passenger locomotive.

151. *1855—America. Madison.* 4-4-0. Rogers, Ketchum and Grosvenor, passenger locomotive.

154. *1856—America. Tiger, No. 134.* 4-4-0, inclined cylinders. M. W. Baldwin and Company, Boston and Worcester Railroad.

156. *1857—America.* Special type. James Millholland. Twelve wheels connected freight locomotive. Reading Railroad.

157. *1859—England.* Special type. *Princess Royal No. 610.* 2-2-2, 8-foot drivers, outside cylinders, standard gage, London and North Western Railway.

161. *1862—England. Lady of the Lake, No. 531.* 2-2-2, single driver, 7-foot, London and North Western Railway locomotive. Ramsbottom. Bronze Medal, Exposition, 1862.

162. *1863—France. Peitiets.* Twelve-wheeled, 6 coupled, double engine, condensing tank locomotive, with head and rear end cylinders.

163. 1864—*America. Telegraph No. 84.* 4-4-0. Davis piston valve locomotive. A. & C. W. Railway, Jersey City Locomotive Works.

166. *1865—America.* James Millholland, *Nashville.* 4-6-0, Reading Railroad locomotive.

169. *1866—America.* Mitchell's consolidation locomotive *No. 63.* Baldwin Locomotive Works. First of its type. Lehigh Valley Railway.

170. *1867—America. Bee, No. 32.* 2-10-0, first of the Decapods. Lehigh Valley Railway, Lancaster Locomotive Works.

171. *1867—America. The America*, 4-4-0, Chicago, Rock Island and Pacific Railway locomotive.

173. *1868—America. Hudson's Double Ender, No. 36.* New York and New Haven Railway 2-4-2. Roger Locomotive and Machine Works.

174. *1868—England. Fairlee.* Double ender.

178. *1877—America. No. 408.* 4-6-0, the first "Wootten" boiler, locomotive, Reading Railroad.

182. *1881—America.* Central Pacific Railroad *No. 229.* 4-8-0 locomotive.

185. *1886—Germany. No. 1177.* 0-6-0, Von Bories Compound engine.

191. *1890—France.* Modern type. *No. 802*, 4-4-0, Salamon-Flaman, steam drum boiler locomotive.

193. *1890—America.* Modern type. 0-10-0, Belpaire firebox, *No. 275*, Rogers Locomotive and Machine Company locomotive.

195. *1891—America.* Modern type. *No. 412.* Great Northern. 4-8-0. Belpaire firebox. Brooks Locomotive Works locomotive.

197. *1891—America. No. 355.* Central Railroad of New Jersey, 4-4-0. Baldwin Locomotive Works locomotive.

203. *1891—France. Mallet* compound. 0-4-4-0, tank locomotive.

204. *1891—America.* Modern Type. *Baldwin Compound No. 82.* Ten wheeler. Baldwin Locomotive Works.

206. *1892—America. No. 232.* 4-4-0, the Dean Compound locomotive. Old Colony Railway.

207. *1892—America.* Modern type. T. Edward Hambleton locomotive *No. 122.* 2-8-0. Richmond Locomotive and Machine Works.

208. *1892—America.* The Rogers Compound *No. 424.* 2-6-0 cross-compound locomotive. Illinois Central Railroad. Rogers Locomotive Works.

210. *1892—America.* Baldwin Compound. *No. 618.* 2-4-2, Prairie type, Wootten firebox. Pennsylvania and Reading Railroad locomotive.

212. *1892—America.* Modern type. *No. 1503.* 4-6-0, cross-compound, 10-wheel engine built by the Schenectady Locomotive Works.

213. *1892.—Mexico. No. 150.* 2-6-0-6-2 double ender. Johnestone double Bogie compound locomotive built for the Central Mexican Railway.

214. *1892—France.* Modern type. 0-8-0, P. O. *No. 1191.* Paris and Orleans Railway locomotive.

215. *1892—Russia.* St. Petersburg and Warsaw compound. 4-4-0. *KM16*, locomotive.

216. *1892—France.* 4-4-0, Belpaire firebox, Walschaert valve gear locomotive. Paris, Lyons and Mediterranean Railway.

217. *1892—Spain. No. 224.* 0-8-0, Goods engine. Societe de St. Leonard, Belgium.

218. *1895—America.* Baltimore and Ohio Railroad. 0-8-0 type *Electric Locomotive No. 1.* First electric locomotive operating on a steam railroad.

221. *1903—America.* Baltimore and Ohio Railroad. Class LE-2, *Electric locomotives No. 5 and No. 6.* 0-4-4-0 type. Geared electric locomotive.

228. *1927—America.* Baltimore and Ohio Railroad. *Class EL-6-a*, simple Mallet, 2-8-8-0 locomotive. Converted from compound to simple at Mount Clare Shops. Originally built by Baldwin Locomotive Works.

232. *1927—America.* Baltimore and Ohio Railroad. *Class Q-1-aax*, 2-8-2 *Mikado* type locomotive with water tube firebox boiler built and applied at company shops at Mount Clare.

235. *1926—No. 60,000.* 4-10-2 type, with Grotan boiler with water tube type firebox. Baldwin Locomotive Works experimental locomotive.

Historical Railroad Pictures

BALTIMORE AND OHIO LOCOMOTIVES

Easel DD

1995. *Tom Thumb—1829.* One twenty-fourth scale model. First American built locomotive. Constructed by Peter Cooper of New York to prove steam operation. Ran successfully on rails of Baltimore and Ohio Railroad in 1829–1830.

1996. *York—1831.* Reproduction made for operation under steam at Mount Clare in 1927. First practical American built locomotive. Designed and constructed by Phineas Davis of York, Pa. Weight 3½ tons.

1997. *Johnson—1831.* Life sized model. One of the Baltimore and Ohio competition locomotives. Built by George W. Johnson of Baltimore. Boiler with twin firebox and firetubes.

1998. *Childs—1831.* Life sized model. First turbine locomotive. Built by Ezra Childs of Philadelphia. Competed in Baltimore and Ohio Mount Clare competition. Operated successfully but failed to meet required specifications.

1999. *James I—1831.* Life sized model. Built in New York, engine having vertical conical boiler and two vertical cylinders and link motion valve gear.

2000. *Costell—1831.* Life sized model. Oscillating cylinder locomotive built by Stacey Costell of New York. One of the contestants in the Baltimore and Ohio Mount Clare competition.

2001. *York Remodelled—1831.* Life sized model representing the Davis' *York* as changed at Reeder's Shops, Baltimore, by Phineas Davis in 1831 after the running of the *York* on trial trip on the Baltimore and Ohio Railroad, cylinders being changed from sides to back of boiler and propelled by one pair driving wheels through spur gears. Weight 3½ tons.

2002. *Atlantic—1832.* Built by Phineas Davis of York, Pa. for the Baltimore and OhioRailroad. The *Remodelled York* proving too lght for the grades of the road, Davis built this engine of a Grasshopper type, geared to a single pair of drivers. The present engine was largely reconstructed from an old engine, the boiler being renewed in 1926 at Mount Clare Shops for steam operation at the Baltimore and Ohio Centenary Exhibition. Weight 6½ tons.

2003. *Thomas Jefferson—1835.* Original engine. A heavier engine of the Grasshopper type, geared to two pairs of drivers to increase the hauling capacity. Built by Davis and Gartner, York, Pa., for the Baltimore and Ohio Railroad. In switching service until early 1893. Reconditioned with new boiler applied at Mount Clare Shops in 1926 for the Baltimore and Ohio Centenary Exhibition. Weight 15½ tons.

2004. *Lafayette—1837.* Built by Richard Norris of Philadelphia, Pa. (*One Armed Billy.*) Reproduction of locomotive made at Mount Clare. First six-wheel locomotive on the Baltimore and Ohio Railroad. Weight 10 tons.

2005. *Mason No. 25—1856.* Original locomotive. First of American type of locomotives. One of the best examples of passenger type. Engine retired from service in 1892. Weight 28 tons.

2006. *Ross Winans No. 217—1869.* Original Baltimore and Ohio locomotive. Boiler renewed at Mount Clare Shops in 1926. Ten-wheel camel freight locomotive built at Mount Clare Shops employing Ross Winans' construction in the type of boiler and cab arrangement. Cylinders 19 x 22 inches, drivers 50 inches in diameter, boiler pressure 115 pounds. Represents a type of ten-wheel camel passenger engine built by S. J. Hayes at Mount Clare in 1853. Weight 50 tons.

2007. *Thatcher Perkins No. 117—1863.* Original Baltimore and Ohio locomotive. Ten-wheel locomotive designed by Thatcher Perkins and built at Mt. Clare Shops. First of the heavy 10-wheel locomotives built for heavy passenger service over the 17 mile grade of the Mountain Division, west end of Cumberland Division. Reconditioned at Mount Clare Shops 1927. In service until 1890. Weight 45 tons.

2008. *J. C. Davis No. 600—1875.* Original Baltimore and Ohio locomotive. Built at company shops at Mount Clare by J. C. Davis in 1875. Original Mogul type for heavy passenger service. Weight 45 tons.

2009. *A. J. Cromwell No. 824—1880.* Baltimore and Ohio Railroad locomotive, Class 1–1, 4-4-0 type. Designed by A. J. Cromwell with increased firebox capacity by extending the firebox over the rear wheels and eliminating the previously used deck plates. Built at company shops at Mount Clare. Established a record of high speed service on the Philadelphia Division. Cylinders 19 x 24, tractive power 15,476 pounds. Weight 47 tons.

2010. *A. J. Cromwell No. 545—1888.* Original Baltimore and Ohio Railroad locomotive. Designed and built at Mount Clare shops by A. J. Cromwell, Master of Machinery, a cotton mill machinist from Grays, near Ellicott City, and a wholly Baltimore and Ohio Railroad educated locomotive designer. Cylnders 21 x 26, tractive power 30,213 pounds. Weight 62½ tons.

2011. *A. J. Cromwell No. 993.* Baltimore and Ohio Railroad locomotive. Class K–3, 2-6-0 type, built at Mount Clare. Cylinders 19 x 24, drivers 56 inches, boiler pressure 150 pounds, total weight 113,200 pounds.

2012. *A. J. Cromwell No. 830.* Baltimore and Ohio Railroad locomotive. Class 1–4, 4-4-0 type, passenger locomotive. An improvement over the extended firebox construction for heavy mountain service. Designed by A. J. Cromwell and built at company shops at Mount Clare. Cylinders 19 x 24, tractive power 16,179. Weight 51 tons.

2013. *No. 1436.* Baltimore and Ohio Railroad locomotive. Class B–8, 4-6-0 type, 10 wheeler, 20 x 26 cylinders, 60-inch drivers, 170 pounds boiler pressure, tractive power 20,046 pounds. Total weight 127,500 pounds. Built at Mount Clare, 1891.

2014. *No. 5180.* Class P–c, 4-6-2 Pacific type passenger locomotive.

2015. *No. 1474.* Baltimore and Ohio Railroad locomotive. Class A–2, 4-4-2 Atlantic type, cylinders 22 x 26, 80-inch drivers, boiler pressure 197 pounds, tractive power 26,400 pounds, total weight 180,000 pounds. Built by American Locomotive Company, 1903.

2016. *No. 2718.* Baltimore and Ohio Railroad locomotive. Class E–27, 2-8-0 consolidation engine 22 x 30 cylinders, drivers 60 inches, boiler pressure 205 pounds, Walshaert valve gear, 12-inch piston valves, radial stays, one piece crown and firebox side sheets, tractive power 42,168 pounds, total weight 220,400 pounds. Built by American Locomotive Company, 1909.

2017. *No. 5213.* Baltimore and Ohio Railroad locomotive. Class P–5, 4-6-2 Pacific, first engine to haul the Capitol Limited. Cylinders 25 x 28 inches, 74-inch drivers, 200 pounds boiler pressure, tractive power 40,200 pounds, total weight 280,000 pounds. Built by the Baldwin Locomotive Works, 1919.

2018. *No. 5232.* Baltimore and Ohio Railroad locomotive. Class P–6, 4-6-2 Pacific type, 25 x 28 cylinders, 74-inch drivers, 200 pounds boiler pressure, 40,200 pounds tractive power, total weight 288,600 pounds. Built by the Baldwin Locomotive Works, 1922.

2019. *No. 7303.* Baltimore and Ohio Railroad locomotive. Class EL–6a, 2-8-8-0 simple Mallet, converted Mount Clare, 1927. Built by the American Locomotive Company, 1917. Cylinders 25 x 32, 63-inch drivers, 200 pounds boiler pressure, 108,000 pounds tractive power, total weight 492,000 pounds.

2020. *No. 5039.* Baltimore and Ohio Railroad locomotive. Class P–1a, 4-6-2 Pacific type, 26 x 28-inch cylinders, 74-inch drivers, boiler pressure 205 pounds, 44,600 pounds tractive power, total weight 299,000 pounds, converted at Mount Clare, 1924. Originally built by Baldwin Locomotive Works, 1911.

2021. *No. 2556.* Baltimore and Ohio Railroad locomotive. Class E-27da, 2-8-0 consolidation type, cylinders 24 x 30, 62-inch drivers, tractive power 50,900 pounds, boiler pressure 215 pounds, total weight 226,550 pounds. Equipped with Nicholson syphon.

BALTIMORE AND OHIO LOCOMOTIVES

Easel EE

2022. *No. 1630.* Baltimore and Ohio Railroad locomotive. Class E-13, 22 x 28 cylinders. Consolidation locomotive, total weight 164,000 pounds. Built by Baldwin Locomotive Works, 1896.

2023. *No. 1450.* Baltimore and Ohio Railroad locomotive. Class A, 4-4-2, Atlantic type, 19 x 28 cylinders, 78-inch drivers, 200 pounds boiler pressure, tractive power 22,000 pounds, total weight 145,000 pounds. Built by Baldwin Locomotive Works, 1900.

2024. *No. 1342.* Baltimore and Ohio Railroad locomotive. Class B-8, 4-6-0 type, 10-wheeler, 20 x 26 cylinders, 60-inch drivers, 170 pounds boiler pressure, tractive power 20,046 pounds, total weight 127,500 pounds. Built at Mount Clare, 1891.

2025. *No. 1430.* Baltimore and Ohio Railroad locomotive. Class A-3, 4-4-2, Atlantic type 22 x 26 cylinders, 80-inch drivers, boiler pressure 205 pounds, total weight 214,700 pounds. Built by Baldwin Locomotive Works, 1910.

2026. *No. 2504.* Baltimore and Ohio Railroad locomotive. Class E-27, 2-8-0, Consolidation locomotive, with water tube firebox boiler, applied at Mount Clare, 1927. Cylinders 25 x 30 inches, tractive power 55,300 pounds, weight 241,500 pounds, total heating surface firebox 479 square feet, heating surface tubes and flues 2072 square feet, total heating surface 2551 square feet. Designed by G. H. Emerson, Chief of Motive Power and Equipment.

2027. *No. 601.* Baltimore and Ohio Railroad locomotive. Class L-2, 8-wheel switcher converted from E-27, 0-8-0. Cylinders $25\frac{1}{2}$ x 30, 62-inch drivers, boiler pressure 207 pounds, tractive power 55,360 pounds, total weight 221,000 pounds.

2028. *No. 950.* Baltimore and Ohio Railroad locomotive. Class

U, 0-10-0 switcher, rebuilt from Class S at Mount Clare, 1926. Cylinders 30 x 32, 58-inch drivers, boiler pressure 225 pounds, tractive power 95,000 pounds, total weight 349,500 pounds.

2029. *No. 2722.* Baltimore and Ohio Railroad locomotive. Class E-27-j, 2-8-0 Consolidation locomotive with Caprotti Poppet valve gear applied at Mount Clare 1927. Engine built 1910. Cylinders 24 x 30 inches.

2030. *No. 2020.* Baltimore and Ohio Railroad locomotive. Class B-18c, 4-6-0, 21 x 28 cylinders, 70-inch drivers. Rebuilt at Mount Clare, 1923.

2031. *No. 848.* Baltimore and Ohio Railroad locomotive. Vauclain four-cylinder compound locomotive built by Baldwin Locomotive Works, 1889.

2032. *No. 1314.* Baltimore and Ohio Railroad locomotive. Class B-15, 4-6-0, 10-wheeler, 20 x 26 cylinders, 68-inch drivers, boiler pressure 190 pounds, total weight 141,200 pounds, tractive power 24,000 pounds. Built by Baldwin Locomotive Works, 1896.

2033. *No. 1312.* Baltimore and Ohio Railroad locomotive. Class B-14, 4-6-0, 10-wheeler, 21 x 26 cylinder, 78-inch drivers, 190 pounds boiler pressure, tractive power 23,400 pounds, total weight 145,200 pounds. Built by Baldwin Locomotive Works, 1896.

2034. *No. 1815.* Baltimore and Ohio Railroad locomotive. Class E-19, 15½ x 26 x 30 cylinders, compound Consolidation engine. Wooten firebox. Built by Baldwin Locomotive Works, 1900.

2035. *No. 4837.* Baltimore and Ohio Railroad locomotive. Class Q-7f, 26 x 32 cylinders, 2-8-2 Mikado type locomotive.

2036. *No. 7145.* Baltimore and Ohio Railroad locomotive. Class EL-5, 2-8-8-0 compound Mallet, cylinders 26 and 41 x 32, 58-inch drivers, 225 pounds boiler pressure, tractive power 108,500 pounds, total weight 491,300 pounds. Built by Baldwin Locomotive Works, 1919.

2037. *No. 353.* Baltimore and Ohio Railroad locomotive. Class D-30, 21 x 28 cylinders, 6-wheel switcher, U. S. R. A. standard. Built by Baldwin Locomotive Works, 1919.

2038. *No. 5242.* Baltimore and Ohio Railroad locomotive. Class P-6, 4-6-2 Pacific, 25 x 28, cylinders, total weight 288,600 pounds, tractive power 40,200 pounds, boiler pressure 200 pounds. Built by Baldwin Locomotive Works, 1922.

2039. *No. 6206.* Baltimore and Ohio Railroad locomotive. Class S-1a, 2-10-2 Santa Fe, 30 x 32 cylinders, 64-inch drivers, 220 pounds boiler pressure, total weight 436,510 pounds, tractive power 84,300 pounds. Built by Baldwin Locomotive Works, 1926.

2040. *President Washington No. 5300.* Baltimore and Ohio Railroad locomotive. Class P-7, 4-6-2 type, Pacific, 27 x 28 cylinders, 80-inch drivers, boiler pressure 230 pounds, tractive power 50,000 pounds, total weight 326,000 pounds. Built by the Baldwin Locomotive Works, 1927.

BALTIMORE AND OHIO LOCOMOTIVES AND CARS

Easel FF

2041. Multiple unit motor car equipped with G. E. 282–600-volt motors, type PC-10 control.

2042. Baltimore and Ohio 0440-E-180 4 G. E. 209 locomotives.

2043. Baltimore and Ohio typical steam train. Annadale, Staten Island.

2044. Baltimore and Ohio 150-ton electric locomotive consisting of two units.

2045. Staten Island Rapid Transit Multiple Unit motor-car equipped with 2 G. E. 282–600-volt motors.

2046. Baltimore and Ohio Railroad Class 0440–E–240-4 G. E. 209 C. 600-volt locomotives.

2060. Interior of Colonial Diner. Baltimore and Ohio *Capitol Limited.*

2061. Baltimore and Ohio Railroad, interior view of individual-seat passenger coach Class A-18.

2062. Interior view of Club Car, Baltimore and Ohio Railroad *Capitol Limited.*

2063. Interior view of Pullman Sleeper, Baltimore and Ohio Railroad *Capitol Limited.*

2064. Interior view of Pullman Sleeper, Baltimore and Ohio Railroad *Capitol Limited.*

2065. Interior view of Club Car, Baltimore and Ohio Railroad *Capitol Limited.*

2066. Interior view of express baggage car, Baltimore and Ohio Railroad.

2067. Colonial Diner, *Molly Stark*, Baltimore and Ohio Railroad *Capitol Limited.*

2068. Baltimore and Ohio Railroad Standard Passenger Coach, Class A-18.

2069. Pullman Sleeper, *Lake Gregory*, Baltimore and Ohio Railroad *Capitol Limited.*

2070. Pullman Sleeper, *Red Pine*, Baltimore and Ohio Railroad *Capitol Limited.*

2071. Pullman Observation Car, *National View*, Baltimore and Ohio Railroad *Capitol Limited.*

2072. Combination Club Car, *Capitol Home*, Baltimore and Ohio Railroad, *Capitol Limited.*

LOCOMOTIVES 1830–1893

Easel GG

301. *De Witt Clinton.* Mohawk and Hudson Railroad, 1831. Old print.

302. *South Carolina.* South Carolina Railroad, 1831. Old print.

303. *Phoenix*, South Carolina Railroad, 1831. Old print.

304. *West Point.* South Carolina Railroad, 1831. Old print.

325. Founders of the Baltimore and Ohio Railroad.

324. Patterson Viaduct, Baltimore and Ohio Railroad, 1830.

307. Portland Company, 1856.

308. Taunton Locomotive Manufacturing Company, 1858.

309. William Norris, 1856.

310. Cincinnati Locomotive Works, 1856.

630. *No. 198* coal and coke burning passenger engine, Baltimore and Ohio Railroad. Designed by Samuel J. Hayes.

313. Richard Norris and Son, 1855.

314. Richard Norris and Son, 1857.

315. Richard Norris and Son, 1855.

442. *No. 859 Director General.* 1893.

441. Hinkley and William Works, 1870.

317. *George W. Johnson, 1830.* The first locomotive built in Baltimore.

319. Knight Horse Locomotive, Baltimore and Ohio Railroad, 1829.

329. William Mason and Company, 1853.

330. William Mason and Company, 1853. Original drawing.

331. Seth Wilmarth, 1856.

369. Amoskeag Manufacturing Company, 1853.

555. *William Penn—1835.* Rebuilt 1841–1865. W. P. R. R.

565. Richard Norris and Son, 1855.

675. *France.* William Norris, America, 1843.

674. *America.* William Norris and Company, 1843.

320. Richard Norris and Son, 1854.

404. Baltimore and Ohio Railroad. Locomotives on the Main Stem and Washington Branch, during year ending September 30, 1850.

1175. Jersey Greenbook Perkins *No. 262.* Eight-wheel connected locomotive.

PASSENGER CARS—FREIGHT CARS—TRUCKS

Easel HH

338. Harlan and Hollingsworth Company. Passenger and freight cars and trucks—1860–61.

339. Harlan and Hollingsworth Company. Freight cars and trucks.

340. Harlan and Hollingsworth Company. Freight cars and trucks.

341. Harlan and Hollingsworth Company. Trucks—1840.

342. Harlan and Hollingsworth Company. Passenger and freight cars and trucks—1867–68.

343. Harlan and Hollinsworth Company. Passenger cars—1866.

344. Harlan and Hollingsworth Company. Trucks—1839.

345. Harlan and Hollingsworth Company. Freight cars and trucks.

346. Harlan and Hollingsworth Company. Freight and passenger cars—1863–65.

347. Harlan and Hollingsworth Company. Trucks—1836.

351. Harlan and Hollingsworth Company. Freight cars and hand car 1859, trucks 1865.

353. Harlan and Hollingsworth Company. Passenger and freight cars—1868–1869.

354. Harlan and Hollingsworth Company. Passenger car 1867. Trucks 1860–1866.

356. Harlan and Hollingsworth Company. Passenger and freight cars and trucks—1865–1866.

357. Harlan and Hollingsworth Company. Passenger and freight cars and trucks—1861–1863.

352. Manchester, Sheffield and Lincolnshire Railway, 1892.

355. Manchester, Sheffield and Lincolnshire Railway, 1892.

358. Manchester, Sheffield and Lincolnshire Railway, 1892.

LOCOMOTIVES AND CARS—1832–1885

Easel II

599. Rogers Ketchum and Grosvenor, 1848.

600. Drawing of English locomotive *Brother Jonathan*, with forward truck as substituted by John B. Jervis, 1832.

601. *John Bull.* Original Drawing. Mohawk and Hudson Railroad as altered in 1836 by Asa Whitney.

396. Original drawing for freight car on Mohawk and Hudson Railroad by Asa Whitney, 1833.

398. Harlan and Hollingsworth Company. Passenger car and trucks and dump car—1865-1866.

399. Original drawing of passenger coach for Mohawk and Hudson Railroad by Asa Whitney, 1834.

400. First car on New York and Hudson River Railroad, 1832. Built by John Stephenson.

401. Probably the first private car in United States. Built for President, Western Railroad of Massachusetts, 1842.

402. Passenger car. Baltimore and Ohio Railroad, 1830. Old print.

403. *Pioneer 1848.* Chicago and Northwestern Railroad. First locomotive in Chicago.

405. Baltimore and Ohio Railroad Company, 1862. Original drawing.

406. Baltimore and Ohio Railroad Company 8-wheeler. Built at Baldwin Locomotive Works, 1893.

407. Baltimore and Ohio Railroad Company 10-wheeler. Built by Baldwin Locomotive Works, 1893.

408. Danforth Locomotive and Machine Company, 1873.

410. Rodgers Locomotive Works, Patterson, N. J.

411. Rodgers Locomotive Works, Patterson, N. J.

412. Rodgers Locomotive Works, Patterson, N. J., 1891.

413. Monarch Parlor Observation Car. Built, 1885.

414. Cook Locomotive Works, 1863.

397. Car used for the transportation of flour on Baltimore and Ohio Railroad. About 1832.

416. James and Dougherty for Harlem Railroad, 1838. This engine had neither slide valves nor eccentrics. Original drawing by Samuel Dougherty.

417. H. R. Dunham and Company for Harlem Railroad, 1836.

418. Camden and Amboy Railroad. Built by Norris Brothers, 1851.

419. Philadelphia and Reading Railroad. James Millholland, 1863.

420. *No. 13.* New York, Lake Erie and Western Railroad, 1865.

421. Illinois Central Railroad Series. *Grant*, 1873. *Brooks*, 1875. *Mogul*, 1881.

422. James Millholland. Pennsylvania and Reading Railroad, 1859.

423. Norris Works, 1848. First locomotive in Wisconsin.

LOCOMOTIVES AND COUPLERS

Easel JJ

749. George Stephenson's letter to Timothy Hackworth—July 25, 1828. Timothy Hackworth's *Royal George* No. 5.

366. *General.* The famous war engine of the Western and Atlantic Railroad.

386. Roger's Locomotive and Machine Works, 1855.

1176. Ross Winans' Transportation engine, 1852.

349. Camden and Amboy Passenger Coach. Photograph of old lithograph of 1835.

647. Janney Coupler, closed. McConway and Farley Company.

886. *France.* Paris and Orleans Railway, 1892.

887. *England. No. 580.* Locomotive built by W. Adams for the London and South Western Railway, 1892.

669. *Austria.* Royal Locomotive Works. Designed and built by William Norris of America, 1847.

1177. A. R. A. Standard Coupler for Yoke Connection. National Malleable Casting Company.
1178. A. R. A. Standard Coupler for Key Connection. National Malleable Casting Company.
1179. A. R. A. Standard Coupler for Key Connection. National Malleable Casting Company.
1180. A. R. A. Standard Coupler for Key Connection. National Malleable Casting Company.
635. The Hinson Car Coupler Company.
648. Trojan Locomotive Coupler and Draw Casting.
646. Janney Coupler, open. McConway and Farley Company.
637. Pooley Coupler.
643. Trojan Passenger Coupler.
642. Buckeye Automatic Car Coupler.
634. The American Continuous Draw Bar.
633. The American Continuous Draw Bar.

PERMANENT WAY DEVELOPMENT 1676–1892

Easel Q

914. *England.* Evolution and Development of Permanent Way. Millet and Henry. Loire Railway, 1835.
Evolution and Development of Permanent Way. Stephenson and Vignoles, 1835.
France. Evolution and Development of Permanent Way. Paris and Poutoise Railway, 1836.
England. Evolution and Development of Permanent Way. London and Birmingham Railway. Stephenson, 1836.
915. Evolution and Development of Permanent Way.
America. Clark Fisher, 1888.
England. London and Northwestern Railway, 1889.
Midland Railway, 1889.
Queensland. Normantown Line, 1889.
916. *England.* Plate Rail, 1797.
Wyatt, Burhyns Quarry, 1802.
Surrey Railway Cast Iron, 1803.
Josiah Woodhouse on Common Roads, 1803.
917. *America.* Baltimore and Port Deposit, 1838.

England. Great Western Railway, 1838.
America. Baltimore and Ohio Railroad, 1838.
B. H. Latrobe, Compound Rail, 1841.
918. West Jersey Railroad, 1850.
England. Samuels Fish Car, 1850.
France. Great Northern Railway of France, 1853.
French substitute for cast iron chairs, 1853.
919. *England.* Single Way, 1676.
Double Way, 1700.
Outram Plate Rail, 1767.
Loughborough, Jessop.
920. *Wales.* Peny-darren Works, 1804.
Llannelly, Wales, 1808.
England. Lush and Stephenson, 1816.
Brunton and Shields, 1820.
921. *America.* Evolution and Development of Permanent Way.
America. Robt. L. Stevens, Hoboken, N. J., 1830.
Scotland. Garnkirk Railway, near Glasgow, 1831.
France. St. Etienne to Lyons, 1831.
St. Etienne to Lyons, 1831.
922. *America.* New Jersey Railroad, 1837.
Long Island Railroad, 1837.
Boston and Worcester Railroad, 1837.
Philadelphia and Reading Railroad, 1837.
923. *England.* Double Headed Rail, 1855.
Adam's Suspended Girder, 1855.
Adam's Suspended Girder, 1855.
Barlow's Saddle Back, 1856.
924. Great Western Railway, 1837.
England. Liverpool and Manchester Railway, 1837.
Liverpool and Manchester Railway, 1837.
Liverpool and Manchester Railway, 1837.
925. *America.* Long Island Railroad, 1837.
Long Island Railroad, 1837.
England. London and Birmingham Railway, 1836.
America. Albany and Schenectady Railroad, 1837.
926. *America.* Baltimore and Ohio Railroad, 1837.
Philadelphia and Reading Railroad, 1837.

England. London and Birmingham Railroad, 1837.
Ireland. Dublin and Kingston Railway, 1837.
927. Evolution and Development of Permanent Way.
America. Baltimore and Ohio Railroad, 1837.
Camden and Amboy Railroad, 1837.
Camden and Amboy Railroad, 1837.
Georgia Central Railroad, 1838.
928. Phoenix Central Railroad, 1856.
Adams and Erie Railway, 1857.
Phoenix Company, 1857.
England. Great Western Railway, 1857.
929. *Germany.* Rhine Railway, 1891.
France. Vanteren System, France, 1891.
Egypt. Egyptian Railway, 1891.
Spain. Bilbac and Las Arenas Railroad, 1891.
930. *India.* Midland Railway of India, 1890.
Holland. Post Tie, 1890.
Belgium. Central Railway of Belgium, 1890.
Germany. Elberfeld Railway, 1890.
931. *England.* Manchester, Sheffield and Lincolnshire, 1849.
Barlocos Half Chair, 1849.
America. Baltimore and Ohio Railroad, Mt. Savage, 1844. First rail rolled in America.
Baltimore and Ohio Railroad, 1848.
932. *South America.* Argentine Central, 1891.
America. Fisher Rail Joint Works, 1892.
Bargion Compound Rail, 1892.
Track Tank Baltimore and Ohio Railroad, 1892.
933. *England.* Evolution and Development of Permanent Way.
Losh Wilson and Bell, 1829.
America. Baltimore and Ohio Railroad, 1829.
England. Berkinshaw, 1820.
Liverpool and Manchester Railroad, 1828.
934. *America.* New York Central Railroad, 1855.
Ireland. Great Southern Railway of Ireland, 1854.
America. New York Central Railroad, 1855.
New York Central Railroad, 1855.

935. *England.* Great Northern Railway of England, 1855.
South Western Railway of England, 1855.
South Western Railway of England, 1855.
America. Phoenix Company, 1855.
936. New Castle and Carlisle Railroad, 1837.
England. Liverpool and Manchester Railway, 1837.
Liverpool and Manchester Railway, 1837.
London and Birmingham Railway, 1837.
937. *England.* Days Cast Iron Base Plant, 1835.
America. New Orleans Railroad, 1835.
France. St. Helens and Runcorn, 1836.
Barlow's Cast Iron Chair, 1835.
938. *America.* Baltimore and Ohio Railroad, 1837.
Providence and Stonington, 1837.
Boston and Providence, 1837.
New Castle and Frenchtown, 1837.
939. *England.* London and North Western Railway, 1855.
Canada. Great Western Railway of Canada, 1855.
America. Troy Union Railway, 1855.
Troy Union Railway, 1855.
940. *England.* Great Northern Railway of England, 1855.
Great Northern Railway of England, 1855.
Adam's Suspended Girder, 1855.
Adam's Suspended Girder, 1855.
941. *America.* Pennsylvania Railroad, 1875.
Pennsylvania Railroad, 1875.
Western Railroads, 1869.
New Jersey Railroad, 1860.
942. *England.* New Castle on Tyne, 1797.
Edge Rail, 1797.
Edge Rail, 1797.
Edge Rail, 1789.
943. *America.* Clarence Railway, 1835.
New Castle and Carlisle Railroad, Losh's Patent, 1833.
Baltimore and Ohio Railroad Stone Stringer and Strap Rail, 1833.
New Jersey Railroad, 1832.

BRAKE DEVELOPMENT

Easel R

England. Evolution and Development of Railway Brakes.

944. Types of car brakes used at New Castle Upon Tyne, 1630.

945. The Le Caan Brake, 1796.

946. The Sprag Brake, Primitive Type.

947. A Primitive Brake for Railway Waggons.

948. The Wooden Lever Primitive Type.

949. Early Type of Lever Brake, 1825.

950. Types of Locomotive Engine Tender Brakes, Fig. 1, 1827. Fig. 2, 1831. Fig. 3, 1832.

951. Types of Railway Carriage Wagon and Tender Brakes Figs. 1 and 2, 1831. Fig. 3, 1839.

952. Lever Type of Goods Wagon Brake, 1832.

953. Stephenson's Locomotive Steam Driver Brake, 1833. Used on one side of engine only.

954. Fig. 1 Hawthorne's Tender Brake, 1840. Fig. 2. Railway Carriage Brake, 1839. Fig. 3 Railway Carriage Brake, 1839.

955. Types of Railway Carriage Brake Gear, 1846.

956. The Creamer Brake, 1853. Cord pulled by engineer liberating coil spring attached to hand brake staff.

957. Michigan Central Freight Car Hand Brake, 1865.

958. The Loughridge Chain Brake, 1855. Continuous chain wound upon a shear and thrown into contact with engine.

959. The Westinghouse System Non-Automatic Air Brake, 1869. Commonly known as the Straight Air Brake.

960. The Smith Vacuum Brake, 1872. Commonly known as the Strait Vacuum.

961. *England.* The Westinghouse Non-Automatic Brake, 1869. Commonly known as the Strait Air Brake as applied.

962. *America.* The Westinghouse Plain Automatic Air Brake, 1872.

963 A modern type of foundation brake gear and standard for passenger fourwheel trucks, 1887.

964. Westinghouse Plain Automatic Air Brake, 1872. Applied to a train.

965. American Brake Company's Buffer Brake, 1884. Operated by the compression of the draw bars on the cars.

966. The American as applied to a consolidated locomotive. The American Brake Company.

967. Westinghouse System Quick Action Automatic Air Brake, 1887.

968 Westinghouse Quick Action Automatic Brake. Applied to a modern freight car.

969. Westinghouse Quick Action Automatic Air Brake, 1887. Applied to a train.

970. American Brake Company's Locomotive Engine Truck Brake, 1892. New type of brake gear.

1015. *America.* Evolution and Development of the Railway Brake, The Westinghouse System Quick Action Automatic with High Speed Brake Attachment, 1894.

1016. Evolution and Development of the Railway Brake. Early type of Wooden Brake Shoe used on passenger cars.

1017. Evolution and Development of the Railway Brake. The Smith Vacuum Brake, 1872. Applied to car.

2513. Engine and tender brake equipment 42″ x 48″. Westinghouse Schedule 6—E. T.

2514. Westinghouse Schedule U. C. Passenger Car Brake Equipment—42″ x 48″.

2515. Westinghouse Schedule U. C. Passenger Car Brake Equipment—42″ x 60″.

2516. Loughridge Straight Air Brake.

WHEEL DEVELOPMENT

Easel T

991. *America.* The process of manufacturing wrought iron center for steel tired car wheels. Half sections of wheels fitted with tires one by integral tire lock and the other by Mausell retaining rings and bolts.

992. *America.* The process of manufacturing wrought iron center for steel tired car wheels by the Boies Steel Wheel Company. Disc billets ready for treating and scrap iron from which forged.

993. The process of manufacturing wrought iron center for steel tired car wheels by the Boies Steel Wheel Company. Opposite sides of center rough bored.

994. Wrought Iron Center Steel Tired Car Wheels. The Boies Steel Wheel Company.

995. The process of manufacturing wrought iron center for steel tired wheels by the Boies Steel Wheel Company. Opposite sides of center finished for integral tire lock.

996. The American Steel Wheel Company.

997. Steel Tired Wheels—back. Ramapo Wheel and Foundry Company.

998. Steel Tired Wheels—front. Ramapo Wheel and Foundry Company.

999. Paper and Metal Center Steel Tired. Allen Paper Wheel Company.

1000. Paper and Metal Center Steel Tired. Allen Paper Wheel Company.

1001. Paper and Metal Center Steel Tired. Allen Paper Wheel Company.

1002. Section Steel Tire Wheel—full size. Ramapo Wheel and Foundry Company.

1003. Paper and Metal Center Steel Tired. Allen Paper Wheel Company.

2500. Chilled car wheel mold. Double plate design. American Railway Association.

2501. Pouring a chilled tread wheel. Temperature of iron 2400° to 2500° Fahrenheit. American Railway Association Specification.

2502. Placing hot wheels in annealing pits. Temperature 1400° to 1500° Fahrenheit.

2503. 750 pounds double plate chilled tread car wheel. Front and back view. Center sectional view. American Railway Association design.

2504. 750 pounds single plate chilled tread car wheel. Front and back view. Center sectional view. American Railway Association design.

2505. Forged and rolled steel car wheels. Ingot and bloom under blooming press.

2506. Forged and rolled steel car wheels. Bloom and blank under forging press.

2507. Forged and rolled steel car wheels. Blank under punching press.

2508. Forged and rolled steel car wheels. Wheel in rolling mill.

2509. Forged and rolled steel car wheels. Wheel under dishing or coning press.

2510. Forged and rolled steel car wheels. Wheel on cooling bed.

2511. Forged and rolled steel car wheels. Wheels being machined.

2512. Forged and rolled steel car wheels. Final inspection.

MISCELLANEOUS PICTURES

2074. Staten Island Electric Coach, built in 1925.

2080. Class N-12K, 50-ton Baltimore and Ohio Railroad steel hopper car, built in 1925.

2081. Class W-2a, Baltimore and Ohio Railroad, 70-ton four-door steel hopper car, built in 1926.

2082. Class W-2a, Baltimore and Ohio Railroad, 70-ton, four-door steel hopper car, built in 1926.

2083. Class M-27-A, Baltimore and Ohio Railroad, 40-foot 6 inch, all steel box car, built in 1926.

2100. Original Baltimore and Ohio Washington Station train announcing gong in use 1855–1905.

EXHIBIT TRACKS

Outside and Adjacent to the Hall of Transportation

Track Development

Ten sections, of track showing the development of rails and construction methods from 1830 to the present day.

Track No. 1. Representing the original main tracks of wood string and sleeper constructed between Baltimore and Ellicott Mills in 1830.

Track No. 2. Representing the stone sill construction in the original main tracks between Baltimore and Ellicott Mills, built in 1830.

Track No. 3. Track of the wood string and edge rail construction as built in the original main track between Relay and Washington in 1835.

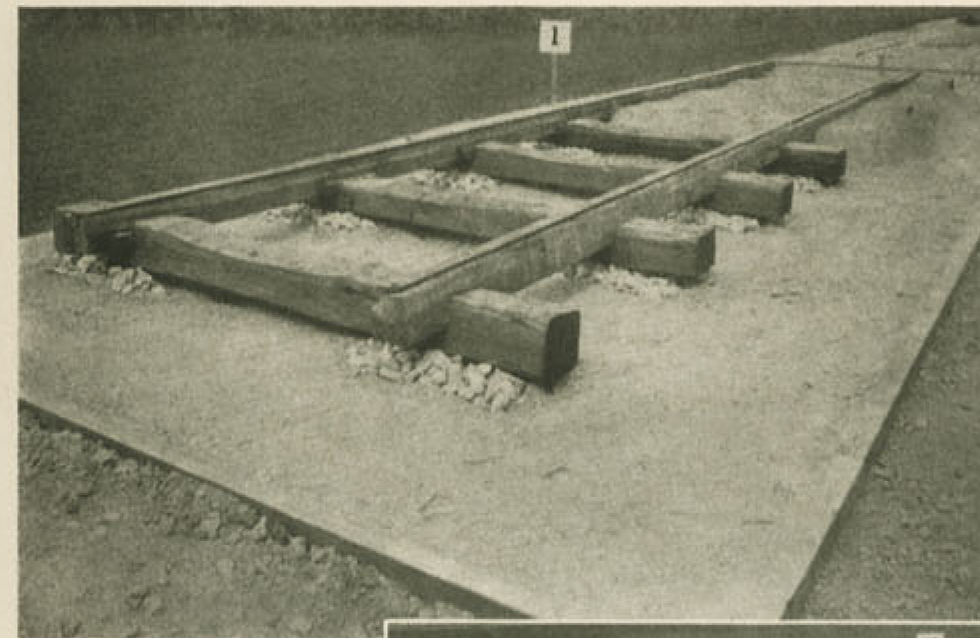
Track No. 4. Wood string and U-rail construction of the original main track as built between Harpers Ferry and Cumberland, 1841 to 1842.

Track No. 5. Cross tie and T-rail construction as built in the original main track between Cumberland and Wheeling, 1851 to 1852. The rail, of the Pearshaped type, was made of iron, and weighed about 60 pounds per yard. This was the first construction where the rail was placed directly on the cross ties, similar to present day practice.

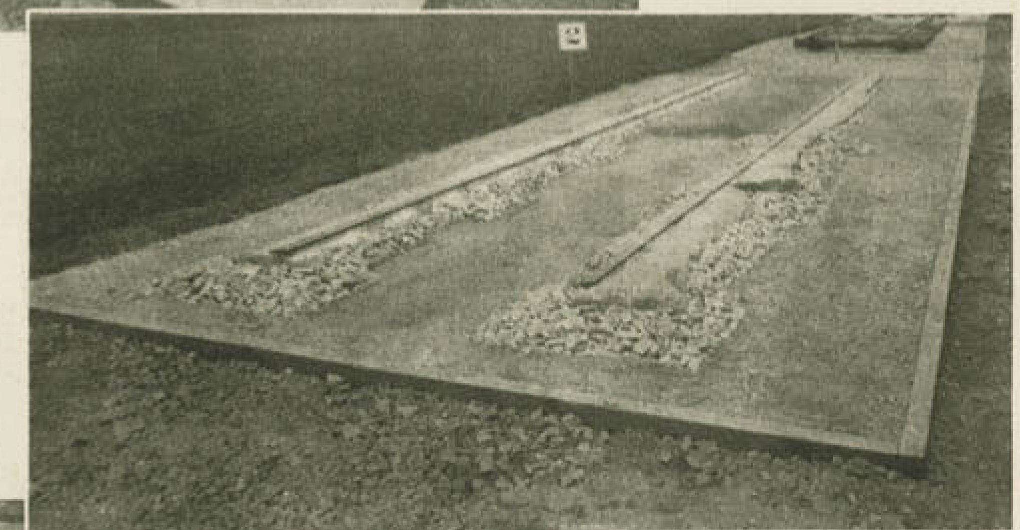
Track No. 6. Represents track built in 1869, which type of construction was used in the renewal of the former types of track. This construction is of the cross tie type with John Brown steel rail, 60 pounds per yard, which was first rolled in England and manufactured by the Sheffield Atlas Steel Company.

Track No. 7. Track laid with 67 pound rail on cross ties, similar to present day construction. This weight of rail was first used about 1874.

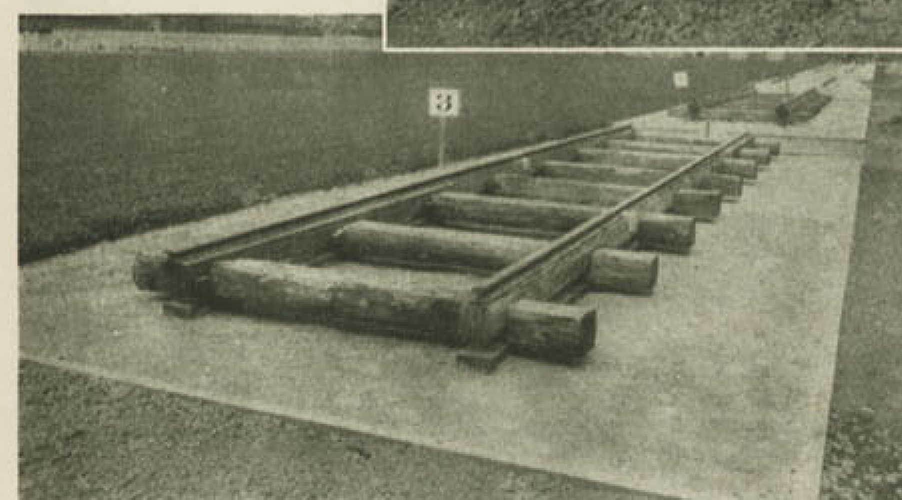
Track No. 8. Track laid with 85 pound rail on cross ties, similar to present day construction. First used in the relaying of old tracks and the construction of new about 1889.



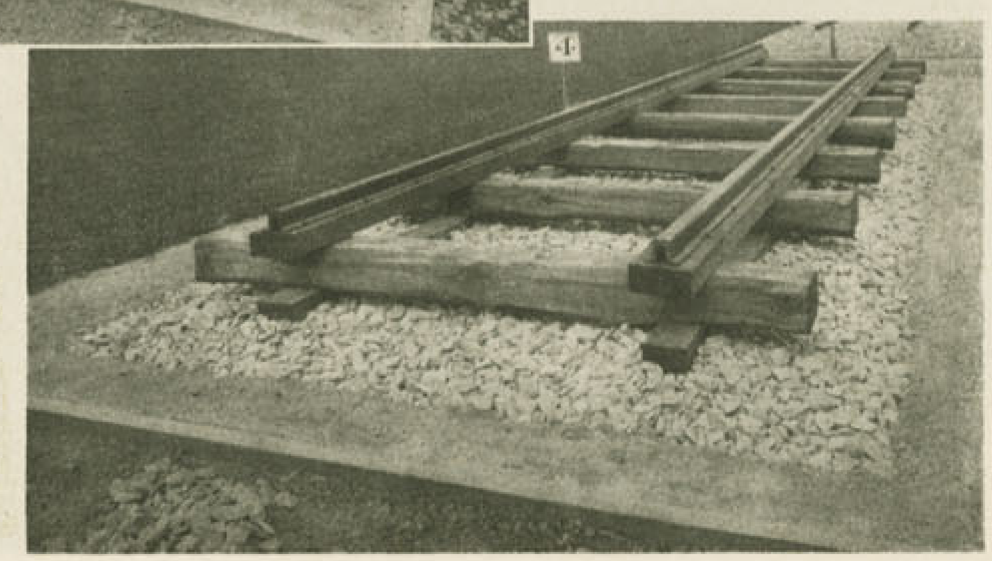
1. Wood String and Sleeper



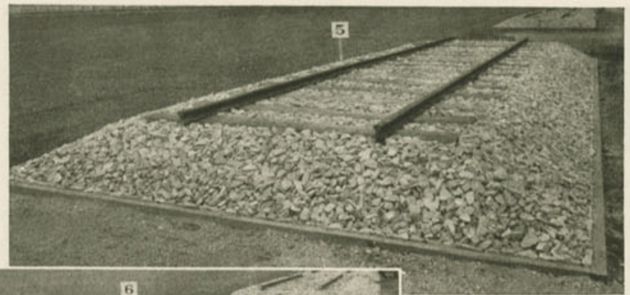
2. Stone Sill



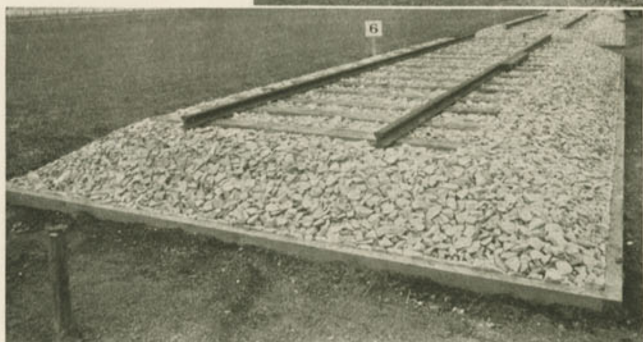
3. Wood String and Edge Rail



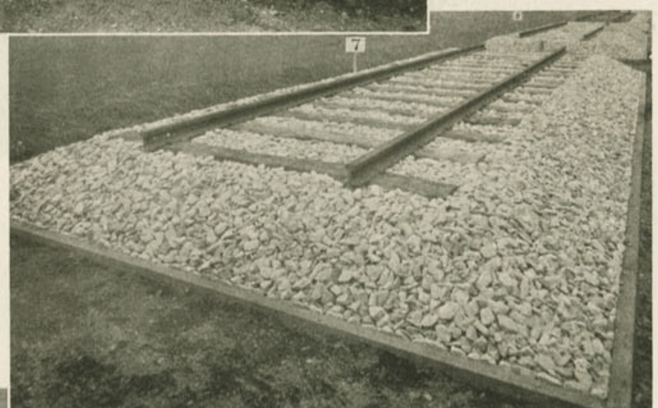
4. Wood String and U-Rail



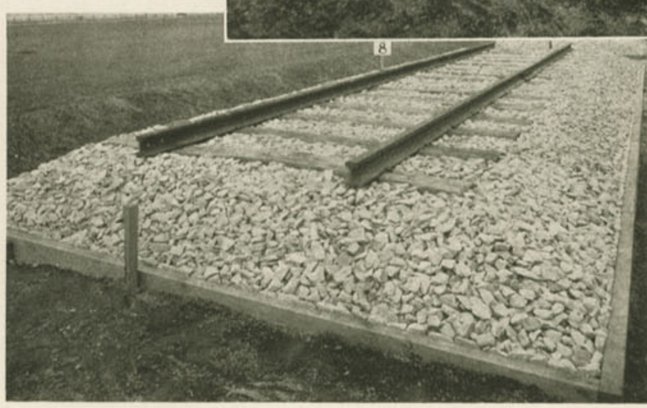
5. Cross Tie and Pearshaped Rail



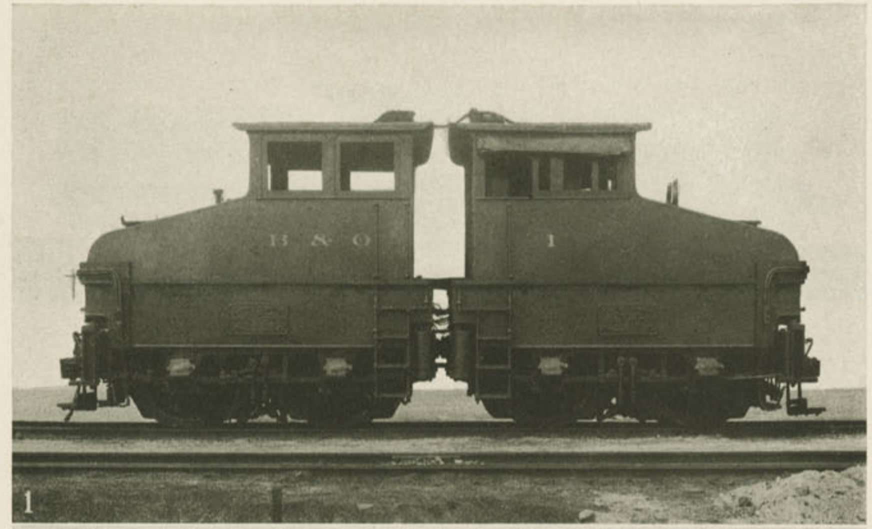
6. Cross Tie and John Brown Rail



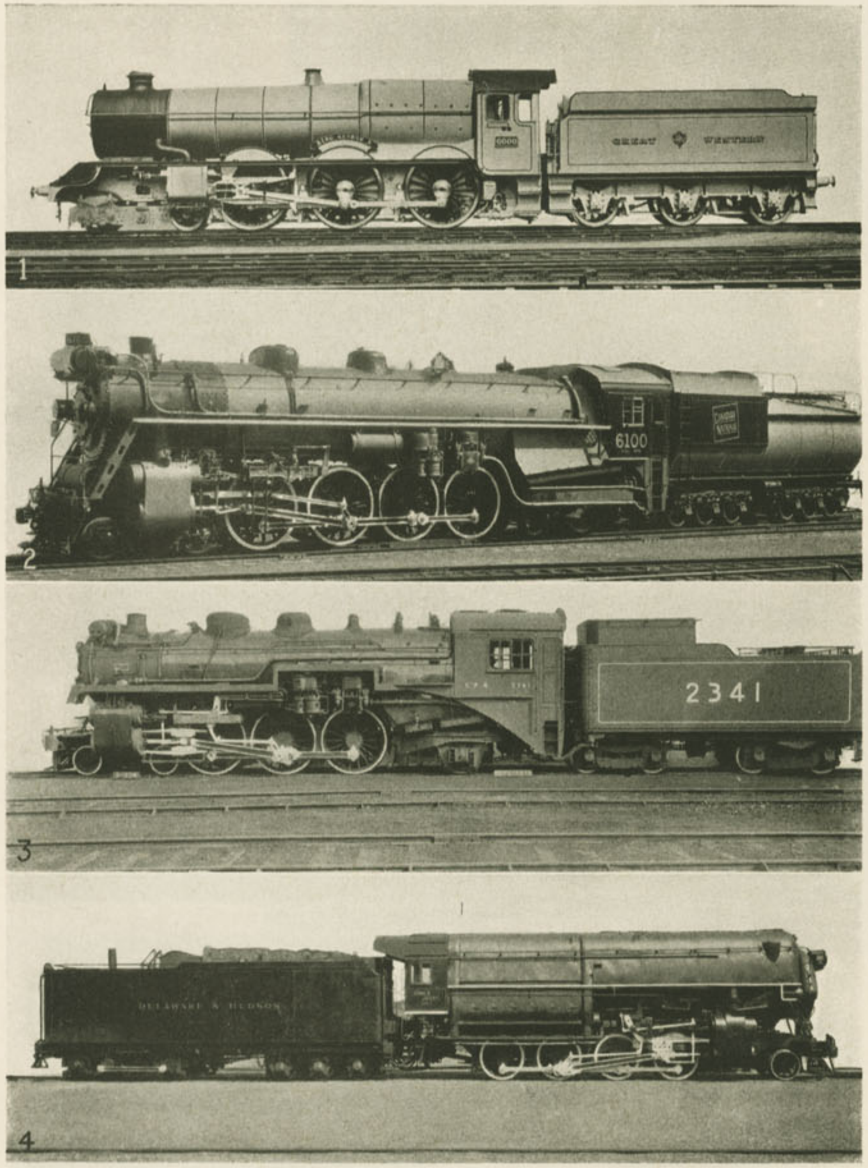
7. Cross Tie and T-Rail



8. Cross Tie and T-Rail



1. Baltimore and Ohio Electric Locomotive No. 1
2. Oil Electric Switching Locomotive
3. Gas Electric Motor Car



Modern Super Locomotives

1. King George V
2. Confederation
3. No. 2341, Canadian Pacific
4. John B. Jervis

Track No. 9. Track laid with 100 pound RB section rail on creosoted cross ties, similar to present day construction, used in renewal work and all new track in 1908. This section represents present day standard construction for this weight of rail.

Track No. 10. Track laid with 130 pound RE rail laid on creosoted cross ties, and shows the present standard of track construction. First used in 1921.

Locomotive Development

1837—North Star. English locomotive. One of the first engines on the Great Western Railway. 7-foot gage. 2–2–2 type engine designed by Daniel Gooch, locomotive superintendent of Great Western Railway and built by Robert Stephenson and Company. Made first trial trip New Year's Day 1838. Cylinders, 16x18 inches; drivers, 84 inches. Exhibited at Darlington Celebration 1926 on specially constructed truck, accommodated to the standard gage. This locomotive sent, together with the *King George V*, to be exhibited in the Baltimore and Ohio Centenary Exhibition.

1838—Rocket. Four-wheel locomotive built by Braithwaite and Company of London, England, for the Reading Railroad. Length, 15 feet 5½ inches; cylinders, 9 x 16 inches; wheels, 34 inches in diameter; wheel base, 4 feet 9 inches; grate area, 14.8 square feet; weight, 11.8 gross tons. The engine was named after George Stephenson's famous *Rocket.* It was placed in regular service on July 16, 1838, when the Reading Railroad was opened for passenger service from Reading to Norristown, Pa. It was retired in March, 1879, after having run 310,164 miles.

1851—Pioneer. Built by Seth Wilmarth of Boston. 2-2-2 type locomotive. Cylinders 12½ inches; stroke 16 inches; four cast iron wheels with chilled rims, 3½ feet in diameter, located 16 feet 6 inches from center to center. The *Pioneer* cost $6200 when built and is now owned by the Pennsylvania Railroad.

1838—Samson. Canada's first locomotive. The original engine. 0–6–0 type. Built in England by Timothy Hackworth, shipped to Halifax, Nova Scotia, in a sailing vessel. Its service was very satisfactory. Ran from Albion Mines (Stellarton) to loading ground Pictou Company, Nova Scotia, 1839. Had two vertical cylinders located at rear with center line directly over outside crank pin with connecting rod to the cylinder. Engine not in working condition.

1838—Nova Scotia Coach. A private car for directors of Coal and Iron Company, built by Timothy Hackworth, Soho Shops, England, and shipped by sailing vessel and delivered on rails at Halifax wharf. Original car.

1839—Albion. Original engine. Canada's second locomotive. 0–6–0 type. Built in England by Timothy Hackworth, shipped to Canada in a sailing vessel. Engine incomplete, details missing.

1855—General. Famous Civil War historical locomotive of the old Western and Atlantic Railroad, now part of the Nashville, Chattanooga and St. Louis Railroad. Built by the Rogers Locomotive Works in 1855. 4–4–0 type. Cylinders 15 x 22 inches; drivers 60 inches; weight 25 tons. During the Civil War in 1862 it was captured from the Confederate forces by Andrew's raiders of the Union Army at Big Shanty, engine being run towards Chattanooga, and being hard pressed, was abandoned near Graysville, about 90 miles away and retaken by the Confederate forces. The engine is now honored with a permanent home at the Union Depot at Chattanooga, Tennessee.

1927—King George V, No. 6000. English four cylinder (4–6–0) express locomotive, built by Great Western Railway Company at Swindon Works, England. Known as the "*King*" class. Four cylinder compound locomotive with inside cylinders connected to forward pair drivers and outside cylinders connected to second pair drivers. The most powerful express locomotive in Great Britain. Tractive power, 40,300 pounds; total weight, 89 tons; weight engine and tender, 135 tons 14 cwt. High pressure superheater boiler, conical barrel; copper firebox; Belpaire and toboggan type, without drums; substituting an open pipe at highest point of firebox; water supplied through top feed; Swindon type superheater; boiler pressure, 250 pounds. Drivers, 78 inches in diameter; cylinders, $16\frac{1}{2}$ x 28 inches: Walschaert valve gear placed between frames for inside cylinders, with rocking levers fitted through frames for outside cylinders. Forward pair front truck wheels equipped with outside journal boxes and rear pair with inside journal boxes to clear cylinders. Engine equipped with equalized vacuum braking on all coupled wheels, audible signal and automatic train control. Rigid wheel base, 16 feet

3 inches; total wheel base, 29 feet 5 inches. Six wheel tender, 4000 gallons capacity, equipped with water scoop. On trial trip ran from Paddington to Plymouth, a distance of $226\frac{3}{4}$ miles in 4 hours and 2 minutes without stop. First 155 miles was run at rate of 61.7 miles per hour with load of 410 tons.

1927—Confederation, No. 6100. 4–8–4 type of passenger locomotive with booster. Built at Kingston Shops of the Canadian National Railway, Canada, C. E. Brooks, chief of motive power. Engine designed for long runs and the purpose of the booster is to provide reserve power for heavy winter blizzard service. Height of engine, 15 feet 4 inches; width, 10 feet 11 inches; boiler pressure, 250 pounds; 73-inch drivers; cylinders, $25\frac{1}{2}$ x 30 inches; tractive power, 56,800 pounds; maximum tractive power with booster, 69,700 pounds. Straight top boiler; combustion chamber firebox; two thermit syphons firebox and one in combustion chamber; high tensile steel boiler plates of 70,000 to 83,000 pounds tensile strength used in construction of boiler to keep down weight. Special feature is four wheel trailer truck for carrying added weight of firebox. Equipped with Duplex D–1 stokers, Elesco K–39 feed water heaters with C.F. pumps, type "E" superheaters, American multiple throttles, Precision reverse gear and Security brick arch. Driving wheel base, 19 feet 6 inches. Capable of operating around 18 degree curves.

Heating surface flues	3814 sq. ft.
Heating surface firebox	315 sq. ft.
Heating surface syphon and arch tubes	117 sq. ft.
Heating surface—total	4256 sq. ft.
Superheating surface	1700 sq. ft.
Grate area	84.4 sq. ft.

	Weight in working order with booster	without booster
On drivers	232,000 pounds	230,000 pounds
Engine truck	65,000 pounds	65,000 pounds
Trailer truck	91,000 pounds	83,000 pounds
Total engine	388,000 pounds	378,000 pounds
Tender	260,000 pounds	260,000 pounds
Engine and tender	648,000 pounds	638,000 pounds

1926—Canadian Pacific Locomotive No. 2341. Class G–3–D Pacific 4–6–2 type. Built in Montreal Shops of the Canadian Pacific Railroad

Company. Similar in design to the No. 2300 series. The most powerful engine yet built for Canadian Pacific lines. The outstanding feature is the use of nickel steel alloy boiler plates with tensile strength of 70,000 pounds, for the purpose of increasing the pressure from 200 pounds to 250 pounds and not increase the weight of the locomotive. Grate area, 65 square feet; diameter first course, 79⅞ inch O.D.; wheel base, 67 feet 10 inches; length overall, 78 feet 9 inches. Cylinders, 23 x 30 inches; drivers, 75 inches.

Heating surface tubes	1950 sq. ft.
Heating surface flues	1031 sq. ft.
Heating surface arch tubes	33 sq. ft.
Heating surface firebox	258 sq. ft.
Total heating surface	3272 sq. ft.
Superheating surface	864 sq. ft.

Weight on drivers 184,000 pounds; total engine, 306,000 pounds; engine and tender, 497,500 pounds.

The engine met expectations as to fuel economy and it will haul ten to twelve cars at a speed of 80 to 85 miles per hour. Equipped with combined superheater heater and throttle and uses superheated steam in auxiliary equipment. Equipped with feed water heater.

1927—John B. Jervis, No. 1401. American locomotive. 2–8–0, cross-compound, *Consolidation* type freight locomotive with water tube firebox boiler to carry 400 pounds pressure. Built by the Schenectady plant of the American Locomotive Company from designs of the Delaware and Hudson Railroad Company, J. E. Muhlfeld, consulting engineer. Cylinders, 22¼ and 38¾ x 30 inches; drivers, 57 inches; maximum tractive power simple, 84,300 pounds; maximum tractive power compound, 70,300 pounds; maximum tractive power with booster, 88,300 pounds; weight on drivers, 295,000 pounds; total weight, 336,500 pounds; weight of engine and tender, 639,500 pounds.

Evaporating heating surface of tubes	788 sq. ft.
Evaporating heating surface of flues	1166 sq. ft.
Evaporating heating surface of firebox	1150 sq. ft.
Evaporating heating surface of arch tubes	67 sq. ft.
Evaporating heating surface total	3121 sq. ft.
Superheating surface	700 sq. ft.
Grate area	82 sq. ft.

Side of firebox consists of multiple rows of vertical water tubes 2½ inches in diameter expanded into top and bottom drums. Back head and throat sheets are parallel straight sheets. Drums carried with a flat backhead and rear tube sheet with 9-inch water leg and flanged to receive the bottom and top drums and extending through tube sheets to center of boiler where they are secured with a saddle to the boiler shell. The brick arch is carried on 6 tubes from the back water leg to the backhead with full brick arch separating the firebox into two compartments, causing the products of combustion to circulate through the bank of vertical tubes at the side of the firebox.

No. 1112. Western Maryland Class 12–54-f freight locomotive. Decapod, 2–10–0, type with 30 x 32-inch cylinders; driving wheels, 61 inches; boiler pressure, 225 pounds; tractive power, 90,000 pounds; weight of engine, 419,280 pounds; total weight of engine and tender, 835,200 pounds. The locomotive is equipped with Type A superheater, stoker, power reverse, and air brake on all driving and tender wheels, with two 8½-inch cross-compound pumps. Features of unusual size are: tender, 22,000 gallons water capacity; 30 tons coal capacity; average load per driving axle, 77,360 pounds.

1927—No. 5200. New York Central Class 464-S-343. 4-6-4 locomotive. Cylinders, 25 x 28 inches; driving wheels, 79 inches in diameter; boiler pressure, 225 pounds; tractive power of engine 42,000 pounds; tractive power of booster, 10,900 pounds; weight of engine, 343,000 pounds; weight of tender 212,200 pounds; total weight, 646,200 pounds.

1926—No. 3877. Pennsylvania Class K4s. 4-6-2 type locomotive. Cylinders, 27 x 28 inches; drivers, 80 inches in diameter; boiler pressure, 205 pounds; tractive power, 441,460 pounds; weight of empty locomotive, 274,500 pounds; weight in working order, 308,890 pounds; weight of empty tender, 75,500 pounds; weight of loaded tender, 212,725 pounds.

1927—Baltimore and Ohio Locomotive No. 2024. Class B–18ca. Modernized 10-wheel, heavy, local service passenger locomotive. New piston valve; 21 x 28 inch cylinders; outside steam pipes; 70-inch driving wheels; 200 pounds boiler pressure; 30,000 pounds tractive power; total weight, 173,400 pounds.

1924—Baltimore and Ohio Locomotive No. 5039. Class P–1c 4–6–2, passenger locomotive converted from the Mikado type. Outside steam pipe, 26 x 28 inch cylinders with piston valve; 74-inch drivers; new frames; Walscheart valve gear; 205 pounds boiler pressure; 44,600 pounds tractive power; total weight, 299,000 pounds.

1920—Baltimore and Ohio Locomotive, No. 4400. Class Q-4, latest type of Mikado, 2–8–2 type, designed by George H. Emerson, and built by the Baldwin Locomotive Works. Cylinders 26 x 32 inches; drivers, 64 inches; boiler pressure, 220 pounds; tractive power, 63,200 pounds; total weight, 327,400 pounds.

1926—Baltimore and Ohio Locomotive No. 6200. Class S-1a, Santa Fe type (2–10–2). A development of the Mikado type by addition of another pair driving wheels for heavy mountain freight service. This locomotive built by Baldwin Locomotive Works for the Baltimore and Ohio, George H. Emerson, chief of motive power and equipment. Cylinders, 30 x 32 inches; drivers, 64 inches in diameter; tractive power, 84,300 pounds; boiler pressure, 220 pounds; weight on drivers, 347,230 pounds; total weight, 436,500 pounds; weight engine and tender, 734,900 pounds.

1927—Baltimore and Ohio Locomotive No. 4045. Q-1x. A water-tube firebox boiler locomotive and tender equipped with auxiliary engine, designed by George H. Emerson, for applying to original class Q-1 *Mikado* locomotive. Boiler pressure, 250 pounds; weight on drivers, 242,000 pounds; total weight of engine, 326,000 pounds. Tractive power of engine, 60,960 pounds; tractive power of auxiliary engine, 15,475 pounds; total tractive power, 76,435 pounds. Heating surface of firebox, 603.2 square feet; total heating surface, 3457.2 square feet; superheating surface, 842 square feet. The firebox consists of a double row of 2½ inch water tubes extending from a mud ring manifold to overhead steam drum carried in a double plate tube sheet, and double plate back head braced with screw stay-bolts. The grate area is 73.5 square feet.

1926—Philip E. Thomas—No. 5501. Mountain type, Class Ta, Baltimore and Ohio locomotive, designed by G. H. Emerson and built at Mount Clare. Cylinders, 30 x 30 inches; drivers, 74 inches in diameter; boiler pressure, 220 pounds; tractive power, 68,200 pounds; weight on drivers, 275,000 pounds; total weight, 400,000 pounds; weight locomotive and tender, 659,000 pounds.

1927—President Washington—No. 5300. Baltimore and Ohio locomotive, Class P-7, 4–6–2 Pacific type, high speed locomotive of the President series. Designed by G. H. Emerson, built by the Baldwin Locomotive Works, for Washington–New York heavy passenger service. Cylinders, 27 x 28 inches; drivers, 80 inches; boiler pressure, 230 pounds; tractive power, 50,000 pounds; weight, 159 tons; weight engine and tender, 270 tons. Engine equipped with Walschaert valve gear, Westinghouse air brake and signal, steam heating system, Superheater Company's superheater, power reverse gear, stoker, Nicholson syphon, automatic train control.

Grate area	70.3 sq. ft.
Tube heating surface	3448 sq. ft.
Firebox, including syphon	390 sq. ft.
Total heating surface	3838 sq. ft.
Superheating surface	950 sq. ft.

The tender has a water capacity of 11,000 gallons, 17½ tons coal, fitted with water scoop.

1895—Baltimore and Ohio Electric Locomotive No. 1. 0–8–0 type. First electric locomotive operating on a steam railroad. Built by the General Electric Company, Schenectady, N. Y. Weight, 98 tons. Installed in the year 1895 for operating in the Baltimore and Ohio Belt Line tunnel, Baltimore, Md., between Camden Station and Waverly, a distance of about 3½ miles, over an ascending grade of 2 per cent, for hauling passenger trains ahead of the idle steam locomotive. Locomotive originally operated by overhead trolley and later changed to third rail system, which electric operation has continued up to the present. First official dispatchment shown hereon:

TELEGRAPHIC TRAIN ORDER NO. 28

Superintendent's Office, July 1st, 1895

To—C & E Motor No. 1 DX

Motor No. 1 will run extra from Camden Sta. to North Ave. and return to Camden Sta.

C. C. F. B.

Operator Mullinix.

1927—Baltimore and Ohio Oil Electric Switching Locomotive No. 6033. A 100-ton locomotive manufactured by the Ingersoll Rand Company, the American Locomotive Company and the General Electric Company. Two 300-horsepower oil engines drive two electric generators which in turn deliver current to four motors, one of which is geared to each of the axles, making all of the wheels driving wheels. Because of this arrangement the locomotive is able to exert a maximum tractive effort of 60,000 pounds, and combines the high efficiency of the oil engine and the notable tractive power of the straight electric locomotive.

Passenger Car Development

1859—No. 9. The First Pullman Sleeping Car. This earliest sleeping car of the Pullman Company is about 44 feet long, and 6 feet high inside, with a flat roof. Four wheel trucks with iron wheels and hunks of rubber to assist the meager springs of that day, support the car. The narrow, one-sash windows do not seem designed to keep out much dust, nor were the candle lamps conducive to reading at night.

Berths, braced by stanchions, and raised and lowered by pulleys, form a shelf of fair width that clung to the flat deck during the day. Bedding was stored in one end section. Curtains hung before and between the beds. There was no linen. A blanket, mattress and pillow constituted the bed equipment.

Heat was provided by two stoves, and filled wood boxes furnished the fuel. Toilet facilities were at each end of the car, but washing was performed in the open, in a tin basin. It is assumed that a roller towel was used.

No porter nor Pullman conductor manned No. 9. The railway conductor handled the tickets, and the brakeman made the beds. The first trip of the first Pullman sleeper was made on the night of September 1, 1859, from Bloomington, Illinois, to Chicago, over the Chicago and Alton Railroad.

Entertainment Car. This car is 82 feet long and has a 12 foot section in one end devoted to a gymnasium and shower bath. The recreation hall is 38 feet long; the barber shop, 9 feet, 3 inches. The library-lounge takes up the remaining 10 feet of space.

The recreation hall has a seating capacity of forty-nine persons, and fifteen couples can dance in it with ease. It is used for lectures, concerts, and motion pictures as well.

The gymnasium equipment includes a mechanical horse, a punch-bag, medicine ball, chest weights and rings. Adjacent are four lockers, toilet room and shower bath. The library-lounge contains a writing desk, seats, book table and shelves with space for more than a hundred books.

This car was built in 1926 by the Pullman Company for use by Raymond and Whitcomb in high-grade, long distance railroad tours in North America. It is aimed to provide for the railroad traveler something of the luxury that he finds in the highest type of trans-atlantic liners. Indeed, the trips in which it ordinarily is employed, have been called "land cruises."

Individual Seat Coach—A-19. An all-steel, 70-foot coach, with individual seats for 76 passengers. Six-wheel trucks; commonwealth cast steel, 36-inch steel wheels; weight, 152,800 pounds. Metal window sash, with the latest ventilating arrangement whereby the passenger may obtain air without an accompanyment of dust, cinders or rain. Ceiling fans; men and women's lavatories and toilets; semi-indirect lighting fixtures; Geissel sanitary drinking water containers. The car is also luxuriously upholstered in blue velour, harmonizing with the general scheme of its decorations.

Combination Passenger and Baggage Car—D-15a. An all steel 70-foot car with a 28-foot, 6-inch baggage compartment and seating capacity for 48 persons. Six-wheel commonwealth cast steel trucks, 36-inch steel wheel; weight, 154,500 pounds. The passenger seats are of mahogany and upholstered in leather; the lighting is accomplished by semi-indirect electric fixtures. Acetylene equipment is provided for use in case of accidents.

Freight Car Development

American Railway Express Refrigerator Car. This car, of the very latest type for transporting fruits, meats and other perishable products, is 50 feet long, with a bunker capacity for 11,550 pounds of ice, and a gross carrying capacity of 60,000 pounds.

The icing of these cars while en route is performed by means of hatches on top of the car. The car contains what is termed a "false floor" or floor rack which permits the shipments to be loaded with crushed or lump ice directly above the contents and keeps the water from the melting ice from damaging the portion of the shipments next to the floor. Water from the melting ice finds its way from the bunkers through the drips at the bottom of the car.

Merchants Despatch Refrigerator Car. A steel underframe ventilated refrigerator car, for the transportation of fruits, dressed meats, vegetables, and other perishable merchandise. It has an inside length of 33 feet 2 inches; width,8 feet 4 inches; height, 7 feet, 7 inches. The carrying capacity of the car is 70,000 pounds, and it has a cubic capacity of 2096 cubic feet, with bunker ice capacity of 11,500 pounds. Its construction conforms to, and in some particulars exceeds, the requirements of the United States standard refrigerator car.

Fruit Growers Express Refrigerator Car. This car has a steel underframe, with wood superstructure. Its ice compartments of the full basket type are arranged at each end for full icing of 9600 pounds of chunk ice. The car has a capacity of 80,000 pounds, and its loading dimensions are: length, 33 feet 2¾ inches, width 8 feet 4 inches, and height 7 feet 8 inches.

The Fruit Growers Express Company is owned and operated by fourteen railroads operating east of the Mississippi river for the transportation of fruits, vegetables, dairy products, poultry, dressed meats and other perishable products. On December 31, 1926, it had 17,910 refrigerator cars in operation. It maintains icing facilities at convenient points along its lines, as well as repair shops of its own for the upkeep of its cars.

Baltimore and Ohio Railway Post Office Car No. 48. Standard type, 60 feet long, and built in accordance with the United States Post Office Department specifications. The facilities provide 744 letter boxes; adjustable racks to accomodate 160 sacks for second and third class mail; 50 boxes for the separation of paper mail, giving a total separation of 954 letters and papers; storage space for sacks and pouches, with stanchions so arranged as to permit of their being kept apart for connecting railroad lines, cities and terminals.

The use of the Railway Post Office car, permitting of the separation and distribution of mail en route, contributes to a large degree in expediting the delivery of mail. In many instances, mail destined to cities is distributed in these cars to letter-carrier routes, so that when such mail reaches a given post office, further sorting is unnecessary, thereby enabling quick delivery to addresses.

Express Car. All-steel, 70-foot, express car of 50,000 pounds capacity, in charge of a regular American Railway Express messenger. The car is set up to represent a Baltimore to Cincinnati express messenger car as it is operated every day, so that the manner in which express shipments are handled en route may be readily understood. The car is equipped with a stationary fire-and-burglar-proof safe as well as the portable safe and kit-box used by the messenger. Arranged about the car are packages, boxes, crates, barrels, bales and other shipments of every conceivable character, containing merchandise of every description, including perishable commodities, destined to points on or adjacent to the Baltimore and Ohio Railroad, from Baltimore to St. Louis.

Express Horse Car No. 741. 74 feet, 11 inches long, construction of steel, with steel stall partitions, and a total capacity of twenty-four horses. It has the highest type of ventilation, is electrically lighted and steam heated, typifying the most modern equipment for the transportation of horses. It is used frequently for transporting valuable thoroughbred animals to and from the race tracks on the Baltimore and Ohio lines. Doors of open-end design permit of the car being also used for the movement of automobiles, airplanes and other large shipments.

Milk Tank Car. The milk tank car is in effect two large thermos bottles of 3000-gallons capacity each, made of steel, glass-lined, thoroughly insulated, and equipped with agitating, temperature-recording and regulating devices. It will carry three times as much milk as a regular refrigerator car filled with cans, and so enables the shipper to route fewer cars into his plant, an important factor in a large dairy receiving from 40,000 to 50,000 gallons daily. In terms of refrigerator cars loaded with cans, this would mean approximately twenty cars, but using the bulk system, with glass-lined tanks, only six or seven cars would be required.

The milk tank car also cuts down the time required for unloading because the milk can be pumped from the tank, whereas unloading cans is a time-taking task. The improved quality of the milk delivered in glass is due to the fact that milk shipped in tank-cars loses less than two degrees in temperature during warm weather, while in winter months a uniform temperature is maintained that prevents freezing.

Tank Motor Truck. An accessory unit to the tank car which collects the milk at receiving stations not directly situated on a railroad line, and brings it to the railroad, where it is in turn picked up by the tank car. It is also used in the city to transport the milk from the terminal to the plant.

The Baltimore and Ohio Railroad placed the first milk tank car in service over its lines on August 31, 1921. It is now a common type of transportation vehicle and is used by leading dairies in many cities. Both the milk tank car and the truck tank are manufactured by the Pfaudler Company, at Rochester, New York.

Motor Coach Development

1927—Oil Electric Motor Car. Built for the Canadian National Railway by William Beardmore & Company Ltd., of Glasgow. The car is 73 feet long, and is equipped with a six-cylinder Diesel engine, arranged in line. Of 8¼-inch bore by 12-inch stroke, they develop 300-horsepower at 750 revolutions per minute. The electrical equipment consists of a 198-k.w. 300-volt d.c. 600-ampere generator. It is compound-wound and is mounted on the same bedplate with, and rigidly connected to, the engine. On the same shaft as the generator is mounted a 5.6 k.w. 64-volt auxiliary generator.

The balance of the electrical equipment consists of two 569C4, 600-volt, 215-horsepower railway motors, mounted on the leading truck and connected through helical gears at a 20:59 ratio. An 84-volt M. V. A. 17 Exide Ironclad battery is carried under the rear part of the floor from which it is suspended in a steel battery box. This battery furnished a starting circuit for driving the generator as a motor and is charged from the auxiliary generator when its voltage is higher than the battery voltage. The engine and the fly-wheel together weigh approximately 6900 pounds and the car itself with full equipment about 63 tons. The fuel oil is delivered to the engine from a 150-gallon tank under a pressure of from 8,000 to 10,000 pounds to the square inch. Lubricating oil is forced to all working bearings at 40 pounds pressure, and is air cooled; in the sump. The engine itself is water-cooled. It is capable of a speed of 60 miles an hour.

The interior of the car is divided into four compartments providing space for baggage, a smoking-room and general passenger accommodations, as well as a 16-foot engine room. There are seats for thirty-seven passengers, these being so arrranged that three people can sit on one side of the car and two on the other.

1927—Gas Electric Rail Motor Car. A 60-foot Baltimore and Ohio all steel car with a capacity of 71 passengers, driven with a gasoline engine of 250-horsepower direct connected to 160-kilowatt, 600-volt d.c. generator, driving two 200-horsepower motors mounted on the front truck. The car is equipped with air brakes and all Interstate Commerce Commission safety devices. It has a maximum operating speed of 60 miles an hour on level track without the train. It was built for local main line service for handling one or two trailer cars.

Train-Side Motor Coach. Operated by the Baltimore and Ohio in transporting passengers from its stations in New York, Brooklyn, Elizabeth (N. J.) and Newark (N. J.) to its railroad terminal in Jersey City. With a seating capacity of twenty-three, these coaches adhere to the regular parlor coach type, with a special partition at the rear for hand baggage, which is handled by the railroad attendants and deposited aboard the train, or at the designated station. Powerful motors, bumpers of the heavy spring type, and luxurious appointments, provide a maximum of riding comfort.

Agricultural Demonstration Special Train

Equipment used in conducting soil improvement, better dairy use and livestock improvement work.

Exhibit Car. Herein special exhibits are installed, the subject matter being in keeping with the lecture program and changing with each special train, according to the nature of the work. These exhibits are prepared by the railroad and outside cooperating agencies, such as the United States Department of Agriculture, State Agricultural colleges and others. In addition, the latest bulletins on the subject under discussion are distributed free of charge to farmers visiting the special train where attendants are in charge to answer questions on farm problems.

Lecture Car. In this car lectures on important agricultural matters are delivered by railroad and agricultural college representatives. Farmers are invited to ask questions, farm problems are discussed fully to the advantage of both the farmers and the railroad serving them. From twelve to fifteen weeks each year are devoted to agricultural demonstration special trains.

Livestock Exhibit Car. Herein purebred dairy bulls, purebred rams and etc., are carried and offered for sale to farmers at cost. The animals are carefully selected from only accredited herds and are of such quality as will greatly improve any average farm herd or flock. These purebred sire special trains have placed in the hands of farmers since 1923 a total of 753 purebred animals, of which 611 were males (sires) and 142 females (dams).

Platform Demonstration Car. Cow demonstrations and demonstration treatments for stomach worms and other ailments are conducted by livestock specialists on this platform car. Farmers considering the purchase of animals from the train also have an opportunity to examine them to better advantage on this car. In extremely hot weather the lecture program is also conducted from this platform car, which is equipped with microphone and amplifier for carrying the speaker's voice to those far removed from the speaker.

The Capitol Limited

President Washington—No. 5300. Class P-7, 4-6-2 Pacific type high speed locomotive of the President series designed by George H. Emerson and built by the Baldwin Locomotive Works for heavy passenger service. Cylinders 27 x 28 inches; drivers 80 inches; boiler pressure 230 pounds; tractive power 50,000 pounds; weight 159 tons; weight of engine and tender 270 tons. Equipped with Walschaert valve gear, Westinghouse Air Brake and signal, steam heating system, Superheater Company's superheater, power reverse gear, stoker, Nicholson syphon, automatic train control.

Tender has a water capacity of 11,000 gallons, 17½ tons coal capacity, fitted with water-scoop.

Grate area	70.3 sq. ft.
Tube heating surface	3448 sq. ft.
Firebox, including syphon	390 sq. ft.
Total heating surface	3838 sq. ft.
Superheating surface	950 sq. ft.

Equipment

Club Car. An all-steel car equipped with a baggage compartment, showerbath, barber shop, card room, and large observation room furnished with leather covered chairs and sofas, tables, reading lamps and writing desk. A Japanese valet, a train secretary and other special attendants for service to passengers.

Twelve-Section Drawing Room Car. Accommodating twenty-four persons in twelve sections, and one drawing room suitable for three people. Large lavatories for men and women. An all-steel car with the interior finished in walnut with brown upholstery. Lighted by electricity with modern standard lamps and fans.

Ten-Section Compartment Car. Similar to the twelve-section car, with the exception that twenty people are accommodated in the open sections, two each in the two compartments, and three in the drawing room.

Dining Car. Of Colonial design, accommodating thirty-six people. Every detail of the car and its fittings harmonize with the scheme of Colonial decoration. It is finished in cream white tone, and the chairs are upholstered with blue hair cloth. The lighting fixtures and the design of the large windows are also Colonial. The kitchen as well is enameled in white.

Observation Car. Designed with a large observation platform and observation room. The latter is equipped with desk, writing materials, and telephone connection and is furnished with comfortable chairs and lounges of mahogany. There is a separate lounge room for ladies.

THE TRAFFIC BUILDING

Locust Point Grain Elevator

Scale model of the plant and equipment of the Baltimore and Ohio grain elevator, at Locust Point, Baltimore, built by P. L. Keyes.

Placed in operation in September, 1924, the Locust Point Grain Elevator, was erected following a thorough study of the leading installations in the United States and Canada and many original investigations. Due to its modern construction and operating practice it permits the continuous handling of the various grain-handling units without interference with each other, and is one of the most efficient and rapid grain operating plants in the world.

The shipping of grain to vessels loading at eight different berths on Piers No. 6 and No. 7, over a gallery system of 2500 feet, to the most distant berth, is possible at the rate of 150,000 bushels an hour, while cars may be unloaded at the same time over the four automatic dumpers, at an average of eight minutes a car on each dumper, or a total of 60,000 bushels an hour.

Six grain cleaning machines remove dirt and other foreign material at the rate of 40,000 bushels an hour. Grain driers, machines for clipping oats and barley, and giant washing machines, which reclaim grain infected with smut, are parts of the installation. The washer has a capacity of 1000 bushels an hour.

Grain in transit for the various handling requirements is carried at the rate of 800 feet per minute, over a total of 10½ miles of belting, by the elevator equipment in the elevator and galleries.

The total storage capacity is 3,800,000 bushels. Space has been reserved and provision made in the design, however, which will permit the construction of storage tanks with an additional capacity of 6,000,000 bushels, ultimately making the Locust Point Elevator the largest in the world.

Every safeguard known, many of which were developed by investigations made during the preparation of the design of the plant, have been used to protect the property not only from fire, but from dust explosion hazards. The removal of dust from the elevator by

air suction to a dust house, is the most complete and efficient system known. The entire plant is constructed of fire resistive materials, and particular care exercised in the design of motors, machinery, etc.; to guard against sparking and overheating. A complete fire alarm system connects with the Baltimore City Fire Department, and fire extinguishers are located at all points of hazard.

Tube conveyors for handling orders, up-to-date signal systems, and a complete, independent telephone installation, control and ensure the rapid handling of the grain.

The plant is electrically operated with motors and other equipment especially designed for elevator work. There are 148 motors with a total horse power of 7410½. This power is supplied through two banks of transformers, totalling 4200 K.W.

The *yard* has a capacity of 521 cars, which are pulled into the unloading shed, and when unloaded drop out by gravity at the other end of the elevator, ready for classification and movement to reloading points.

The *workhouse*, in which the major portion of the grain handling machinery is installed, is a reinforced concrete structure, 61 feet wide, 240 feet long, with a height of 208 feet, above track level. It has 99 bins with a total storage and handling capacity of 800,000 bushels. In this building are the 20 elevating legs for handling grain, the 2500-bushel capacity scales, (the largest at present developed), and the special machines for handling and treating grain.

The *grain drier* is in a building adjacent to the workhouse 31 feet wide, 144 feet long, and 99 feet high. It is equipped with eight driers and has a storage capacity of 64,000 bushels. It is the second largest drier in the country.

The *storage house* is 209 by 225 feet, with a capacity of 3,000,000 bushels. The grain is stored in 182 cylinder tanks of 14,000 bushels capacity each, and 153 interspace bins of 3500 bushels capacity each. A Zeleny thermometer system connected with each bin records the temperature of the grain in the bin at each 5-foot level, and makes possible constant supervision of the condition of the grain.

The *galleries* contain six 42-inch wide belts to the head of the piers. There are four belts on Pier No. 7, and the same number on Pier No. 6. On Pier No. 7 full grain cargoes are loaded and on Pier No. 6 both grain and general cargoes are handled at the same time.

The *marine tower* for the unloading of the small Chesapeake Bay steamers, which carry grain to Baltimore from bay points, is located at the end of Pier No. 7. By air suction it unloads at the rate of 4,000 bushels an hour, the average bay boat not containing over this quantity.

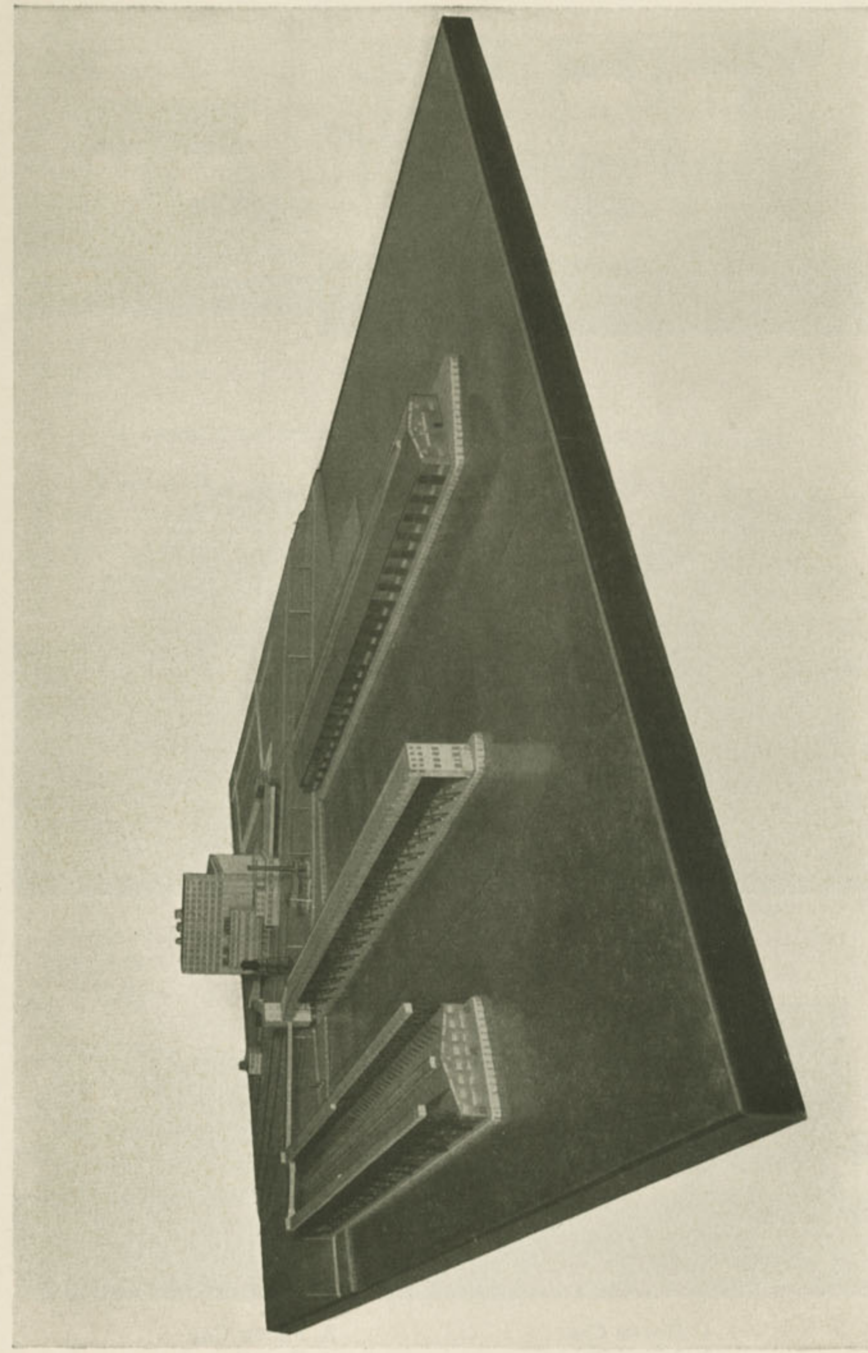
The office building, with grain testing laboratory, dust collection building, grain door salvage plant, where grain doors used in the cars are salvaged and returned to shipping points, and the welfare building, are other units of the plant.

At the closing of the Civil War, John W. Garrett, then president of the Baltimore and Ohio, decided that the best future for the city in which he lived and the railroad which he headed, lay in a larger development of the port of Baltimore. Accordingly he secured a large tract of unimproved land at Locust Point, immediately adjoining Fort McHenry, and upon this he erected sizable docks, warehouses, terminals, etc. He did more. He established direct shipping lines between Baltimore and Liverpool, Hamburg and Bremen, and so at one stroke made Baltimore, nearly 200 miles inland from the sea, one of the most important sea ports of the United States. From time to time Locust Point has been enlarged and improved. The most recent step in its development was the erection of the concrete grain elevator there in 1924, supplanting two wooden elevators, which had just been destroyed by fire.

The Curtis Bay Coal Terminal

The model of the Curtis Bay coal pier of the Baltimore and Ohio at Baltimore—one of the famous coal handling piers of the world—was built of metal by Mr. C. W. Egan, general claim agent of the company and is 12 feet long by 4 feet wide. Exactly 18,694 separate pieces of metal went into its construction, which took 1260 working hours.

The striking features of the Curtis Bay pier are the coal loading machines or towers, three of which are reproduced in miniature upon the Egan model. Each of these coal loading towers is actually 11 feet 4 inches in length and 22 inches wide, being scaled, as is the rest of the model, at three-sixteenths of an inch to the foot. Along one side of the pier are shown scale models of three scows, two of them already loaded with coal, and on the other a miniature ocean-going freight vessel being loaded by the coal trimmers. The hull of the



Grain Elevator and Piers, Locust Point, Baltimore

1. Horse Car
2. Imlay Coach
3. Flour Car
4. Box Car
5. Hopper Car

ship is cut away so as to show how these trimmers penetrate to her bunkers. The entire model is built to operate by electricity and with the use of fine, black sand to simulate coal. It is demonstrated at certain hours of the day.

The Curtis Bay coal pier of the Baltimore and Ohio is situated in the southern part of the city at the harbor side. Operated by great conveying belts which run 500 feet a minute, it has a loading and trimming capacity of 25 tons a minute or 1500 tons an hour; by so doing, hand labor is reduced to an absolute minimum.

Passenger and Freight Traffic Development

Time Tables—1838–1905. Time tables and folders of the Baltimore and Ohio passenger trains. A stage coach notice dated, 1842, eleven years before the line reached Wheeling, announcing "48 Hours, Baltimore to Wheeling, accommodating six (6) passengers." Ohio River Steamer coupons issued in conjunction with Baltimore and Ohio tickets on the opening of the line from Baltimore to Wheeling in 1853. Passenger way bills and rate sheets, 1838–1856.

United States Military Troop Trains—1861–1865. Tickets issued and government orders signed by the commanding officers in charge of troop movements during the Civil War.

Passenger Way-bills and Rate Sheets—1849–1865. Tickets of 1853 ovei the Baltimore and Ohio, the first rail line from the Atlantic seaboard to the Ohio River. Passenger way bill of 1839. Passenger rate sheet of 1865. Pamphlet relating to one of the first meetings of the American Association of Ticket Agents at New York City in 1865. Sample of typed tape telegraph message used in 1859.

Tickets—1840–1869. Excursion ticket of 1857 issued on account of the celebration at the opening of the Ohio and Mississippi Railroad, the direct line from Cincinnati to St. Louis, in connection with the Baltimore and Ohio. General forms of tickets used from 1840 to 1853, when the Baltimore and Ohio was opened to Wheeling; and from 1853 to 1869 when the line was opened from Cincinnati to St. Louis completing the through line from the Atlantic seaboard to the Mississippi River. These tickets range from the plain card ticket to the large coupon tickets. Drovers Tickets, Clergymens Tickets. Immigrants Tickets; Stage-coach Tickets.

Soldiers Tickets—1861-1865. Various issues; to many destinations.

Coupon Tickets—1861-1865. Miscellaneous tickets of various issues to many destinations. In 1864 many of these tickets were redeemed on account of the great flood of the Potomac River, causing the breaking of the Baltimore and Ohio line at Harpers Ferry.

Advertising Posters—1853-1884. Poster advertising the opening of the Baltimore and Ohio line to Wheeling in 1853. Announcement of the reopening of the line for through business in 1865, at the close of the Civil War. Announcement of the opening of the "Great Through Line from New York, via Baltimore, to Wheeling, Cincinnati, Louisville, and St. Louis and the South-west" (1858). Poster announcing the great political meeting for John A. Logan, for Vice President at Mitchell, Ind., 1884. Advertisement of the Cincinnati, Hamilton and Dayton, 1870, in connection with their new sleeping car line. Poster advertising excursions to the Northwest, 1883 and 1886. Announcement of the Oriole Festival at Baltimore in 1882.

Color Pamphlets—1870-1889. Souvenir ticket advertising the history of the Baltimore and Ohio from 1830 to 1889. Photograph advertising the opening of the Deer Park Hotel, July, 1873. Advertisement of the great Queen City Hotel at Cumberland, 1873. Pamphlet issued in connection with the great electrical display "Electra" of the Baltimore and Ohio at Baltimore.

Newspaper Comments—1830-1861. The *Family Reader* of Portland, Me., January 12, 1830, tells the wonderful feats of the Baltimore and Ohio horse cars. The same issue contains a copy of the memorial to Congress from the directors of the Baltimore and Ohio. The *Rockingham Register*, of Harrisonburg, Va., April 18, 1865, carries an announcement of the freight and passenger service of the Baltimore and Ohio Railroad. The *New York World and Enquirer* of April 3, 1862, gives a graphic news item on the reopening of the Baltimore and Ohio after the destruction of its track by the Confederate Army. An English newspaper of 1861 presents a large woodcut showing the interior of a Baltimore and Ohio coach of that time, and in an article accompanying it, American railways are commented on in a jocular vein.

Freight Way-bills and Tariffs—1843-1887. Many old freight waybills and tariffs of the Baltimore and Ohio Railroad, the Ohio and Mississippi Railroad, the Cincinnati, Hamilton and Dayton Railroad, the Cincinnati, Washington and Baltimore Railroad, all of which are now a part of the Baltimore and Ohio system.

Working Schedules of Passenger and Freight Trains—1852-1880. Operating official schedules of passenger and freight service from 1852 to 1882, covering the Baltimore and Ohio and its branches, the Cincinnati, Hamilton and Dayton and the Ohio and Mississippi railroads.

The personal time-table used by Thomas R. Sharp, master of transportation of the Baltimore and Ohio prior to the Civil War. Mr. Sharp, who resigned his railroad connection to become a colonel in the Confederate Army, was in charge of the engineers of the Confederate Army who successfully carried away many Baltimore and Ohio loco motives and much of its rail from Martinsburg and its vicinity, for use on southern lines. At the close of the Civil War Colonel Sharp rejoined the staff of the Baltimore and Ohio as master of transportation and was instrumental in restoring much of the pilfered property.

Celebrating the Laying of the First Stone of the Baltimore and Ohio. Badge worn by Charles Carrol of Carrollton when he officiated at the laying of the First Stone of the Baltimore and Ohio on July 4, 1828. (Loaned by Mr. Blanchard Randall of Baltimore.) Badges representing the different trades that took part in the parade celebrating the laying of the First Stone. Blue china plates, with pictures of the early railroad, made in England by Enoch Wood, to commemorate the founding of the Baltimore and Ohio Railroad. (Loaned by Mrs. Frances T. Redwood of Baltimore.) Pieces of script of various denominations, issued by the Baltimore and Ohio Railroad and sold to the public to raise money to help build the line. Steel and copper plates used in printing stock certificates and bonds in 1836 and 1840. Steel die used in making service medals for distinguished service to the railroad. Woodcuts of remarkable workmanship, made in the thirties, showing the first horse cars and the first engine, the *Tom Thumb*, and the open passenger car of 1830.

Charles Carroll of Carrollton was the last surviving signer of the Declaration of Independence, and in his ninety-second year, when the First Stone of the Baltimore and Ohio was laid at Mount Clare, Baltimore. He cast the first spadefull of earth, and the First Stone was laid with the full Masonic ceremonies usual in the laying of a cornerstone. The ceremony was concluded by pouring wine and oil and scattering corn upon the stone, with a corresponding invocation and response.

In a cavity of the stone was deposited a glass cylinder hermetically sealed, containing a copy of the charter of the company as granted and confirmed by the states of Maryland, Virginia and Pennsylvania; newspapers of the date and a scroll describing in detail the first general meeting of the citizens of Baltimore for the incorporation of a railroad; the meeting of the first Board of Directors and a report of the first surveys for the route.

Passenger and Freight Manifests, Working Schedules, etc.—1830–1865. First passenger manifest, or way-bill, with the conductor's records of the first train which ran between Frederick and Baltimore in December, 1831. This manifest contains all trains through to April, 1832. The first freight manifest of the Baltimore and Ohio used in 1832. Original copies of the *Official Railway Guide*, from the first copy of 1850. A series of *Baltimore and Ohio Red Books* containing political reviews of the campaigns of 1883 and 1884 in the states of Maryland, Pennsylvania, New York, Wisconsin and Illinois. Official working schedules, instructions to conductors, printed circulars and similar items from 1859 to 1880. Announcement to employes of the Cincinnati, Hamilton and Dayton Railroad, and the Dayton and Michigan Railroad, to attend church services if possible at noon on April 19, 1865, while the funeral services of President Lincoln were held in Washington.

Equipment and Appliances of the Baltimore and Ohio—1829–1888. Piece of the original rail from the line between Mt. Clare and Carrollton Viaduct, 1829–1830. Old switch locks, 1829–1830. Lantern used by John Philipp in engineering the grade from Hancock to Cumberland in 1842. Lantern used by Conductor J. S. Boyer in 1869. Lantern carried in the political campaign of 1888, and badge of the same occasion, used by members of the railroad clubs of the Cincinnati, Hamilton and Dayton, the Indianapolis, Cincinnati and Lafayette and the Pittsburgh, Cincinnati and St. Louis (The Panhandle) at Indianapolis in 1888.

The two book manifests of the Baltimore and Ohio for the handling of passengers and freight carried by the conductor of the train between Baltimore and Frederick when the line was opened in 1831, are items of outstanding interest in railroad history. They register the beginning of the passenger and freight operations of the railroad in the United States. At that time conductors did not use tickets, but instead carried a large ledger in which the names of the passengers were entered, and the amount of cash fare paid between the starting point and destination. At the end of his run, the conductor presented the book to the auditor, who counted up the cash and gave the conductor a receipt on his book. The first ledger of this character contains the record of trains from Fredericktown to Baltimore December 3, 1831, the line having been opened on December 1, 1831. It begins with Train No. 1 and carries the number of trains through in consecutive order to the time when the line was opened through to Point of Rocks, Maryland, in April 1832. In the corresponding freight manifest of 1832, is the record of all the articles of freight transported, the cost of hauling registered in each case.

Baltimore and Ohio Magazine

COVER DESIGNS

Original Oil Paintings by H. D. Stitt

The Start at Dawn. Before the coming of the railroad—the old stage coach leaving the doorway of the tavern and loaded with passengers; the landlord and the stable-boy wishing them godspeed.

First Meeting of the Founders. At George Brown's house in Baltimore a meeting was held in February, 1827. It was at this meeting that it was decided to build a railroad, the Baltimore and Ohio, which should extend from Baltimore to the Ohio River.

The Pathfinders. Early engineers in the Cheat River Valley, surveying the land for the coming of the B. & O. R.R. The beauty of this canyon-like country is remarkably depicted in this picture.

Changing Horses at Relay in 1830. Before the coming of steam, horse-cars were used between Baltimore and Ellicott's Mills. The horses which drew the cars were changed at the Relay House, a famous tavern of the day.

The Race between the Tom Thumb and the Horse on August 28, 1830. Peter Cooper's engine had but few staunch supporters.

Rivals. A canal boat on the Chesapeake and Ohio Canal, with a horse on the tow-path. The fact that this horse was frightened by the appearance of the locomotive and train on the track alongside of the canal led to a lawsuit, which, however, was settled amicably.

When the Atlas Came to Frederick in 1839. The stage coach and the covered wagon meet the steam engine *Atlas* at Frederick. The colorful costumes, the green engine and the interest of the spectators make this picture very realistic.

Twenty Minutes to Eat. The *Dutch Wagon* engine stops long enough to allow the passengers of its train to get off and go to the Depot Hotel for lunch—a familiar scene along the Baltimore and Ohio before, during and after the Civil War period.

Col. Schoonmaker Keeps the Line Open. Colonel Schoonmaker, now chairman of the Board of Directors of the Pittsburgh and Lake Erie Railroad, enlisted in the Union Army when eighteen years of age. His use of a handcar to protect his army forces and the Baltimore and Ohio Railroad has gone down in history. The picture shows the Colonel and four workmen on their way to Harpers Ferry in order to dispatch messages that would afford protection.

Milestones. The *York*, the Baltimore and Ohio's first practical engine, operating on the Baltimore and Ohio tracks, and a vision of the development of motive power after a hundred years—the modern locomotive.

Locust Point in 1882. Baltimore and Ohio's loading facilities for huge sailing and steam ships of 1882—old Pier 9, still in use—a train on the wharf with the engine puffing steam. Remarkable facilities for the day, lacking the efficiency of our modern grain elevators and coal piers, but none of the romance of transportation is lost in this picture.

Roseby's Rock in 1852. The Baltimore and Ohio fulfilled the ambition of those who named it, when, on Christmas Eve, 1852, the railroad reached Roseby's Rock, on the banks of the Ohio. The place was named in honor of the man who engineered the building of this section of the road, Roseby Carr.

Christmas in 1837. "When Great Grandma Came Home for Christmas on the Best and Only Train," drawn by the *Lafayette* engine. Great Grandma herself as a young lady, just home from a Young Ladies' Finishing School for the Christmas holidays.

The End of the Run—Christmas Eve. The engineer, in the cab of his locomotive, nearing home on Christmas Eve, sees the vision of his little child, in the arms of Kris Kringle.

The Good Neighbor. When Santa's reindeer go on a rampage and upset the sleighful of toys, the old saint simply steps over to the nearby tracks and flags the Baltimore and Ohio train. He knows a "good neighbor" when he sees one.

Supplementary Exhibits

Those Deadly Grade Crossings. A black and white drawing, done by de Graff for the *Saturday Evening Post.* A lover and his lass are leisurely crossing the railroad track in an ox-cart, totally oblivious of the oncoming train of carriages, drawn by the *De Witt Clinton.* Evidently the grade crossing *was* deadly—but for the passengers in the train rather than those in the lumbering ox-cart.

The Hayden Pictures. Old lithographs of scenes along the Baltimore and Ohio, including Tarpeian Rock, Buzzard's Rock, the Carrollton and Patterson Viaducts; also reproductions of inside and cover pages of the old Carrollton March, used on the day of the laying of the First Stone of the Baltimore and Ohio.

W. K. Blodgett. Photograph of the locomotive of the Connecticut and Passumpsic River Railroad, showing Daniel Willard, now president of the Baltimore and Ohio, in 1881, as the engineer, fifth from left in group, of this old wood-burning locomotive.

A file of *Baltimore and Ohio Magazines* containing a copy of each issue since the *Magazine's* beginning, October, 1912. Available by visitors for reference.

A supply of *Baltimore and Ohio Magazines* for October, 1927, for free distribution to those who wish copies.

Aunt Mary's Book, for the registration of "Little Railroaders," children of employes, who visit the Centenary Exhibition and Pageant. All visiting children are requested to register.

Aerial Photographs of a Railroad

The use of the airplane in practical photography is well demonstrated by five photographs taken from on high of the easterly portion of the Baltimore and Ohio system. The most striking and dramatically beautiful point upon the line is at the narrow impasse that the Potomac makes through the mountains at Harpers Ferry, West Virginia. Two aerial views, one taken from the east, the other from the west, show Harpers Ferry and its surroundings. The three air photographs taken a few miles to the east, depict Brunswick, Maryland, with its great railroad yards. The fourth photograph is of the splendid Union Station in Washington, of which the Baltimore and Ohio is a half owner, with its approach tracks. One gains a clear idea of the vast but orderly tangle of tracks and signals that are used to serve a great passenger terminal.

The fifth, and perhaps most beautiful of all these aerial photographs, is of Fort McHenry and the Locust Point yards of the Baltimore and Ohio Railroad, in the city of Baltimore. Nearby, in the Traffic Building, is the detailed model of the grain elevator and a considerable portion of the Locust Point terminal. The aerial photograph shows clearly the relation of this model to the entire terminal and to the habor of Baltimore.

Laying the First Stone of the Baltimore and Ohio Railroad

The painting by Stanley Arthurs which hangs above the Validation Booth, depicts an interesting and colorful event in the early history of the Baltimore and Ohio. In a field west of their brisk town the citizens of Baltimore gathered on the Fourth of July, 1828, to lay the First Stone of their railroad to the west, the charter for which had been granted in February, 1827.

The ceremony was preceded by an elaborate parade through the streets of Baltimore and was followed in the evening by fireworks and general rejoicings. When the townsfolk repaired to their homes, it was as if the new road were to be finished and operated almost on the morrow. As a matter of recorded fact, twenty-five long years were to elapse before its locomotives were to reach the bank of the Ohio. Yet, in all this time, faith was never lost in the project. At no hour did Baltimore fail to look forward to the completion of its railroad.

Mr. Arthurs' spirited painting portrays both the detail and the prescience of the occasion. No known picture, made at the time, exists of this event, but the printed descriptions of it are detailed and accurate. With these, and a thorough knowledge of the costumes of the day, Masonic insignia, etc. etc., this painting has been made. The figure of Charles Carroll of Carrollton, Baltimore's leading citizen of that day, and in 1828 the only surviving signer of the American Declaration of Independence, standing in the white suit with spade in hand is easily discernible. At his right stands Philip E. Thomas, the first president of the Baltimore and Ohio. The other

figures in the foreground are those of officers of the Masonic lodges who actually laid the First Stone. Mr. Carroll turned the ground with the spade before the stone was laid and pronounced it to be "among the most important acts of my life, second only to my signing the Declaration of Independence, if even it be second to that."

The First Stone, carefully preserved by means of a handsome iron fence, remains in the precise position where it was laid on July 4, 1828.

Relief Map of the Baltimore and Ohio

An elaborate bas-relief map of the territory covered by the Baltimore and Ohio and its attached lines and measuring approximately 3 feet by 7 inches. It was built some years ago by Mr. C. W. Egan, general claim agent of the company and recently has been revised and reconstructed for the Centenary. It depicts clearly all the physical formations of the terrain traversed by the road. Lakes, rivers, high mountains and broad plains can be discerned in their relative positions, even though the scale of the mountains is slightly exaggerated to make them clearly apparent. The lines of the railroad are indicated in red and the principal towns that it serves are plainly shown.

Alexander Brown and Sons

Distinguished for more than a century not only among the banking houses of Baltimore, but among those of the United States, the banking firm of Alexander Brown and Sons came into existence just prior to the foundation of the Baltimore and Ohio Railroad Company. It financed many local enterprises and others more far-reaching such as clipper ships to all parts of the world and the pioneer railroad that was to carry the name of Baltimore far into the interior country. An early member of the firm, George Brown, was the first treasurer of the railroad and a warm supporter of the enterprise.

The firm's exhibit at the Baltimore and Ohio centenary consists chiefly of a miniature replica of its banking house of 1827; of enlarged copies of correspondence which passed between it and the sponsors of the then new railroad, and of the flag which was borne aloft upon the mast-head of Evan Thomas' *Sail Car*.

Travelers Aid Society

Wall Map, 8 × 5½ feet, indicating with red streamers the contacts maintained, and the service rendered by the Baltimore Society to people from all parts of the country.

Chart, 27 × 36 inches, showing the relation of Travelers Aid service to the population in twenty-five of the largest cities in the United States.

Electroscope. Automatic motion slides of the work of the Society.

Posters. Depicting the assistance given to children, elderly people and immigrants.

Badge. Enlarged reproduction of the Travelers Aid emblem that represents helpful assistance to all travellers.

Poster. Original painting by Edwin Berdette Tunis, showing the Travelers Aid in action in a busy railroad terminal.

Desk. Two attendants. Explanations and literature about the organization and its work.

Commercial Development

A pictorial exhibit visualizing the activities of the Commercial Development Department of the Baltimore and Ohio Railroad. Photographic evidence of soil improvement, better dairy sires, pure-bred sheep and swine sanitation specials, boys' and girls' club work, agricultural scholarships, etc. Charts and maps illustrating industrial and natural resources of Baltimore and Ohio territory.

ALLIED SERVICES BUILDING

Illuminated Map

The map of the Baltimore and Ohio lines is 40 feet in length and 13 feet in height, and shows the northeasterly portion of the United States from a point in the Atlantic Ocean to one well west of St. Louis, Mo.

This map has been executed in the ancient manner so popular in America today. Its artist, Mr. George J. Illian, has caught the spirit and the flavor of the map makers of a century and a half or two centuries ago. His cartograph, therefore, shows not merely oceans, lakes, bays, rivers and mountains, not alone the political divisions of the states and the lines of the Baltimore and Ohio railroad as it covers them today, but shows in picturesque fashion details of the cities which the railroad connects. Thus one finds in New York, the Statue of Liberty and the new Telephone Building; in Philadelphia, Carpenter's Hall; in Baltimore, the Washington Monument; in Washington, the National Capitol; in Harper's Ferry, John Browns' Fort.

The trains of the Baltimore and Ohio are upon the tracks, while upon the navigable waters one sees all manner of craft, from the flat-bottomed Mississippi steamboat to the giant trans-Atlantic liners. Cherubs blow the winds from the four corners, while depictions of the three types of Baltimore and Ohio locomotives and the huge illuminated compass add interest to the great map. The canvas upon which it is painted was especially woven for it in Holland.

The Telegraph

Exhibit Prepared in Coöperation with the Western Union Telegraph Company

First Morse Telegraph Instrument. The original model of the electric recording telegraph, constructed by Professor Samuel F. B. Morse. Complete in every detail, even to the bent piece of iron which the penniless artist-inventor borrowed from a blacksmith in making his electro-magnet, and the artist's own canvas stretching frame, mounted on an old wooden table.

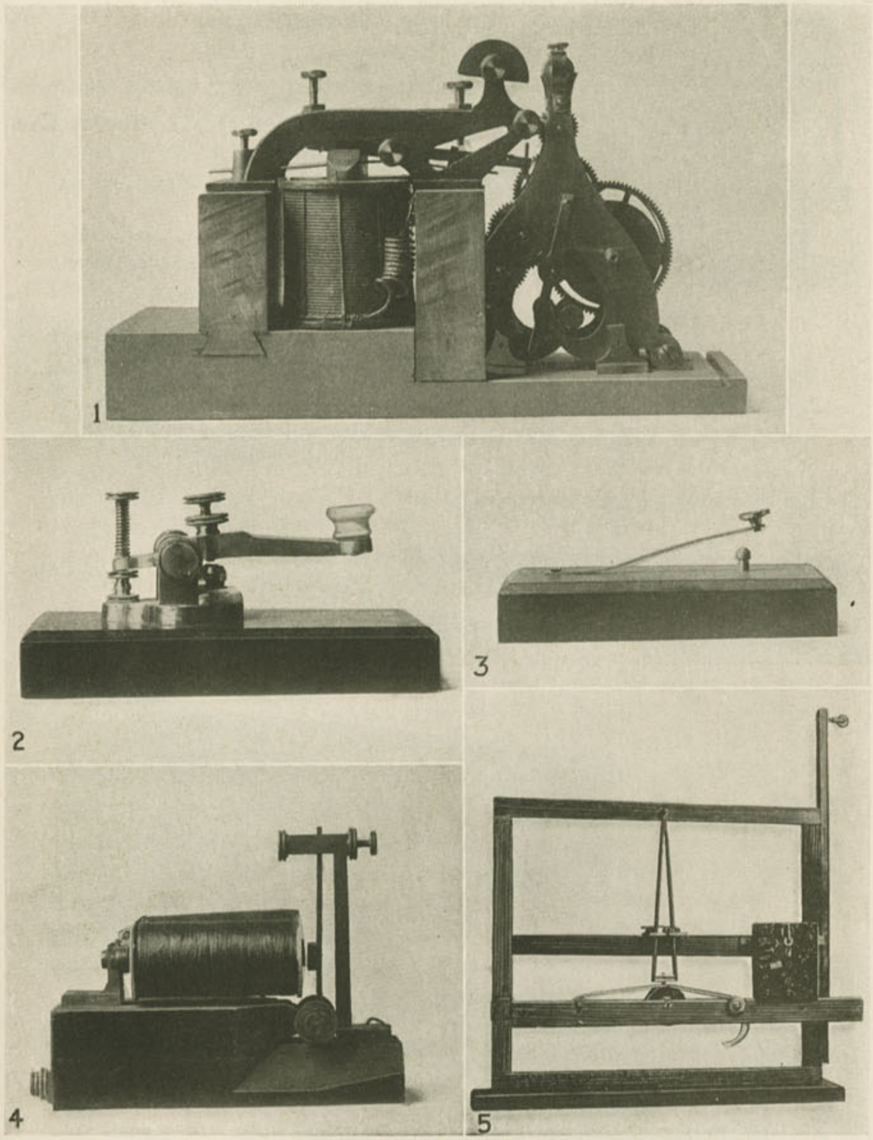
As impulses of electricity passed through the electro-magnet, a pendulum-like device was actuated in such manner that the pencil it held recorded its movements upon the paper tape, which in turn was unrolled at constant speed by means of the clockwork. When the circuit was closed and its armature attracted, the mark would be made obliquely across the paper, like half of a letter "V." When the circuit was broken, and the armature drawn back by a spring, the other half of the letter "V" was formed. Thus the line drawn on the paper contained the three elements of points, lines and spaces, forming by their various combinations, the characters required for letters or numerals.

At the time Professor Morse constructed this machine, he had not conceived the idea of the "key" or sending device. Therefore, his "port rule" or sending mechanism, involved not only the principle of a "key" which is a lever with two contact points by means of which the circuit is "made" or "broken" at will, but also contained an additional automatic device for performing the operation. This additional apparatus consists of a grooved rule, in which were placed metallic type, notched according to the combinations of the various Morse symbols for letters or figures. It worked perfectly, but after a short trial, was discarded for the simple key, manipulated by hand.

This crude machine embodied, nevertheless, virtually all the important principles of the model which nearly ten years later recorded the famous message, "What Hath God Wrought?", transmitted over the first public telegraph—the line constructed by Morse from Baltimore to Washington, paralleling the Baltimore and Ohio Railroad.

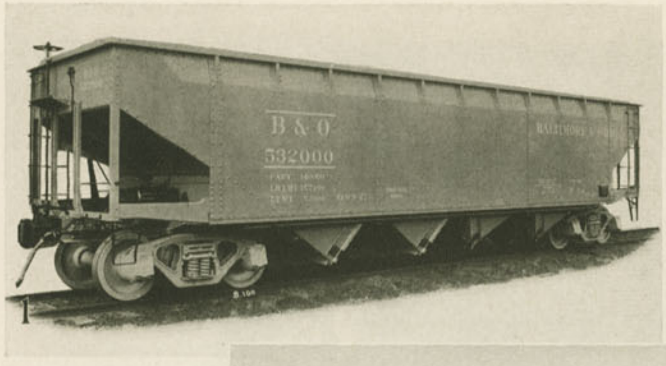
Morse Finger Key—1843-1844. Original model, consisting of a wooden base upon which is mounted a flexible piece of brass with a hard-rubber button attached, and a metal post, or anvil. When the strip of brass is pressed down, it forms a contact with the metal post, thus closing the circuit; when the pressure is released, the circuit is "broken."

Morse Finger Key—1844. Original model involving the improved manipulating lever. The lever is fastened to a base by means of a trunnion, permitting easy motion of the lever up and down. Contact is made by hammer and anvil points in front of the trunnion,



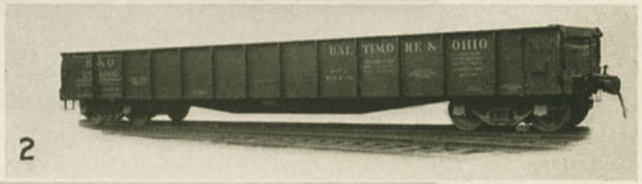
THE TELEGRAPH

1. Register used on the Baltimore-Washington line 1844.
2. First sending key.
3. Early sending key.
4. Early Morse relay.
5. Original Morse recorder.



1. Hopper Car

2. Gondola



3. Flat Car

4. Box Car

5. Caboose

while another hammer and anvil arrangement behind the trunnion, permits of adjustment of the movement of the lever. A hard rubber button is provided at the end of the lever to facilitate gripping by the manipulator.

The same end, the closing and opening of the electric circuit at will, is accomplished by these patterns. The later models, including that of 1845, all involved the same principles, with modifications of construction for the purpose of improving them mechanically. These instruments were used by thousands of operators, and in the most approved mechanical form are still in use. Rapidity and precision of transmission or sending with the Morse key depended to a large extent upon the skill of the individual operator, and many acquired a regional or even national reputation for their skill. The old method, however, has largely given way to the rapid, efficient automatic methods, in which transmitting is accomplished from a typewriter-like keyboard, and by automatic typewriters.

Morse Telegraph Register. Made for Professor Morse by Alfred Vail for use on the first public telegraph line from Baltimore to Washington. It was a compact and efficient instrument. The clock-work machinery moving the paper tape was in close proximity to the electromagnet. The armature, with the marking-pen lever attached, was fitted snugly in a horizontal position above the magnets in the same manner as in modern telegraph sounders. On the end of the pen-lever were pen-points which made markings on the paper tape when brought in touch with it by the action of the magnet in pulling down the lever. Transmitting is accomplished manually by means of a small lever-type-key attached neatly on the same base of the receiving instrument, superseding the mercury cups originally used for the purpose. Contact points of metal also replace mercury cups.

In his earliest sending apparatus used on the register Morse used a lever with two points dipping into tiny cups of mercury. To the mercury cups were attached two electrical terminals, so that when two small wire points on the end of the lever dipped into the mercury cups the circuit was closed.

Morse Relay. Original model of one of the earliest examples of the apparatus now known as the automatic repeater or translator. The relay consists of a bar or armature so arranged as to be free to move when acted upon by an electro-magnet, thus putting a secondary or local battery in connection with the receiving apparatus proper.

"If I can succeed in working a magnet ten miles, I can go round the globe," Morse replied to the skeptics who doubted that his recording telegraph instument would function more than a few miles. "Suppose that in experimenting on twenty miles of wire we should find that the power of magnetism is so feeble that it will but move a lever with certainty a hair's breadth. That would be insufficient, it may be, to write or print, yet it would be sufficient to close and break another or a second circuit twenty miles further, and this second circuit could be made in the same manner to break and close a third circuit twenty miles further, and so on round the globe."

This is a concise explanation of the general principle of the apparatus now known as the automatic repeater or translator. In 1844, when Morse applied this idea practically for the first time to a circuit of any considerable length, he modified it somewhat and it became the ordinary relay. The principle of each, however, is the same. The relays used on the first public telegraph line were huge affairs, weighing 150 pounds each. Each of the two relays consisted of two coils of No. 16 cotton-covered copper wire, saturated in gum shellac, the coils being about eight inches in diameter, and wound on a horseshoe shaped bar of iron, one inch in diameter. Subsequently relay magnets were greatly increased in power and reduced in size, until the weight of the modern Morse relay is about two pounds, and is effective over distances of 500 miles.

The Simplex Printer. The most up-to-date device in the field of automatic telegraphy. A typewriter-like machine, weighing complete about 70 pounds. The operator taps out the words of the message on the keyboard. Letter by letter the electric impulses of that word slip out over the wire to a distant city, setting up impulses in another super-typewriter in such a manner that the corresponding typebars are pulled down and the message is typewritten on the dry side of a gummed paper tape. The operator at the distant end picks up the tape as it flows from the machine and with the aid of a small gumming instrument, glues it to a telegraph or cable message blank, after which the message is ready for delivery.

The operator may be typewriting over a distance of several hundred miles. It is as if the keys being depressed were attached to typebars several hundred miles long, each typebar registering on the distant tape practically instantaneously. As the message is typed it is recorded by the distant machine, while the same message likewise is printed on a tape emerging from the sending machine, so that

the sending office has a perfect record of what has been transmitted. When the distant office wishes to send, the home operator merely stops typewriting and the original process is reversed.

By the Simplex Printer system letters are hurled across the continent in a fraction of a second, and a message of seventy-five words is sent the same distance in a minute. It is coming into wide use in financial districts of metropolitan cities, many Simplex Printers being installed between Western Union offices and large banking houses and industrial firms. It is particularly efficient in the transmission of cable messages in code.

Today more than seventy per cent of the 200,000,000 messages handled annually by the Western Union are transmitted and received automatically. Despite these advances in telegraphy the automatic systems have not driven out the old-time Morse operator, who is still indispensable under certain conditions.

Siphon Recorder. Used in recording messages received on ocean cables, the siphon recorder is one of the most delicate instruments known to electrical science. It consists of an exceedingly light coil of wire, delicately suspended between the two poles of a powerful electro-magnet, and capable of turning on a vertical axis. When a current circulates in the coil, the plane of the wires takes up a position at right angles to the original line, the coil turning one way or the other according to the direction of the current. Motions of the coil are transmitted by silken threads to an extremely thin glass siphon no larger than a hair, one of which connects with a reservoir of ink, while the other rests upon a narrow strip of moving paper tape. In this manner, the incoming signals are recorded in a wavy line, undulations above the imaginary median line representing dots of the Morse alphabet, while undulations below represent dashes. From this wavy line, the operator reads the message and transcribes it on a specially constructed typewriter. It was adopted for general use in 1867.

Sending Apparatus. The operator merely writes out the message on the typewriter-like keyboard of the automatic perforator, and the tape in turn is fed into the transmitting apparatus at a uniform speed. This automatic transmission system superseded the practice of sending cable messages by hand with a special double-lever cable key, about ten years ago.

"*What Hath God Wrought?*" A large reproduction of the first public message over transmitted over the first public telegraph line in the United States, which followed the lines of the Baltimore and Ohio Railroad from Baltimore to Washingron. The message is printed in triple lines of the Morse code of dots and dashes.

To Miss Annie G. Ellsworth, daughter of the Commissioner of Patents, was accorded the honor of sending the first message because it was she who brought the first news to Professor Morse of the passage by the United States Senate of the Telegraph Bill, appropriating $30,000 for the construction of the Washington-Baltimore line.

The Telephone

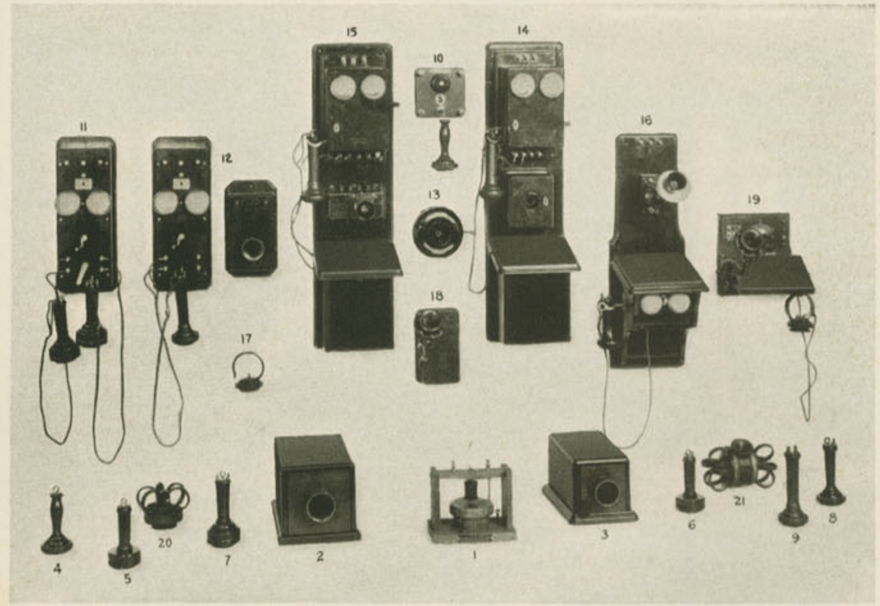
Exhibit Prepared in Coöperation with the American Telephone and Telegraph Company

The telephone exhibit is historical in character, and designed primarily to show the relation of the telephone to railroad service. It also includes early telephone instruments, the first telephone directory, a map showing the railroad lines which use the telephone for despatching, and many photographs and items showing the growth and development of telephone service.

The First Telephone—1875. The invention of Alexander Graham Bell. This was an electro-magnet having an armature, one end of which was attached to the center of a diaphragm made from sheepskin. It served both as a transmitter and receiver, the user speaking into and then listening at the orifice or mouthpiece.

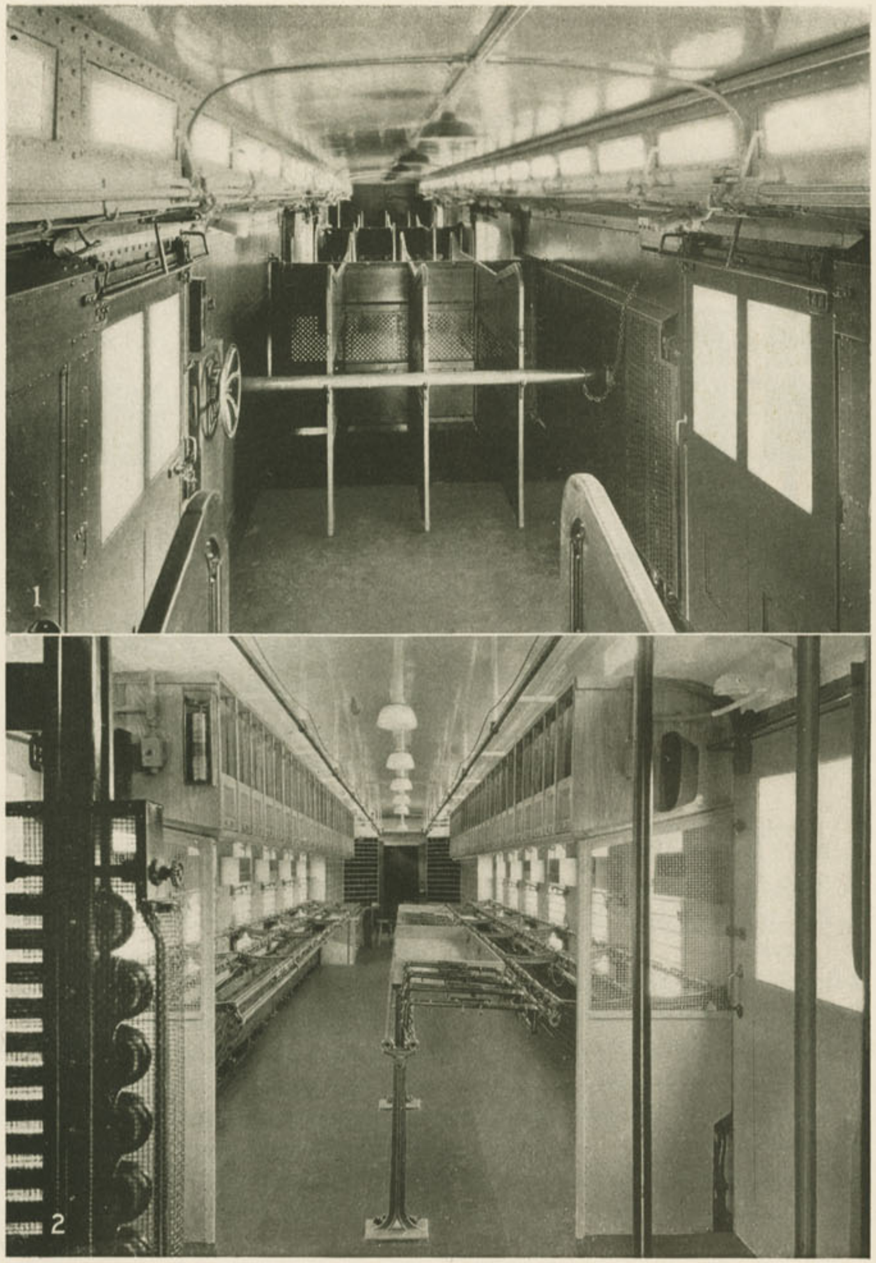
Bell's Box Telephone—1877. The first type of telephone put into commercial use. One was installed for railway service at Altoona, Pa., in that year. There was no bell for signalling, as it had not been invented; the telegraph was used for that purpose. The speakers listened and spoke alternately by means of the single opening, which served as an earpiece and mouthpiece.

Bell's Box Telephone with Watson Call Device—1877. This was a magneto device and operated without battery. It was equipped with one of the earliest methods of calling, that is, a hammer was provided which when operated by the user would strike the side of the dia-



HISTORIC TELEPHONES, 1875–1882

1. Bell's first telephone.
2. Bell's box telephone.
3. Box telephone with Watson's call device.
4-5-6-7. Wooden case hand telephones.
8-9. Rubber case hand telephones.
10. First subscriber's set.
11. First magneto bell set.
12. Magneto bell set with magneto transmitter.
13. Berliner transmitter.
14. Magneto bell set with Blake battery transmitter.
15. Magneto bell set with long distance transmitter.
16. Common battery substation set.
17. Phelps pony crown speaking tube receiver.
18. Edison soft carbon button, battery transmitter.
19. Edison type subscriber set.
20. Phelps single crown telephone.
21. Phelps double crown telephone.



1. Express Horse Car
2. Railway Post Office Car

phragm which caused a knocking or rapping sound to be produced in the telephone at the other end of the line.

Wooden and Rubber Case Hand Telephones—1877–1878. These are early developments of the telephone instruments showing the progressive steps in its development. The first hand receiver consisted of a wooden case supporting a diaphragm, magnet and coil. Later binding posts were added so that a telephone cord could be readily attached. Later improvements included a rubber case as a substitute for wood and improved method for clamping the diaphragm. The strength and life of the magnet was greatly improved by the use of laminations instead of employing a straight steel rod.

First Form of Subscriber's Set—1878. This type of telephone was used by the Reverend Mr. Todd, of New Haven, Conn., the first telephone subscriber. He was the only man to become a telephone patron out of list of a thousand persons who were first solicited. The set consisted simply of a telephone receiver mounted upon a hook and connected between the line and ground. In order to call the station an intermittent current was sent over the line which caused the receiver to produce a buzzing sound. To call central, it was necessary to press a button. The subscriber used the receiver for both listening and talking and many times he attempted to talk with his ear and listen with his mouth. Associated with this set was a telephone directory for the entire exchange which was printed on a card about eight inches long and four inches wide. It contained the names of all the subscribers to the exchange, some fifteen in number. The subscribers called each other by name instead of by number.

First Magneto Bell Subscriber Set—1878. This telephone was equipped with wooden case hand telephones. There was one telephone for talking and one for receiving. This arrangement contributed greatly to the convenience of using the telephone. Central was called by operating a magneto generator which sent an alternating current out on to the line and caused a signal to be given at the central office.

Magneto Bell Subscriber Set with Magneto Transmitter—1878. This was the first attempt to extend the range of transmission by the use of a more powerful magneto transmitting instrument. A magneto transmitter having a larger diaphragm and more powerful magnets was employed which in conjunction with a special mouthpiece improved the transmitting qualities.

Berliner Transmitter—1879. Used primarily for speaking tube or short line service.

Magneto Bell Subscriber Set with Blake Battery Transmitter—1882. This was the second attempt to extend the range of transmission by the use of a more powerful transmitter. The Blake transmitter employed a hard carbon button and platinum point which were connected in series with a single cell of battery and the primary of an induction coil. The secondary of the induction coil was connected to line.

Magneto Bell Subscriber Set with Long Distance Transmitter—1887. This was the third step in extending the range of transmission by the use of a more powerful battery transmitter. This transmitter employed an improved type of induction coil, granular carbon in place of hard carbon and the battery power was increased from one cell to three.

Common Battery Substation Set—1893. This is one of the early forms of the present day common battery system sets, equipped with a solid back transmitter. It registers its call by simply removing the telephone receiver from the hook. No magneto is necessary for calling and no local battery is required for talking.

Phelps Pony Crown Speaking Tube Receiver—1878-9. Used by the Gold and Stock Telegraph Company.

Edison Soft Carbon Button Battery Transmitter—1878-9. Used by the Gold and Stock Telegraph Company.

Edison Type Subscriber Set—1878-9. Used by the Gold and Stock Telegraph Company.

Phelps Single and Double Crown Telephones—1878-9. Used by the Gold and Stock Telegraph Company.

First Commercial Switchboard—1878. Opened in New Haven, Conn., by George W. Coy and Herrick P. Frost. This board was capable of serving but eight telephone lines. In the Baltimore and Ohio Centenary exhibit this switchboard is connected with two early instruments, in good working order, for use by visitors at the Centenary who may wish to test it.

Railroad Despatching by Telephone. The modern system, shown by means of an actual working demonstration of a train despatcher's desk with wires run from the desk telephone to a large photograph of Indian Creek on the Baltimore and Ohio line, while in the distance is

shown an illuminated section of a switch-tower with the tower man at the telephone. Despatchers are located at divisional points on the railroad, controlling circuits sometimes 200 miles long, on which as many as fifteen or twenty signal towers are located. Tower men receive the messages simultaneously by means of loud-speaker telephone instruments.

Map of the United States. Showing the present railroad development of the country, with the railroads using telephone despatching outlined in red. Fifty-eight per cent of the 247,000 miles of railroad line, now use the telephone for this purpose.

The Invention of the Telephone. An oil painting depicting the dramatic scene just after the transmission of the first complete sentence, "Mr. Watson, come here; I want you" on March 10, 1876, at Boston, Mass. Models of the instruments which transmitted the first sentence are also exhibited.

Alexander Graham Bell, Inventor of the Telephone. A model of the bronze bust presented to the Smithsonian Institute.

Bell's Centennial Exhibit at Philadelphia—1876. A replica of the exhibit that first demonstrated the telephone to the public, and produced an international sensation.

Headquarters Building of the New York Telephone Company. A model of one of New York's largest skyscrapers, completed in 1926. It occupies approximately 200 x 250 feet of ground. It is 486 feet high, with five floors below ground and thirty-two stories above the street. The available floor space is 850,000 square feet and it houses 6000 employes. The building is designed to serve 120,000 subscribers.

Television, Telephotography and Trans-Oceanic Telephony. These and other scientific developments of the telephone are shown by means of forty large photographs.

The early history of the telephone in the United States is too well known to be repeated here. The experiments of Dr. Alexander Graham Bell, which began in the early seventies and which resulted in the transmission of a spoken sentence on March 10, 1876, were followed not long afterwards by an adaption of the remarkable new invention to railroad service.

The first primitive set was installed at Altoona, Pa., in 1877. There was no bell used for signalling, as it had not been invented. The telegraph was used for signal purposes. The speakers spoke and listened alternately to a single opening which served as an earpiece and a mouthpiece. Later, in 1879, a set with a transmitter and receiver was developed, employing the usual call bell. This set was adopted by the Boston, Revere Beach and Lynn Railroad in 1879, this railroad being the first to adopt the telephone for train despatching work. In more recent years the telephone has come into widespread use by American railroads for their train despatching work.

The Express

Exhibit Prepared in Coöperation with the American Railway Express Company

The Express Then and Now. Symbolical painting depicting a modern Baltimore and Ohio all-express-car train, with a vision in the clouds picturing the stage coach of former days in territories not then traversed by the steel highway.

Forms and Circulars. Express receipts, forms and circulars of instruction used from the inception of express service in 1839 until 1927.

Treasure Chest. Made of wood, iron-bound and securely locked, this chest was used to carry gold-dust on the stage-coach in the days of early transportation.

Pistol and Sawed-off Shot Gun. Used by the express messenger to guard the treasure chest in stage-coach days.

Revolver and Automatic Rifle. The equipment of the twentieth-century express messenger in protecting money, bullion and other valuables while in transit.

Railway Mail

Exhibit Prepared in Coöperation with the United States Post Office Department

Portrait of Calvin Coolidge, President of the United States.

Portrait of Harry S. New, Postmaster General of the United States.

PAINTINGS

Star Route Mail Carrier. Mountain scene of foot mail carrier of the early days of the country.

Western Mounted Mail Carrier. A mounted mail carrier of the days of the Pony Express crossing the western prairie.

Western Mail Coach. Western mail coach drawn by six horses with passengers.

Early Railroad Transportation of Mail. Early type of railroad engine, fuel tender and house-like car.

Rural Free Delivery Service. Scene shows two farm houses, two-horse wagonette coach, group of people, rural letter box.

Alaskan Winter Scene. Two sledges and attendants on a frozen stream in Alaska.

Alaskan Mail Carrier. Mail sledge drawn by eight dogs, small post office building and store building.

The Capitol Limited. Fast express train of the Baltimore and Ohio carrying mail between Washington and Chicago.

BOOK PLACARDS

Tribute to the Postal Service. "Neither snow nor rain, nor heat nor gloom of night, stays these couriers from the swift completion of their appointed rounds."

Letter Mail Suggestions. Instructions for the proper addressing of mail.

Parcel Suggestions. Indicating the proper method of preparing parcels for the mails.

Model Form of Address. The correct method of addressing letters and parcels for the mails.

Two-cent and Five-cent Postage Map of the World. Showing the range that a two-cent and five-cent postage stamp of the United States will carry a letter weighing one ounce.

Personnel of the Postal Service. In 1789 there were in all the thirteen states only 118 employes of all kinds; in 1927, 365,680.

Growth of the Postal Service. Revenues in 1776, $25,000; 1826, $1,447,703; 1876, $28,644,197; 1925, $599,391,477. Since the days of Benjamin Franklin, the first Postmaster General, the revenues have doubled on an average every ten years.

Railway Mail Service. The United States mail was first transported by a railway train in 1834, and during 1835 was carried 270,504 miles. In 1838 Congress declared all railways in the United States to be post routes. Railway post office mileage: 1864, 22,000 miles; 1876, 72,348 miles; 1925, 230,469 miles. Total miles traveled during 1864, 23,000,000; 1876, 77,741,172; 1925, 579,256,030.

Ramifications of the Postal Service. Personnel and activities of the Post Office Department and Postal Service in photographic form displayed on a large rack.

Air Mail Service. A model, electrically controlled, presentation of the transcontinental air mail service, representing the flights of planes across the continent.

The planes on the transcontinental route leave New York and San Francisco in the morning and arrive at their destinations the afternoon of the following day. The service was inaugurated, July 1, 1924. The first government operated air mail service was between Washington, D. C., and New York, N. Y. and began May 15, 1918. Since the establishment of the service to June 30, 1927, the planes have flown 13,074,524 miles, in all kinds of weather, daylight and darkness. During the past year the mileage flown was 2,547,992 miles, with a single fatality.

Philatelic Display. A case containing United States postage stamps and other stamped paper of past and present issues, with many interesting specimens including die proof stamps, aeroplane stamps of 1918, commemorative stamps and many other similar items.

Mail Sacks, Pouches and Satchels. Specimens used for first-class, air, registered, foreign and other mail. There are fourteen types of all kinds, and 12,770,000 used all in branches of the service.

Methods of Transporting the Mails. Two automatic motion picture machines demonstrating the various methods employed in the government mail service.

Dead Letters. A display rack showing why letters fail to reach their destinations. Over 25,000,000 undeliverable letters went to the Dead Letter Office last year, representing a loss of more than $750,000.

Lost Articles. A few specimen samples of the varied articles lost in the mails through improper wrapping and addressing, displayed in a large case. Last year 456,713 parcels went to the Dead Parcel Post Offices; of this number 67,756 were destroyed as of no value; 121,780 were eventually delivered and the remaining 267,177 were sold at public auction, netting $108,198.45 for the postal revenues. This represented an actual loss of more than $500,000 to the owners.

How and How Not to Wrap Parcels. Display of parcels picked from the accumulation of undeliverable parcels on hand in the Division of Dead Letters and Dead Parcel Post at Washington, D. C.

Fake Medical Cures. A case demonstrating fake medical cures for tuberculosis, cancer, deafness, diabetes, obesity and many other ailments of the human body exposed and prosecuted by the Post Office Department.

Mail Frauds. Pictures and facts concerning fraudulent schemes shown on a display rack. Any scheme involving the use of the mails for obtaining money, property, or anything of value by means of false or fraudulent pretenses, representations or promises, is unlawful. Fraud orders were issued closing the mails to 1,437 persons and concerns between March 4, 1921 and June 1, 1926.

Rondout Train Robbery. Three paintings depicting the men and the facts concerning the hold up of Train No. 57 of the Chicago, Milwaukee and St. Paul railway on June 12, 1924. The train was looted of more than $2,000,000 in currency, bonds, jewelry and other valuables. The eight men who participated in the crime were all apprehended and convicted.

Okesa Train Robbery. Three paintings illustrating the holding up and robbery of the mail car of the Missouri, Kansas and Texas Railroad Mail Train No. 123, near Okesa, Oklahoma, on the night of August 20, 1923. About $200,000 in currency and $20,000 in Liberty Bonds, was stolen from the registered mail, $14,000 worth being recovered.

Railway Postal Car. A miniature model of one of the first railway postal cars used about sixty years ago.

Rural Delivery Horse Drawn Vehicle. A model of a type that was used in the delivery and collection of mail on rural routes in bygone days.

Alaskan Dog Sledge and Equipment. Present day equipment used for transporting mail in Alaska. It will carry about 700 pounds of mail and has been used on various routes from 1918 to 1924, having traveled 19,420 miles in that time. Drawn by from nineteen to twenty-five dogs according to the weight of the mail carried. An average load weighs 250 pounds, and the transportation cost is approximately $6.30 a ton for each mile traversed.

Owney. The Railway Postal mascot who traveled 143,010 miles and received 1,017 medals.

Sub-station of the Baltimore Post Office. A service station for the convenience of the public and the sale of stamps.

Mail Catcher and Crane. All Railway Post Office Cars are equipped with a mail catcher attached to the frame of one door on each side of the car for the delivery of mails to through trains at non-stop stations. At stations where the mail is caught by moving trains an iron crane with movable arms upon which pouches are suspended is located. The pouches are held by spring clips in a position that brings them in direct contact with the catcher on the car, the impact causing the spring clips to release the pouch when the arms of the crane automatically adjust themselves to a position parallel with the crane.

Steamship Models

AQUITANIA

By Courtesy of The Cunard Steam Ship Company, Limited

Model, 5 feet 5 inches in length, reproducing the ocean liner *Aquitania*. Gross tonnage, 45,647; length, 901 feet; breadth, 97 feet; depth, 64 feet; indicated horse power, 60,000; speed, 23 knots per hour.

The *Aquitania*, built in 1914, is an oil burner and modern in every phase of her equipment. Two hulls make her truly a ship within a ship. Her gigantic size assures surprising freedom from motion; anti-rolling tanks contribute to keeping her steady in the roughest seas. Her wireless plant is so powerful that she is never out of touch with land. A submarine signalling system guards her when approaching land under unfavorable circumstances.

Like a true host the *Aquitania*, provides entertainment for every hour of the day for her passengers. Every morning the *Daily Mail*, Atlantic Edition, the ship's newspaper, is distributed. There is a concert each afternoon, and music for tea and in the evening for dancing. Several hundred books are on the library shelves. For the athlete there is space on deck for tennis, quoits, and shuffleboard; a gymnasium equipped for fencing and other sports in charge of a professional trainer, and a swimming pool as large and fine as in many clubs. A ship's branch of the London Joint City and Midland Bank offers the passenger financial facilities.

CHESAPEAKE BAY

By Courtesy of the Chesapeake Steamship Company

Topographical Relief Model, 7 by 4 feet, tells the transportation service story of the Chesapeake Steamship Company. The directness and pleasures of the waterway routes between Baltimore, Norfolk and Richmond are shown in connection with the fine fleet of steamers which ply them. Alternating day, night, dawn and twilight scenes show Chesapeake Bay with its watercraft life and alluring shore lines as well as the surrounding land areas with their great wealth and commercial advantages, together with its pleasure and historical attractions. From the sea levels of the Coastal Plain, through the higher elevations of the Piedmont Plain, with the Blue Ridge and Alleghany mountains in the distance, is the achievement in contours of this model production. Cities, towns, resorts and historic points are shown as well as lighthouses. All are lighted in the night scenes.

CLERMONT

By Courtesy of the Hudson River Day Line

Model of Robert Fulton's *Clermont*, the first practical steamboat. The *Clermont* was 130 feet long, 13 feet wide, 7 feet deep and drew 2 feet of water. The boiler was of copper, 20 feet long, 7 feet high, and 8 feet broad, under which pine wood was burned. The steam cylinder was 24 inches in diameter with a piston stroke of 4 feet. The paddle wheels were 15 feet in diameter with paddles of oak 4 feet long and 8 inches broad. The machinery and wheels were uncovered and exposed to view and the weather. There was no steam whistle, and when nearing a wharf a dinner horn was blown. She was built in New York, but the engine was built in England after Fulton's own design.

The trial trip of the *Clermont* took place August 9, 1807, on the East River in New York harbor, and on August 17 Fulton made his first famous trip on the Hudson River to Albany in 32 hours at a speed of nearly 5 miles an hour. While she was building the Clermont was popularly called "*Fulton's Folly*," but she was named after the home of Chancellor Robert R. Livingston, Fulton's partner and backer, near Rhinebeck on the Hudson.

baggage rooms and other service features are located as much as possible amidships, reserving every available part of the steamer from which a good vantage point to view the river scenery is obtainable, to the use of travelers. Her passenger license covers 5000 people.

LEVIATHAN

By Courtesy of the United States Shipping Board

Scale Model of the *U. S. S. Leviathan,* 18 feet long. Gross tonnage, 59,956; length, 950 feet; horsepower, 66,000; width, 100 feet; speed, 27 knots.

The *Leviathan,* built in 1914, sails on a regular schedule between New York, Cherbourg and Southampton. She is the flagship of the fleet of transatlantic liners which the United States Lines operate for the United States Government.

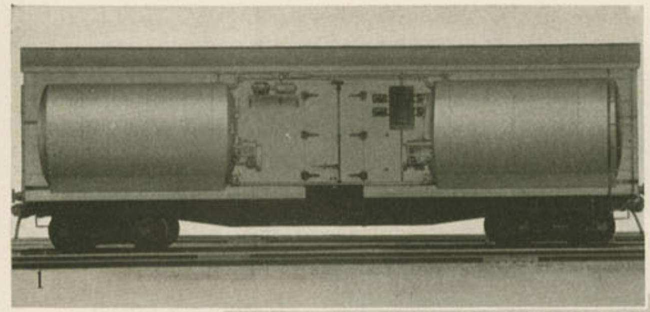
Monster engines can drive the *Leviathan* through the water at a speed exceeding 27 knots per hour. She not only holds the world's speed record for a twenty-five-hour run, of 687 nautical miles at an average speed of 27.48 knots an hour, but has made a record run between Cherbourg and New York of five days, seven hours and twenty minutes.

Service is the watchword of the *Leviathan* in accommodating the 3400 passengers. The ship has been compared to the finest metropolitan hotels —anything, everything you want. It is said that the Leviathan is the only ship in the world having a special dining room managed and operated by the Ritz-Carlton Company, the only ship having a telephone in each first class stateroom, the only ship having pre-release moving picture features, the only ship having American plumbing. The social hall, smoking room, library and other rooms for the use of all passengers are open twenty-four hours a day, as against the usual custom of closing such rooms at midnight.

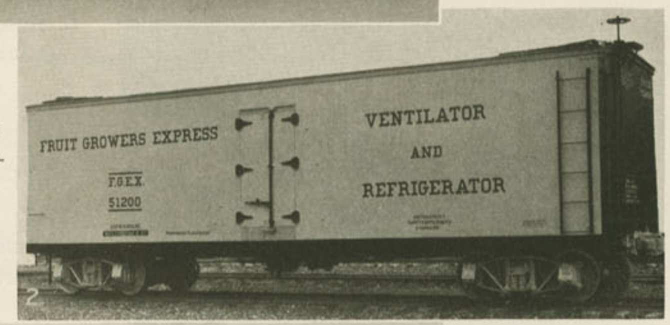
LEWIS LUCKENBACH

By Courtesy of the Luckenbach Steamship Company, Inc.

Model of the twin-screw steamship *Lewis Luckenbach,* 14,400 tons deadweight, built at Quincy, Mass., in 1919, and one of the finest cargo liners afloat. The model shows not only the outline of the



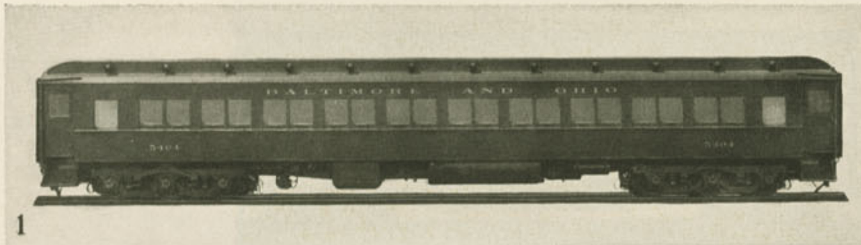
1. MILK TANK CAR

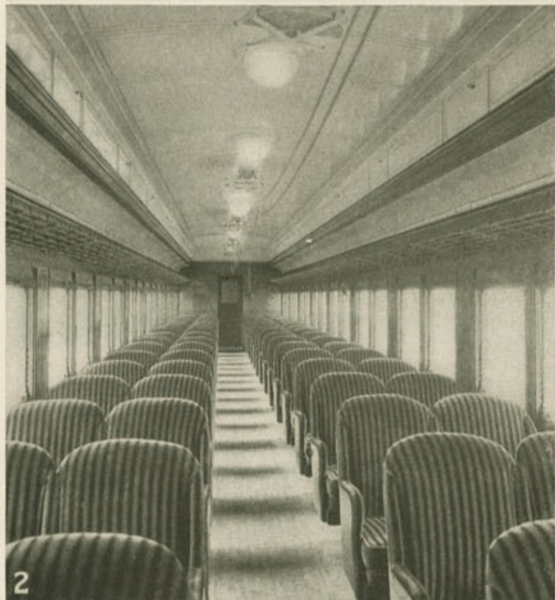


2. FRUIT GROWERS EXPRESS REFRIGERATOR CAR

3. AMERICAN RAILWAY EXPRESS REFRIGERATOR CAR

4. MERCHANTS DESPATCH REFRIGERATOR CAR





1. Modern Coach (exterior)

2. Modern Coach (interior)

3. Entertainment Car

ship, rigging, gear and fittings, but also the interior arrangements for the stowage of cargo. This vessel is but one of the fine units operated by the Luckenbach Steamship Company.

Luckenbach Terminals. Model of the Luckenbach Terminals at Woodcliff, N. J., showing piers, offices and railroad facilities.

MAJESTIC

By Courtesy of the White Star Line

Model of the giant ocean liner reproduced to scale on a length of 12 feet. The dimensions of the *Majestic* are: Gross tonnage, 56,000; length, 956 feet; breadth, 100 feet; depth, 102 feet; horse power, 100,000; speed, 25 knots per hour.

The *Majestic,* built in 1921, is an oil burning ship, and has 48 boilers with 240 furnaces that supply steam to four turbine engines which drive quadruple screws.

She has nine steel decks, connected by electric elevators. Her capacity is 4000 passengers, and her crew numbers 1000. All first class cabins are fitted with beds, there being no upper berths. The ship is lighted by electricity, more than 15,000 bulbs being required. A complete telephone system connects all parts of the ship with a "central."

The special service features of the *Majestic* include a playroom for children, a gymnasium with an athletic instructor in charge; a sports deck with equipment; large squash racket courts; a great swimming bath; a darkroom for photographers; barber shop; hairdressing parlors; tailor's shop; conservatory; kennels for dogs.

OCTORARA

By Courtesy of the Great Lakes Transit Corporation

Model of the passenger steamer *Octorara* which plys between Lake Erie and Lake Superior ports. The ship is 361 feet long, 47 feet wide and has accommodations for 600 persons, but carries no freight. She is operated by a steam engine driving a single screw propellor.

The *Octorara* is furnished with all modern appliances for the convenience, safety and comfort of her passengers. All the staterooms are well ventilated, and are equipped with running water, electric lights and the best of beds. Wide promenade decks extend entirely around the ship, and her lounge, dining room, social hall and library are artistically furnished.

ONTARIO

By Courtesy of the Merchants & Miners Transportation Company

Model of the *S. S. Ontario.* The ship is 315 feet long, 42 feet wide, and has a displacement of 4380 tons. Her 52 cabins accommodate 108 first class passengers. The ships of this line, including five new 7000 ton vessels, operate between Baltimore, Philadelphia, Boston, Providence, Norfolk, Savannah, Jacksonville, West Palm Beach and Miami, and comprise one of the largest coastwise shipping fleets for the transportation of passengers and freight.

STATE OF MARYLAND

By Courtesy of the Baltimore Steam Packet Company

Model of the *State of Maryland.* The steamer has an over-all length of 330 feet and an extreme beam width of 58 feet, and is propelled by a four cyliner, triple-expansion vertical inverted steam engine driving a single bronze propeller. Steam is supplied by four single end Scotch type marine boilers using coal as fuel.

Modern and handsomely equipped in every detail, the ship has five decks, three of which are devoted exclusively to passenger accommodations. Large rooms with beds and berths, all with running hot and cold water, and many with private baths. The glass enclosed palm and music room is a feature of great attraction, while the decorative scheme throughout is done in the Colonial manner. The ships of the Baltimore Steam Packet company are operated on the waters of Chesapeake Bay between Baltimore and Norfolk.

Relief Department

The exhibit of the Relief Department of the Baltimore and Ohio Railroad is designed to show the importance of its work in the life of the employes. Charts and illustrations present a graphic record of what has been accomplished by its Relief, Savings and Pensions

Features. The main section of the exhibit portrays in a dramatic manner how, through the Savings Feature, the employe is enabled to save systematically and how these savings are then utilized in enabling other employes to acquire their own homes. It depicts how the Relief Feature aids the employe during his active service, and how after retirement, he may continue to enjoy the comfort of his home, sustained through the earnings of his savings supplemented by the pension granted by the Company in recognition of, and measured by, his years of service. The houses in the central part of the exhibit are actual models of some of the thousands of homes constructed by employes in recent years.

Relief Feature. On May 1, 1880, a mutual benefit association was organized under the title of "The Baltimore and Ohio Employe's Relief Association," for the purpose of providing for the members and their dependents an insurance coverage commensurate with the payments made. This association undertook to pay stated benefits covering disability arising from either sickness or accident, and also to pay death benefits to the dependent family of the member—with double the stated benefits payable when death occurred from accidental causes.

On April 1, 1889, this Association relinquished its charter, and the Baltimore and Ohio Railroad Company took over the supervision of its operation and reorganized it as a section of the Relief Department of the Company, under the official title of "The Relief Feature."

This Relief Feature was a pioneer institution of its kind in the United States, and has served as a model upon which the welfare departments of many railroad and industrial companies have since been organized.

From May 1, 1880, to June 30, 1927, total disability and death benefits have been paid to its members amounting to $37,270,620.72.

Membership in the Relief Feature is entirely voluntary, and all employes of the company, not over 45 years of age, are eligible for membership upon passing a satisfactory physical examination. On June 30, 1927, there were 76,639 employes in the service of the company; and of this number 56,544 were members of the Relief Feature.

Savings Feature. On August 1, 1882, a Savings Feature was organized as a section of the Relief Department, for the purpose of operating a mutual savings institution for the benefit of the employes of the company. Employes all over the system may deposit their savings with designated depositaries, usually their local station agent, for transmission to the Savings Feature at Baltimore. Many employes, however, prefer to execute an allotment card authorizing the deduction of a stipulated amount regularly from their pay checks for credit to their savings accounts.

On June 30, 1927, the Savings Feature had 11,018 depositors with total savings deposits of $16,670,175.23.

The first call on the use of the funds of the Savings Feature is given to those employes of the company who desire to purchase or build homes for themselves. Suitable regulations have been adopted to insure that such loans may be properly made and secured; and a corps of competent inspectors is maintained, who, if the employe desires to purchase a home already built, will appraise it for him and advise him so that he may make his purchase at a fair valuation. On the other hand, if the employe desires to build a new home, these inspectors are available to examine his plans, inspect the material used, and in a general way advise the employes in the construction of his house, in order that he may secure for himself the best possible construction at the lowest cost.

On June 30, 1927, the Savings Feature had total assets amounting to $17,794,051.51, of which $11,445,119.37 was invested in first mortgage loans made to employes to enable them to purchase their own homes, and the balance was invested in sound income producing securities or held in cash on deposit with the Treasurer of the Company to the credit of the Savings Feature.

The Savings Feature undertakes to pay to its depositors 4 per cent interest on their deposit balances plus such dividends, in the form of additional interest on their deposits, as the earnings of the Feature in any year may warrant. Since 1893, the Feature has paid to depositors from 5 to 5½ per cent annually on their deposits, and in 1910 as much as 6 per cent was paid.

Since its inauguration in 1882, the Savings Feature has operated without a loss to a single depositor; has paid to its depositors $8,644,946.25 in interest and $2,482,159.99 in dividends, or $11,127,106.24 altogether; and has in addition assisted employes over the company's entire system to purchase their own homes to a total

appraised valuation of some $55,000,000 to $60,000,000, at the time of purchase.

Pension Feature. The Baltimore and Ohio was one of the first railroads in the United States to adopt a comprehensive plan providing for the retirement of those employes, who had grown old in its services, upon stated monthly pension allowances to be paid them during the remainder of their days.

This Pension Feature, organized on October 1, 1884, has been in continuous operation to the present date. During this period some 4,099 employes have been retired and placed on the pension roll of the company, of which number, 1,528 were living and receiving pension allowances on June 30, 1927.

Although some employes remain in active service until they are well over 70 years of age, it has been found that the average age of the employes at the time of their retirement is about 67½ years. The average length of service of those employes who have been retired has been about 35 years.

The Baltimore and Ohio Railroad Company has always furnished the funds required for the payment of these pensions. The employes have made no contributions thereto.

During the first six months of 1927, a total of $398,660.15 was expended by the company in payment of pension allowances to its retired employes, and between October 1, 1884, and June 30, 1927, a total of $7,312,553.92 has been expended for this purpose.

Railroad Bookkeeping

Superhuman, almost, is the machinery by which the modern railroad meets the almost overwhelming problem of its manifold bookkeeping operations. A system like the Baltimore and Ohio, with many miles of line and covering many states, finds its individual transactions in the course of a year running high into the millions; in a single month it will run close to 900,000 waybills embracing over 1,500,000 individual shipments.

In the accounting department's exhibit at the Centenary the effort has been to show a cross section of this vast bookkeeping machinery of the Baltimore and Ohio. The exhibit starts with the most modern form of station equipment and adds to it the work done at headquarters; the whole being shown in a typical station and audit unit, consisting of a waybilling machine, a tabulating-printing machine, an assorter, a duplicating key punch, an abstract machine and a calculator. To this there is added a payroll unit consisting of an addressograph machine, a graphotype, a pay check writing machine and a payroll typewriter.

These are, of course, only a portion of the mechanical plant of the accounting department of a modern railroad. In such a plant there are many other lesser machines, or those in more common use such as, for instance, the typewriter and the dictating and transcribing machines. The use of such machines is so generally understood today as not to require their exhibit as a part of a railroad accounting display. The following unit machines are shown:

Waybilling Machine. As is generally known, the waybill is the ticket by which a freight shipment moves from point to point upon the American railroad. If the shipment is entirely upon one railroad the transaction is simple, comparatively. If, however, as very frequently happens, two or more railroads are involved in the shipment, it becomes more complicated.

Waybills usually are issued in triplicate, one copy of which goes with the shipment and passes through the hands of the conductors of the various trains that handle it, the other two being retained for office and accounting uses. A highly modern form of typewriter performs the operation of writing these bills in large numerals and capital letters so that they may be easily read, allowing a narrow margin for error. This waybilling typewriter is shown at the exhibit. It also is shown in another rôle where it is used for the abstracts of a railroad's freight operations.

The Duplicating Key Punch. The electric tabulating and accounting machine method was devised to automatically classify and aggregate all the figure-facts of an extensive business. This is accomplished at the minimum expenditure of time, energy and money by transferring original data—such as, for instance, the waybill—to tabulating cards by means of punched holes and then by use of these same holes, sorting and tabulating these records.

The operation of the highly modern electric duplicating key punch is at one and the same time a simple and complex operation. With only fourteen keys, compactly arranged and requiring but a very light operating touch, the data which the operator writes from the waybill or other document is transcribed to the record cards with the utmost ease and rapidity. All information common to more than one card is recorded automatically. Any card in its entirety, or any portion of it, can be duplicated with absolute accuracy and great rapidity.

The unpunched cards are held in a magazine from which the individual cards to be punched are automatically fed into the punching position. When desired, cards of different form or color may be fed directly into the punch without removing or in any way disturbing those in the magazine.

The Sorting Machine. The electric sorting machine assembles all cards for each class of information and simultaneously arranges the various classes in numerical sequence. It receives 850 cards at a time and sorts them at a rate of from 350 to 400 cards per minute. Its metallic fingers do this by means of the punch holes in the cards.

The Tabulating and Accounting Machine. This mechanism takes the cards as assorted and completes the story that they tell. It adds, simultaneously, from one to five columns of figures at the rate of 150 amounts per minute for each counter thus, on demand, supplying as many as 750 additions every minute. This machine also adds the quantities and amounts punched in tabulating cards in the same manner as the electric tabulating machine, but differs from it in that it makes printed records directly from punched cards.

When group totals only are desired the electric accounting machine adds from one to five columns of figures simultaneously at the rate of 150 cards per minute; when detailed analyses are required this machine can be transformed instantly into a listing machine capable of printing from one to seven itemized columns of figures, together with group totals, at the rate of 75 cards per minute. Ruled report forms can readily be inserted in the machine and finished reports secured in printed detail directly from the punched tabulating cards. The printing is done on a 20-inch carriage with single or double typewriter spacing. Multiple carbon copies can be secured. This machine, as well as the various other models, accumulates grand totals in addition to the individual group totals.

The routine incident to interline abstracting is quite similar in all railroad organizations. Briefly described, interline abstracting follows the receipt of waybills attached to station reports after they have been checked and sorted by roads and stations. The operators post the waybills to the station abstracts making, at the same time, a continuous record of all way-bills received at a given station. This record provides the totals of weight, freight, advance and prepaid charges without further work or effort.

After all the waybills from a given station are entered to the proper abstract, the continuous record is submitted for comparison with the station agent's report and if the totals agree, the work is proved correct. At the end of the month the abstract totals by stations and roads is taken and subsequently consolidated into a summary grand total of all abstracts for the month. This total must agree with the grand total of all of the agents' daily received reports for the month. The abstract totals are then entered to the division statement and the proportion of freight charges due the operating road and its connecting lines is shown.

The Calculating Machine. This machine is in such general use in modern business that it requires no special description in this catalogue.

The Addressograph Machine. The same is true of the modern addressograph which, as every business man knows, is nothing more or less than a rapid printing device by which names upon a mailing list are clearly and legibly imprinted upon mailing wrappers or envelopes, each individual name and address being set in type upon a separate plate. The system is highly flexible; name-and-address plates can be added to or taken away from the list with great rapidity and flexibility.

Graphotype Machine. A Graphotype is a machine for cutting plates showing employes name, occupation, shop in which engaged, rate of pay, and used in the Addressograph machine for printing daily time cards. These plates are made in sections so that the frame holding all the sections can be used in writing pay checks, by the application of a device that depresses those portions of the frame containing information not required on a pay check.

Pay Check Writing Machine. Motor driven check protector which imprints on the pay check both in words and numerals, the amount due the employe, the name of the employe having previously been put on the check by the Addressograph machine.

Adding Machine. This is a special type of adding machine somewhat similar to those in general use in modern business, and is used for adding the payrolls and other purposes, especially where sub-totals

are carried forward to a grand total. In addition to this and in connection with handling pay checks, the amount of each check is listed by this machine and total compared with total of the payroll.

Payroll Typewriter. This is a special typewriter with a flat fixed platten and is used when a number of copies of the payrolls are required. It is equipped with a special easily-readable open-type face.

THE MARYLAND PAVILION

In order to show that portion of the world which comes to the Centenary something of the resources of the State of Maryland and its principal city, the Maryland Pavilion has been erected on a highly convenient location. It houses, among other things, a large bas-relief map of Maryland and a similar one of the harbor and city of Baltimore. There are specific exhibits of the University of Maryland, the State Highway Commission, the Conservation Commission, and other branches of the state organization.

THE PAGEANT

Over a loop of standard railroad track more than a mile long and a parallel highway, moves the Pageant of the Iron Horse. It illustrates the remarkable progress made in the development of speed and efficiency of inland transportation during the past one hundred years in this country. It shows in a colorful and elaborate succession of floats and vehicles the many ingenious devices invented to carry passengers and goods quickly and safely from place to place.

At the head of the parade is placed a float called, "America" resplendent in red, white and blue, which carries the Baltimore and Ohio Glee Club, a male chorus of forty voices. It sings a number of selections appropriate to the occasion.

Pre-Railroad Transportation

A group of American Indians, with heavily-laden pack-horses and the primitive "travois," pass first in review. The "travois" consists of two long poles crossed over the neck of a horse, the rear ends laced together with vines forming a cradle which drags along the ground and on which are packed the movables of the red men and their families. The Indians of this group come from Glacier National Park by courtesy of the Great Northern Railway. They are full-blooded members of the Blood and Piegan tribes of the Blackfeet Nation. This part of the pageant is symbolic of early highway travel, crude and slow.

Next comes a float representing Father Marquette, famous missionary and explorer, accompanied by Joliet and two aides, sighting and blessing the Mississippi. An eighteen-foot canoe built similarly to those used on the expedition is shown "beached." Three persons as Indians work at the business of portaging.

Following this tableau is a float carrying an old fashioned river bateau, a queer-looking boat pointed at either end, very deep like a dory, and equipped with a crude sail. Then come in order the earliest American road wagon, with a group of early pioneers and their families; the post chaise, which furnished the "fast" passenger service in the early days; and a post rider of the Paul Revere type,

who helped relay mail and messages over the country. Costumes of the time are closely imitated.

Canals

Introducing an important means of travel by water, a canal boat, of the kind used on the Chesapeake and Ohio canal, is mounted on a thirty-foot float. Several colored boys play and sing old plantation songs.

Early crude methods of freight transportation are symbolized by tobacco rollers showing a number of negroes moving large hogsheads of tobacco along the route of the parade.

Conestoga Wagon

A great improvement in those days in the moving of freight is represented by a Conestoga wagon, the fast freight of the time, a spacious stoutly-built vehicle covered with a picturesque canvas canopy, drawn by six horses. Deep streams were no barrier to this type of carrier; the wagon was built to float and the horses swam.

A curious vehicle is the so-called George Washington coach, a high and narrow carriage, yellow in color, in which Henry Clay is seen riding over the National Road. It is closely followed by an even more elaborate vehicle of a somewhat later day. This is the stage coach which almost at the very hour of the coming of the Baltimore and Ohio reached its apotheosis upon the National Road. The particular coach shown, loaned by Mr. Henry Ford to the pageant, is the famous *Kearsarge*, built by Abbott and Downing of Concord, N. H., who early achieved a great proficiency in this type of coach. Another coach, equal in interest, is loaned by Mr. Fred Stone.

The Birth of the Railroad

These vehicles, however, though great improvements over earlier modes of travel, still did not come up to the demands of a rapidly expanding civilization. A faster means of transportation was needed. The problem in Baltimore was made more acute by the fact that the Erie canal was taking a great deal of trade away from the city, and Baltimore's commerce was being diverted for lack of a convenient outlet. To face this crisis, a meeting of prominent citizens was held at the home of George Brown, in Baltimore, February 1827. Reports had come from across the ocean of rail travel in England and at this assembly the Baltimore and Ohio railroad was conceived. It was decided to build a railroad west from Baltimore.

This famous meeting is represented on the next float in the pageant, showing George Brown, Philip E. Thomas and their associates gathered in an impressive group.

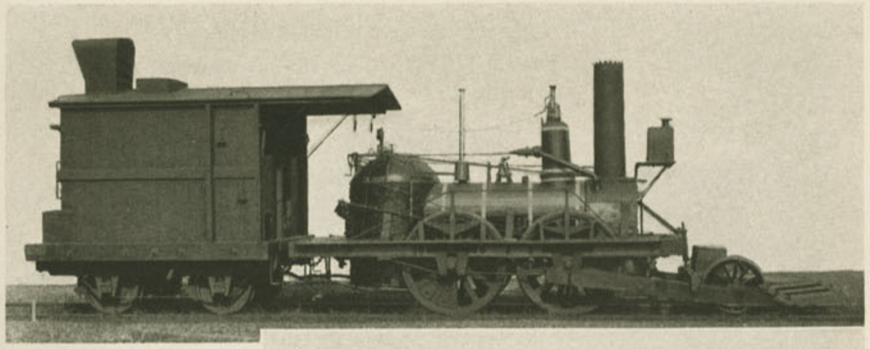
Laying the "First Stone"

The pageant turns once again to the highway. Now the broad roadway is the principal street of Baltimore City, one hundred years ago. For there is being produced the historic parade of July 4, 1828, held in celebration of the laying of the First Stone of the Baltimore and Ohio railroad. For this the allied interests and trades of the town furnished many elaborate floats. Four are reproduced; from the carefully printed documents of the event. The First Stone, which was to be put in a prominent resting-place at Mount Clare rides upon a huge car and is preceded by the Mount Clare band of today, playing the historic "Carrollton March" which was written for the parade of ninety-nine years ago.

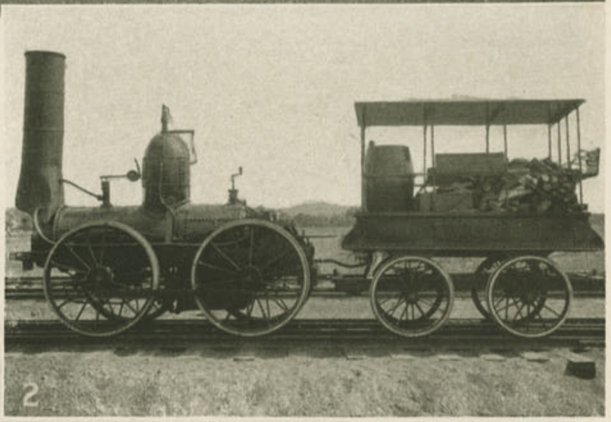
The blacksmiths are represented by their float; the Sons of Vulcan carrying a large forge; the carpenters by a miniature Doric Temple and the shipbuilders by a vessel, the Union, a replica of one of the historic Baltimore craft. Charles Carroll of Carrollton nearly ninety-two years of age, and the only living signer of the Declaration of Independence, rides in a barrouche alongside Philip E. Thomas, the first president of the Baltimore and Ohio. There are numerous citizens, uniformed and otherwise, in the parade.

Surveying a New Railroad

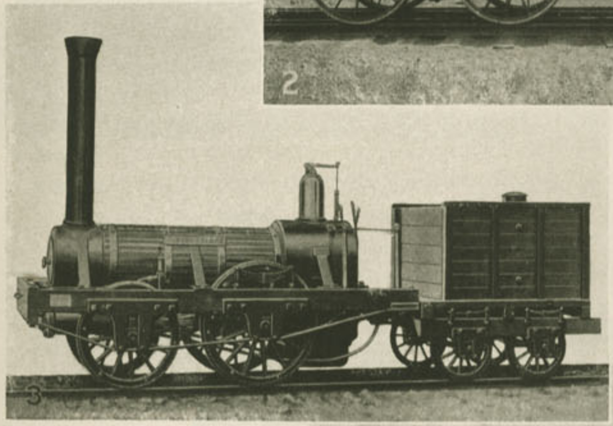
At the time of the beginning of the Baltimore and Ohio there was no school of engineering in the land save the United States Military Academy at West Point. Its graduates were called upon to plan and construct most of the important internal improvements of the day. Tribute to these army men of the Baltimore and Ohio is paid in the float depicting Captains McNeil and Whistler and Lieutenant Thayer with their associates making the first reconnaisance for the new railroad.



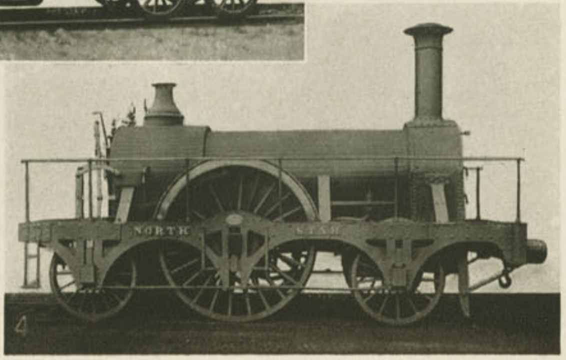
1. John Bull



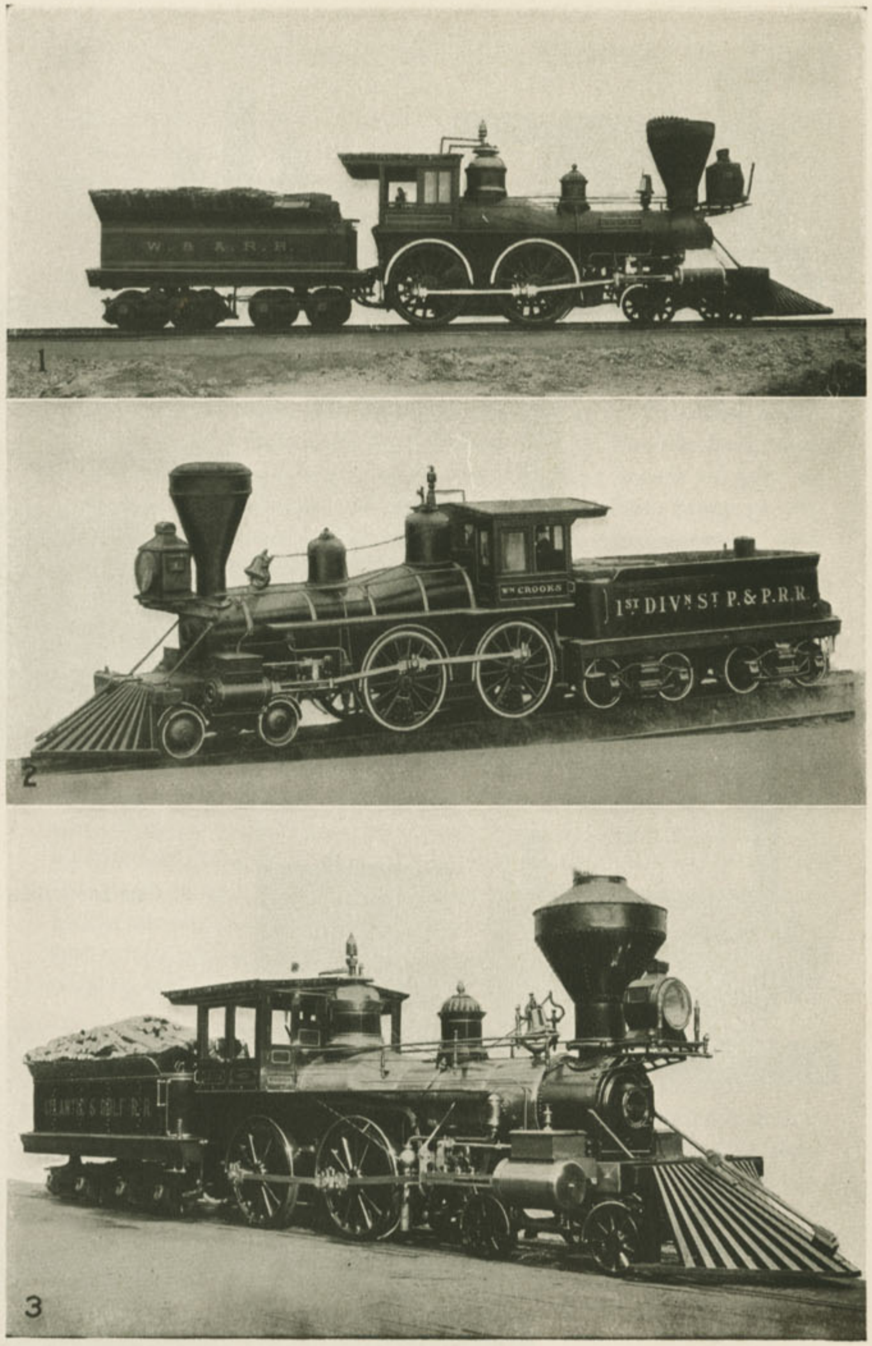
2. De Witt Clinton



3. Old Ironsides



4. North Star



1. General 2. J. W. Crooks 3. Satilla

The Coming of Steam

The new railroad had no certainty as to its motive power. It experimented with various crude devices. Therefore one float in the pageant shows the so-called treadmill car and another the sail car, preposterous in conception but so interesting to the Russian minister at Washington that he had a model of it sent to his master at St. Petersburg.

More practical was the horse car, which began regular trips between Baltimore and Ellicotts Mills, May 24, 1830, and continued in steady use for many months thereafter. In the Pageant of the Iron Horse this small car runs upon its own track placed between the highway and the main loop track.

The horse car was not the solution. Alderman Peter Cooper of New York, a hard-headed business man who had made investments in Baltimore real estate and who had a knack for invention, became alarmed at the dilatory policy of the directors of the Baltimore and Ohio in regard to the new steam locomotive and so he built the tiny *Tom Thumb*, the first practical American-built locomotive.

The Iron Horse

An exact replica of the *Tom Thumb*, carefully made to every dimension, leads the most amazing part of the Pageant of the Iron Horse; the long row of steam locomotives, old and new, by which the railroad in America has measured its growth.

It is to this progress of the Iron Horse that the pageant now devotes itself. One sees in quick succession that *York*, built in 1831, which won first prize in the competitive locomotive trials of that summer, followed by the *Atlantic*, built the following year. The *York* is another carefully fashioned replica of the original engine, but the *Atlantic* is the original locomotive which for sixty-one years remained in service on the Baltimore and Ohio, and which for ninety-five years has been kept in good running condition. Because of the unusual record of this sturdy veteran it has been accorded the honor of hauling a very early Baltimore and Ohio passenger train composed of two Imlay double-deck coaches which came into service on the line in 1831.

Fourth in this file of engines is the *Thomas Jefferson*, built in 1835, and the first locomotive to operate in the state of Virginia between Harpers Ferry and Winchester. The *Thomas Jefferson* is another original locomotive. The *William Galloway* named after the grandfather of C. W. Galloway, the present vice-president in charge of operation of the Baltimore and Ohio, is a precise working replica of the famous *Lafayette*, the first locomotive upon the road to have the horizontal type of boiler.

The *William Galloway* is followed by the *Memnon*, a typical locomotive of 1848, which also has been carefully preserved all these years. The *Memnon* in turn gives to the *Ross Winans No. 217* typical of the curious camel-back locomotives which continued in use on the Baltimore and Ohio for many years. The *Ross Winans* is shown hauling a small freight train of house cars (box cars) and coal hoppers, typical of railroad practice more than half a century ago.

The Telegraph

Then follows a double float, the "Birth of the Telegraph," bearing a placard with the words "What Hath God Wrought," the first telegraph message sent in America, which was transmitted between Washington and Baltimore by wires along the Baltimore and Ohio line.

Once again the scene shifts momentarily to the highway and one sees a fleeting glimpse of another form of communication in the United States which in the east closely followed the birth of the telegraph and in the far west actually preceded it. This is the Pony Express, which with an early western stage coach, lent to the pageant by the American Railway Express Company, gave glamor to the ancient and far-spread name of Wells Fargo and Company.

Another float. The Civil War is beginning. One sees Abraham Lincoln on his way to Washington for his first inauguration, riding on a train of the Baltimore and Ohio. It is followed by a float representing the destruction of tracks by the Confederate Army during the Civil War. This refers to the constant efforts of the Southerners to cut off the supplies and communications of the Union armies by tearing up the line of the Baltimore and Ohio, one of the most important railroads in the military program of the country.

On the Track Again

More of the color of sixty-five years ago is given by the early locomotives interspersed with these floats of wartime days. Thus one sees a typical creation of William Mason of Taunton, Massachusetts the first man to give an American locomotive the grace and power for which it quickly became known. The *Mason No. 25*, shown in the Pageant of the Iron Horse, has been owned by the Baltimore and Ohio for seventy years, and for this event it has been completely restored, in outline and in color; the latter a brilliant green and gold.

Sharing honors with the *Mason* is the *Thatcher Perkins No. 117*, which was built at Mount Clare in 1863. Thatcher Perkins was a distinguished master mechanic of the Baltimore and Ohio and the ten-wheel passenger engine which he evolved for the heavy mountain grades of the line, and which is here shown, was not equalled in strength or capacity until 1889. The *Thatcher Perkins*, resplendent in livery of red and gold, after the fashion of all Baltimore and Ohio passenger engines of that day, hauls a baggage car and two small passenger coaches of the type that came into use in the years of the Civil War and immediately thereafter.

Upon its heels there comes the *J. C. Davis No. 600*, the ten-wheel passenger engine which was built just in time to be exhibited at the great Philadelphia Centennial of 1876. It returned to Philadelphia last year to be exhibited in the Sesqui-Centennial there.

Vieing in interest with the *J. C. Davis*, is the *A. J. Cromwell No. 545*, the creation of another very distinguished master mechanic of the Baltimore and Ohio, whose name it perpetuates. The *Cromwell* is a consolidation engine, the first of the type used on the Baltimore and Ohio. The *No. 1310* and the *Muhlfeld* follow.

Locomotives from Afar

Now, for a moment, the pageant ceases to tell the story of the development of the Baltimore and Ohio solely, and devotes itself to locomotives old and new from other railroads. England is the mother of railroads. She began her commercial railroad operation in 1825 and four years later George Stephenson produced his remarkable *Rocket* for the Liverpool and Manchester Railroad long since recognized as the first really practical steam locomotive in England.

Baltimore and Ohio recognizes England as the mother of railways, and so upon a float one sees at this point of the parade, Stephenson and the remarkable small locomotive that was the product of his brain.

That was the beginning in England. The height of attainment there today is shown by the next locomotive in the pageant; the magnificent *King George V*, which was built by the Great Western Railway at its Swindon shops, just in time to be shipped to America for the Fair of the Iron Horse.

Two other locomotives come from British dominions; the first, the *Confederation No. 6100* of the Canadian National Railways, built in 1927; the second is the *No. 2341* of the Canadian Pacific Railway.

The picture returns to the early development of the locomotive in the United States. Two locomotives contemporaneous with the *York* and the *Atlantic;* the *De Witt Clinton* of the Mohawk and Hudson (now a part of the New York Central Railroad) and the *John Bull* of the Camden and Amboy Railroad (now part of the Pennsylvania Railroad) which were built and first operated in 1831, follow with their ancient trains.

Two generations later came the *Satilla* of the Atlantic and Gulf Railroad, built by Rodgers at Patterson in 1860 and loaned to the Fair of the Iron Horse by Mr. Henry Ford, and the *William Crooks* of the St. Paul and Pacific, Second Division, loaned by the Great Northern Railway.

American Locomotives and Trains of Today

The great epic drama of rail transport draws to a close. One sees in quick succession the New York Central *No. 5200*, the Pennsylvania *No. 8800*, the *John B. Jervis* of the Delaware and Hudson, the Western Maryland *No. 1112*, and the *Philip E. Thomas No. 5501*, the *No. 2024*, *No. 5039*, *No. 4400* and *No. 6200* of the Baltimore and Ohio.

The end draws near. Long ago the parade presented the *Ross Winans* and an early freight train of the fifties or the sixties. Now one sees the modern freight train of the Baltimore and Ohio of 1927. It is hauled by a simple type of Mallet locomotive and consists of representative freight cars and caboose.

The note of farewell is struck by the *Capitol Limited*, the great feature train of the Baltimore and Ohio, which for five years now has performed swift, excellent and dependable service between Baltimore, Washington and Chicago and which has become recognized as one of the "crack trains" of North America.

When the *Capitol Limited* has finished its circuit of the loop track, it will return in front of the grand stand, where its passengers will alight and take the motor busses at the train side in the fashion made popular by Baltimore and Ohio at its Jersey City terminal.

The long parade ends as it began—with a float. It is entitled *Maryland* and it shows the historic and progressive city of Baltimore, hub of a rich and fertile state, and served by the railroad which, for many years, has endeavored to be at least a good neighbor and faithful servant.

LOCOMOTIVES AND TRAINS IN THE PAGEANT

1829–1830—Tom Thumb. A reproduction of the first Baltimore and Ohio locomotive made at Mount Clare Shops in 1926 of the first American-built locomotive built by Peter Cooper of New York to prove steam operation. Ran successfully on rails of the Baltimore and Ohio, 1829–1830. Thereupon in January, 1831, directors offered $4000 prize for an engine weighing 3½ tons to haul 15 tons on level at 15 miles per hour.

The *Tom Thumb* hauls a reproduction of a 4-wheel open passenger car with longitudinal seats in which the directors of the Baltimore and Ohio rode to witness the demonstration to prove the practicability of operating the steam locomotive around curves and up grades.

1831—York. Reproduction for operation under steam. First locomotive built by Phineas Davis, York, Pa., winner of $4000 prize in Baltimore and Ohio competition at Mount Clare 1831. Vertical boiler, no tubes, with center flue extending down from crown sheet to cylindrical drum firebox, carried on a frame supported on two pairs of drivers with outside cranks connected by trussed side bars with connecting rods to vertical cylinders, bolted to the top of sides of boiler. Engine weighed 3½ tons and after experimenting, the *Remodelled York* was designed. The resulting development of Phineas Davis was the *Atlantic*, the established type of the earliest locomotives.

1832—Atlantic. Baltimore and Ohio locomotive. (The first "*Grasshopper*"). Built by Davis and Gartner of York, Pa. Had 10 x 20 inch vertical cylinders on front side of boiler; piston rods operating walking beams, connecting rods to crank shaft on main frame, gearing into one pair 35 inch driving wheels; boiler 51 inches in diameter, 61 inches high with 46½-inch diameter firebox. Anthracite fuel; forced blast by exhaust steam operated fan; steam pressure 50 pounds; feed water preheated by exhaust steam, forced by pumps through closed heater; weight 6½ tons. Reconditioned from old engines at Mount Clare Shops 1926.

The *Atlantic* hauls two reproduced double-deck Imlay passenger coaches similar in design to the type of stage coaches used in 1831. They accommodate passengers on the inside and on the top in the usual manner of transportation of the period.

1834—Thomas Jefferson. A Baltimore and Ohio locomotive built by Davis and Gartner at the Company Shops at Mount Clare. Cylinders, 12 x 22 inches; Grasshopper type, however, of heavier weight, and of similar construction to *Atlantic* but to increase the traction they were improved by extending the crank shaft through to outside of frame, fitted with crank arms to engage connecting rods to cranks on the outer ends of axles of the two pairs of driving wheels. Driving springs above main frame over top of the journal bearings of the driving axles also was an improvement. Vertical type boiler as previously used, enlarged to 52 inches in diameter and 64 inches high, with 400 1½-inch tubes; exhaust steam feed water heater, pump and forced draft by fan being employed. Tractive power 5,904 pounds; boiler pressure 50 pounds. Weight 15½ tons. The locomotive was equipped with a tender for road service and, with tank and coal space provided on the engine, was used for switching at the Mount Clare Shops of the Baltimore and Ohio Railroad until 1893.

1837—William Galloway (Lafayette). Built by Richard Norris of Philadelphia, originator of the Norris type of American locomotives famous for adhesive power. The first six wheel (4-2-0) locomotive on the Baltimore and Ohio. Inclined cylinders; main rod connecting one pair driving wheels located ahead of firebox; horizontal boiler with dome top cylindrical firebox; inside hook motion. Sister engine of *George Washington*, which successfully operated on the Columbia Incline, Philadelphia. Engine reproduced at the Baltimore and Ohio Mount Clare Shops, 1927.

The *William Galloway* hauls two reproduced four-wheel open, drop side, gondola cars used in 1831 for hauling barrels of flour and boxed freight protected by canvas. This was the first type of freight car.

1848—Memnon No. 57. The original Baltimore and Ohio locomotive, with slight modifications as crept in during her life, and reconditioned at Mount Clare Shops in 1926 for steam operation in the Baltimore and Ohio Centenary Exhibition 1927. Engine had eight connected driving wheels and no trucks; built by the Newcastle Manufacturing Company, Newcastle, Delaware. Had 17 x 22 inch inclined cylinders; straight horizontal boiler and rectangular firebox overhanging rear drivers; driving wheels 43 inches in diameter; all driving boxes in pedestals on main rigid frame with long driving springs connected to top of frame between drivers, extending to the adjoining wheels, engaging in supports extending through the frame and resting upon tops of driving boxes, the springs acting as equalizers; front and rear drivers equipped with flanged tires and second and third drivers with blind tires; boiler fed by plunger pump driven originally by eccentric on back crank pin. Weight of engine about 23½ tons. Tractive power 13,200, boiler pressure 100 pounds.

1869—Ross Winans No. 217. Original Baltimore and Ohio locomotive. Ten-wheel freight locomotive built at Mount Clare Shops, employing Ross Winans' type of boiler with large dome located at forward end close to smoke box with overhanging firebox, with sloping top and with cab located on top of boiler, which gives convenience for observation and ventilation. Cylinders 19 x 22 inches; drivers 50 inches; boiler pressure 115 pounds; tractive power 14,850 pounds; total weight 77,000 pounds. No. 217 is the modern development of the Hayes 10-wheel camel passenger engine of very similar construction built by S. J. Hayes at Mount Clare in 1853.

The *Ross Winans* hauls three reproduced three-pot iron hopper cars of the period of 1876, of 10 tons capacity, of self-clearing type, with link and pin continuous couplers, with hand brakes operated on two pairs of wheels. She also hauls two iron box cars with original bodies built in 1863.

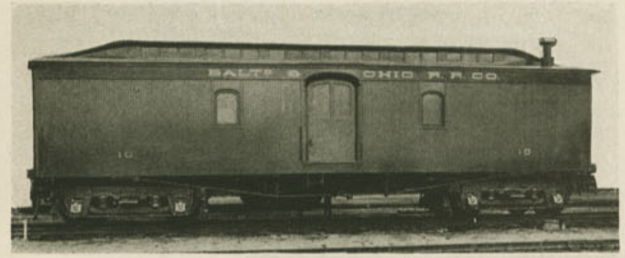
1856—William Mason No. 25. Baltimore and Ohio locomotive, reconditioned at Mount Clare Shops 1926. American type (4-4-0) built by Wm. Mason and Company, Taunton, Mass., with two pairs drivers, with four-wheel leading truck; horizontal cylinders 15 x 22 inches bolted to cast iron saddle fitted under round smoke box; wagon top boiler 46 inches in diameter at smoke box; rectangular firebox located back of rear wheels; drivers 60 inches in diameter. Weight 28 tons. First engine that had link motion valve gear. Forerunner of the standard American type passenger locomotive of the country. Exhibited Chicago and St. Louis Expositions.

1863—Thatcher Perkins No. 117. Baltimore and Ohio 10-wheel locomotive, designed by Thatcher Perkins, master of machinery, and built at Mount Clare Shops early in 1863 for heavy 17-mile grade (116 feet to the mile) over the Alleghany mountains between Piedmont and Grafton. Was the principal passenger locomotive in this service up to 1890; then superseded by heavier type 10-wheeler. Boiler—extended wagon top, 47½ inches in diameter, combustion chamber ahead of firebox, separated by water bridge wall; cylinders 19 x 26 inches; drivers—original 64½ inches, changed to 60 inches; total weight 90,700 pounds; Gooch or stationary link valve gear bar type engine frames; cylindrical smoke box, seated in cast iron cylinder saddle with separate bolted cylinders; extra long firebox 34 x 84 inches; extending over rear driver; grate area 19.8 square feet; 138 $2\frac{1}{4}$-inch tubes 12 feet 4 inches long; tube heating surface 1004 square feet; firebox 108.7 square feet total 1112.7 square feet smoke box equipped with spark arresting netting and firebox with hopper type dumping ash pans; driving wheels equipped with chilled cast iron tires, bolted to cast iron centers with attachment patented by Perkins and McMohon. Boiler filled by injector on one side and pump on other. Boiler pressure 130 pounds. When first built these engines were considered too heavy for track and were stored in white lead for a time. Original engine reconditioned at Mount Clare Shops 1927. Exhibited Chicago and St. Louis Expositions.

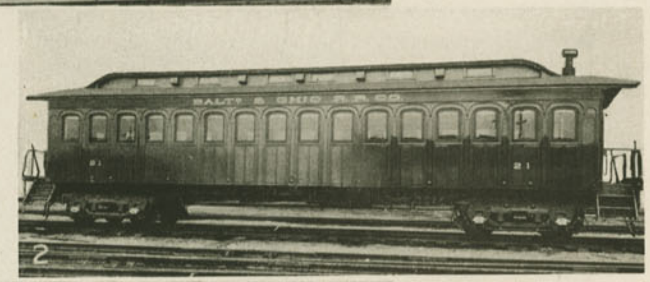
The *Thatcher Perkins* hauls an original baggage car, No. 10, and two original passenger coaches, No. 20 and No. 21, decorated in the original design, and built in 1865.

1875—J. C. Davis, No. 600. Original Baltimore and Ohio locomotive reconditioned at Mount Clare Shops, in 1926. First passenger engine of the *Mogul* or 2-6-0 type used on the Baltimore and Ohio Railroad. Built by J. C. Davis, master of machinery, at Mount Clare, for hauling heavy passenger trains over 17 mile grade (116 feet to the mile) over the Alleghany mountains between Piedmont and Altamont. Cylinders, 19 x 26 inches; boiler, $48\frac{3}{4}$ inches in diameter; pressure, 110 pounds; 115 tubes $2\frac{1}{4}$ inches in diameter, 15 feet long; firebox 66 x 42 inches; grate area 19.25 square feet; tractive power 14,700 pounds; weight in working order 90,400 pounds; on drivers 76,550 pounds. This engine was exhibited at Philadelphia Centennial Exposition 1876, receiving gold medal for being heaviest passenger engine in existence. Also exhibited at World's Columbian Exposition Chicago 1893, St. Louis Exposition 1904 and Sesqui Centennial Exposition Philadelphia 1926.

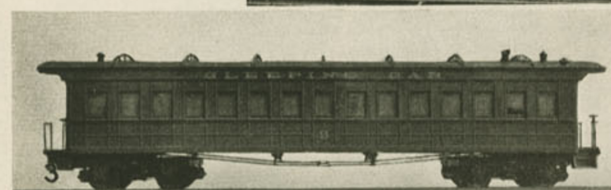
1888—A. J. Cromwell No. 545. Baltimore and Ohio locomotive. An improvement in design over the *Consolidation* type of locomotive by strengthening the weak parts and application of brick arches. Engine designed by A. J. Cromwell, master of machinery, builder of several locomotives and redesigner of a number of others. Engine had 21 x 26 cylinders, 155 pounds boiler pressure, 50-inch drivers, tractive power 30,200 pounds. A very successful engine. In serviceable condition. Mr. Cromwell served his trade a machinist apprentice on cotton mill machinery at Granite Company, Ellicott City, Md. Having lived along the lines of the railroad, naturally in its earliest development, he was attracted to that line of endeavor and when through his apprenticeship entered the shops at Mount Clare. Ultimately entered the motive power department and after numerous promo-



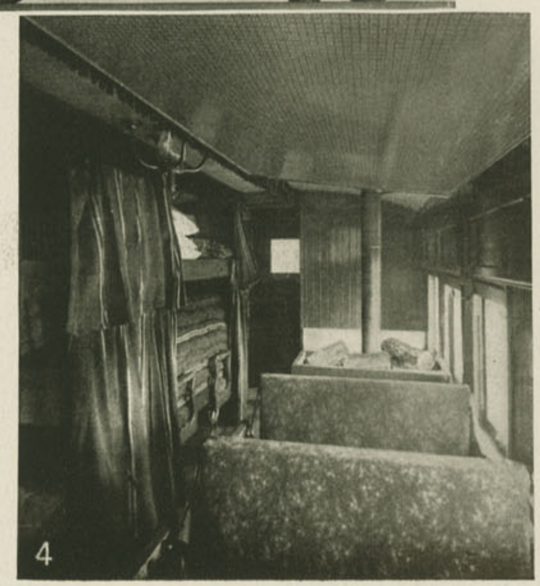
Baggage Car, 1863

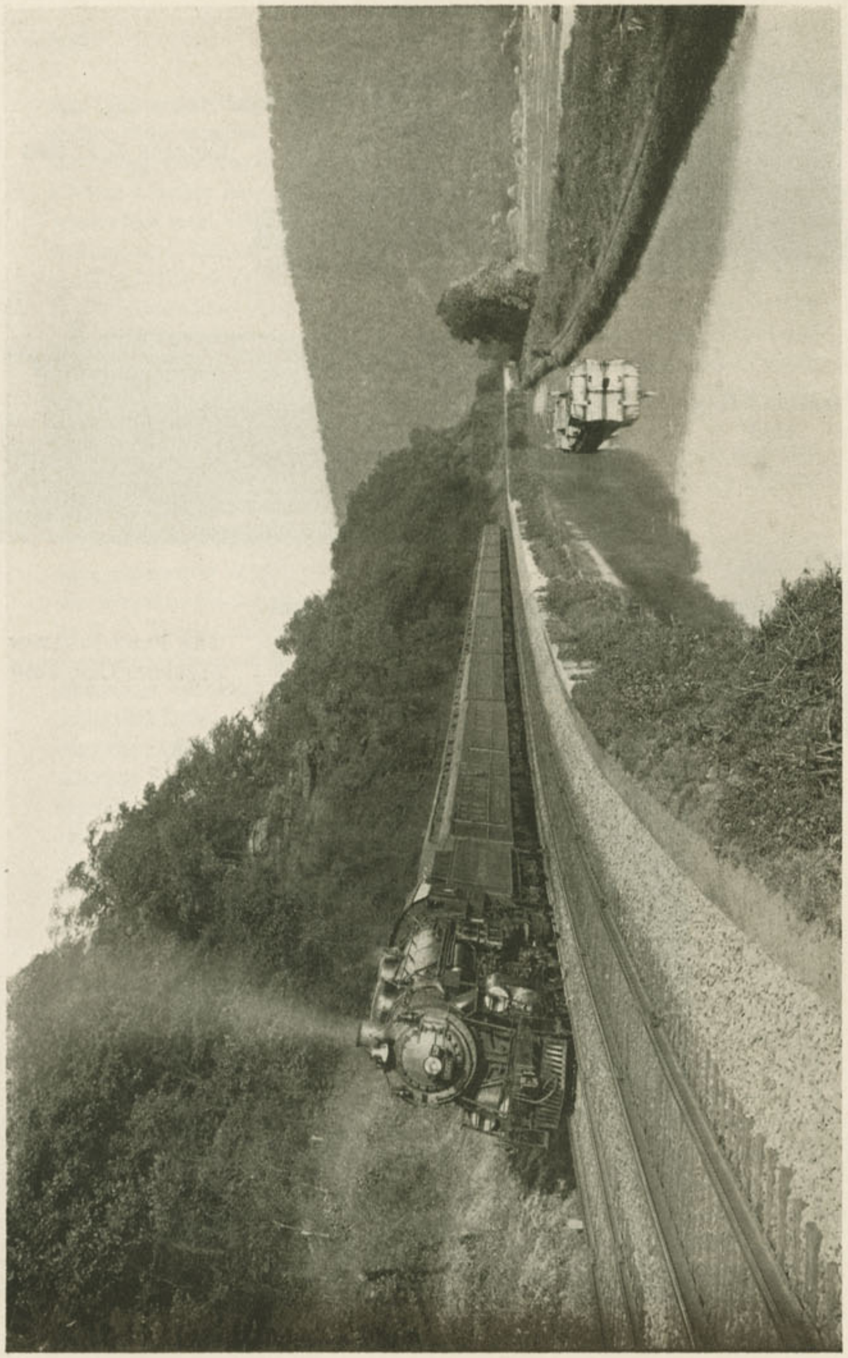


Passenger Car, 1863



The First Pullman Sleeping Car, 1859





THE CAPITOL LIMITED

tions he was in charge as master of machinery at Piedmont, at the foot of the Mountain Division, namely, 17-mile grade, where he acquired his knowledge of the exacting requirements of that service.

1896—No. 1310. Baltimore and Ohio Railroad locomotive. Class B-14. 4-6-0 type, high speed 10-wheel passenger locomotive designed by Harvey Middleton for Philadelphia-Washington service. Cylinders, 21 x 26 inches; 78-inch driving wheels; tractive power, 23,740 pounds; boiler pressure, 190 pounds; weight, 77 tons. A radical departure, as the 10-wheel engines were considered unsuitable for high speed. These engines dispelled this theory. Still in service. Reconditioned and painted in the original design at the Glenwood Shops, 1927.

1904—Muhlfeld No. 2400 (*Old Maud*). First compound articulated Mallet locomotive operated in the United States. Class DD-1. 0-6-6-0 type, tractive power 70,185 pounds, boiler pressure 235 pounds. This locomotive was designed by the Baltimore and Ohio Railroad, J. E. Muhlfeld, general superintendent of motive power, in conjunction with the American Locomotive Company and was the first Mallet built in the United States. Operated on the Pittsburgh division over Sand Patch grade in pushing service. This was a 100 per cent adhesion locomotive. The successful operation of this engine led to the building of numbers of more powerful Mallets for operation over heavier grades of the Alleghany Mountains on the main line, where it became necessary to widen track centers and reduce curves, requiring unusually heavy construction work.

1927—King George V, No. 6000. English 4-cylinder (4–6–0) express locomotive, built by Great Western Railway Company at Swindon Works, England. Known as "*King*" Class. Named after King of England. Four cylinder compound with inside cylinders connected to forward pair drivers and outside cylinders connected to second pair drivers. The most powerful express locomotive in Great Britain. Tractive power, 40,300 pounds; total weight, 89 tons; weight engine and tender, 135 tons 14 cwt. High pressure superheater boiler, conical barrel; copper firebox; Belpaire and toboggan type, without drums; substituting an open pipe at highest point of firebox. Water supplied through top feed. Swindon type superheater. Boiler pressure, 250 pounds. Drivers, 78 inches in diameter; cylinders, $16\frac{1}{2} \times 28$ inches. Walschaert valve gear placed between frames for inside cylinders, with rocking levers fitted through frames for outside cylinders. Forward pair front truck wheels equipped with outside journal boxes and rear pair with inside journal boxes to clear cylinders. Engine equipped with equalized vacuum braking on all coupled wheels, audible signal and automatic train control. Rigid wheel base, 16 feet 3 inches; total wheel base, 29 feet 5 inches. Six wheel tender, 4000 gallons capacity, equipped with water scoop. On trial trip ran from Paddington to Plymouth, a distance of 226¾ miles in 4 hours and 2 minutes without stop. First 155 miles was run at rate of 61.7 miles per hour with load of 410 tons.

1927—Confederation No. 6100. Canadian National passenger locomotive with booster, 4–8–4 type. Built at Kingston Shops of the Canadian National Railway, Canada; C. E. Brooks, chief of motive power. Engine designed for long runs and the purpose of the booster is to provide reserve power for heavy winter blizzard service. Height of engine, 15 feet 4 inches; width, 10 feet 11 inches; boiler pressure, 250 pounds; 73 inch drivers; cylinders, 25½ x 30 inches; tractive power, 56,800 pounds; maximum tractive power with booster, 69,700 pounds. Straight top boiler; combustion chamber firebox; two Thermit syphons in firebox and one in combustion chamber; high tensile steel boiler plates of 70,000 to 83,000 pounds tensile strength used in construction of boiler to keep down weight. Special feature is four wheel trailer truck for carrying added weight of firebox. Equipped with Duplex D-1 stokers, Elesco K-39 feed water heaters with C. F. pumps, type "E" superheaters, American multiple throttles, Precision reverse gear and Security brick arch. Driving wheel base, 19 feet 6 inches. Capable of operating around 18 degree curves.

1926—Canadian Pacific locomotive No. 2341. Class G–3–D, Pacific 4–6–2 type, built in Montreal Shops of the Canadian Pacific Railroad Company. Similar in design to the No. 2300 series. The most powerful engine yet built for Canadian Pacific Lines. The outstanding feature is the use of nicket steel alloy boiler plates with tensile strength of 70,000 pounds, for the purpose of increasing the pressure from 200 pounds to 250 pounds and not increase the weight of the locomotive. Grate area, 65 square feet; diameter first course, 79⅞ inch O.D.; wheel base, 67 feet 10 inches; length overall, 78 feet 9 inches. Cylinders, 23 x 30 inches; drivers, 75 inches. Weight on drivers 184,000 pounds, total engine 306,000 pounds, engine and tender 497,500 pounds.

The engine met expectations as to fuel economy and it hauls ten to twelve cars at a speed of 80 to 85 miles per hour. Equipped with combined superheater heater and throttle and use superheated steam in auxiliary equipment. Equipped with feed water heater.

1831—De Witt Clinton. Original engine, tender and three coaches. 0-4-0 type. Engine and tender measure 23 feet, 9 inches, with a combined weight of 12,098 pounds. Drivers, 48 inches; suspension wheels, braced by rods, have a diameter of 4 feet, 6 inches. She embodied the first outside journals on railroad axles, under the tender. Speed, 15 miles per hour. The three coaches are designed after the stage coaches of the period mounted on 4-wheel trucks, equipped with flanged wheels.

The *De Witt Clinton* was designed by John B. Jervis, and built at the West Point Foundry, New York City, by David Matthew, who was also her first engineer. Reconditioned by the New York Central Railroad to operate under her own steam. The first run was made in July 1831 and on August 9, 1831, made the trip between Albany and Schenectady, New York, a distance of 17 miles in less than one hour, over the lines of the Mohawk and Hudson Railroad, now a part of the New York Central system.

This locomotive made the trip for exhibition at the World's Columbian Exposition at Chicago in 1893 under her own steam, and is operated under the same conditions at the Centenary Exhibition of the Baltimore and Ohio, 1927.

1831—John Bull No. 1, and coach A. Planet type, wood burning engine, built by Stephenson and Company of Newcastle-on-Tyre, England, for Camden and Amboy Railroad, America; arriving in Philadelphia August, 1821. Placed in service on Trenton division November 12, 1831. 0-4-0 type. Cylinders, 9 x 20 inches; drivers, 54 inches; outside cranks and frames. Engine weighed about 11¼ tons without fuel or water. Later, because of difficulty in rounding sharp curves, a pilot, consisting of oak frame 8 feet long and 4 feet wide, side beams fitting extension of front of driving axle and pilot carried on one pair 26-inch wheels was added and this application made it a 2-4-0 engine.

Engine exhibited World's Columbian Exposition, Chicago, 1893, and later in National Museum, Washington. Reconditioned at Altoona Shops of Pennsylvania Railroad for operation under steam in the Baltimore and Ohio Centenary Exhibition. Boiler 13 feet long and 42 inches in diameter; 62 2-inch tubes, 7 feet 6 inches long; furnace, 3 feet 7 inches long, 3 feet 2 inches high. Driving wheels made of cast iron hubs, wood spokes and fellows; cast iron tires ¾-inch thick; tread, 5 inches wide; depth of flange, 1½ inches. Gage of track, 5 feet center to center of rails. Lateral play allowed in order to get around curves of track. Spiral springs held front wheels to rear and acted substantially as center pin of truck. Pilot, headlight, whistle and cab added 1833–40. Engine subsequently changed to cylinders 10⅞ inches instead of 9 inches; 74 instead of 62 tubes; firebox from 3 feet 7 inches to 3 feet 1 inch; depth of firebox 2 feet 5 inches instead of 3 feet 2 inches. Tender exhibited is duplicate of original.

The *John Bull* hauls one of the original coaches placed in service with the locomotive in 1836. It has a length of 30 feet; width, 8 feet 6 inches; wheel base, 20 feet with a seating capacity of 48 persons.

1861—William Crooks and Train. Locomotive No. 1 of the Great Northern Railway with reproduction of baggage car and coach, representing the first train operated in Minnesota. Cylinders 12 x 22 inches; drivers

63 inches in diameter; boiler pressure 120 pounds; tractive power 5000 pounds; weight on drivers 36,000 pounds; weight engine and tender 102,000 pounds. Locomotive designed and constructed in the shops of the New Jersey Locomotive and Machine Works by the firm of Smith and Jackson in 1861 at Patterson, N. J., for the St. Paul and Pacific Railway, now part of the Great Northern system. Locomotive shipped via rail to La Crosse, Wisc., then loaded on a barge and transported up the Mississippi River, arriving at St. Paul September 9, 1861. Baggage car and coach arrived the following year, June 28, 1862. In the afternoon of that day the first train load of passengers was run on the St. Paul and Pacific Railway from St. Paul to St. Anthony, now Minneapolis, a distance of 10 miles.

1860—Satilla. Built by the Rogers Locomotive Works for the Atlantic and Gulf Railroad. Cylinders 12 inches; stroke 22 inches, wheels 50 inches in diameter, boiler pressure 125 pounds, weight 29,000 pounds. This engine operated over the lines of the railroad from their logging plant to the Satilla river, after which it was named, where it connected with the Brunswick and Western Railway. The locomotive is now owned by the Detroit, Toledo and Ironton Railroad.

1927—No. 5200. New York Central Class 464-S-343. 4-6-4 locomotive. Cylinders, 25 x 28 inches; driving wheels, 79 inches in diameter; boiler pressure, 225 pounds; tractive power of engine, 42,000 pounds; tractive power of booster, 10,900 pounds; weight of engine, 343,000 pounds; weight of tender 212,200 pounds; total weight, 646,200 pounds.

1926—No. 8800. Pennsylvania Class M-1 Mountain type 4-8-2 locomotive. Cylinders 27 x 30 inches; drivers, 72 inches; boiler pressure, 250 pounds; tractive power, 64,550 pounds; weight on drivers, 267,000 pounds; weight of empty locomotive, 343,850 pounds; weight in working order, 385,000 pounds; weight of empty tender, 84,210 pounds; weight of loaded tender, 221,050 pounds.

1927—John B. Jervis, No. 1401. American locomotive. 2-8-0, cross-compound, Consolidation type freight locomotive with water tube firebox boiler to carry 400 pounds pressure. Built by the Schenectady plant of the American Locomotive Company from designs of the Delaware and Hudson Railroad Company, J. E. Muhlfeld, consulting engineer. Cylinders, 22¼ and 38½ x 30 inches; drivers, 57 inches; maximum tractive power simple, 84,300 pounds; maximum tractive power compound, 70,300 pounds; maximum tractive power with booster, 88,300 pounds; weight on drivers, 295,000 pounds; total weight 336,500 pounds; weight of engine and tender, 639,500 pounds.

Side of firebox consists of multiple rows of vertical water tubes 2½ inches in diameter expanded into top and bottom drums. Back head and throat sheets are parallel straight sheets. Drums carried with a flat backhead and rear tube sheet with 9-inch water leg and flanged to receive the bottom and top drums and extending through tube sheets to center of boiler where they are secured with a saddle to the boiler shell. The brick arch is carried on 6 tubes from the back water leg to the backhead with full brick arch separating the firebox into two compartments, causing the products of combustion to circulate through the bank of vertical tubes at the side of the firebox.

No. 1112. Class 12-54-f Western Maryland freight locomotive. Decapod, 2-10-0, type with 30 x 32-inch cylinders; driving wheels, 61 inches; boiler pressure, 225 pounds; tractive power, 90,000 pounds; weight of engine, 419,280 pounds; total weight of engine and tender, 835,200 pounds. The locomotive is equipped with Type A superheater, stoker, power reverse, and air brake on all driving and tender wheels, with two 8½-inch cross-compound pumps. Features of unusual size are: tender, 22,000 gallons water capacity; 30 tons coal capacity; average load per driving axle, 77,360 pounds.

1926—Philip E. Thomas, No. 5501. Mountain type, Class Ta, Baltimore and Ohio locomotive, designed by George H. Emerson, and built at Mount Clare Shops. Cylinders, 30 x 30 inches; drivers, 74 inches in diameter; boiler pressure, 220 pounds; tractive power, 68,200 pounds; weight on drivers, 275,000 pounds; total weight, 400,000 pounds; weight of locomotive and tender, 659,000 pounds.

1927—Baltimore and Ohio Locomotive No. 2024. Class B–18ca. Modernized 10-wheel, heavy, local service passenger locomotive. New piston valve; 21 x 28-inch cylinders; outside steam pipes; 70-inch driving wheels; 200 pounds boiler pressure; 30,000 pounds tractive power; total weight, 173,400 pounds.

1924—Baltimore and Ohio Locomotive No. 5039. Class P–1c—4–6–2 passenger locomotive converted from the *Mikado* type. Outside steam pipes; 26 x 28-inch cylinders with piston valve; 74-inch drivers; new frames; Walscheart valve gear; 205 pounds boiler pressure; 44,600 pounds tractive power; total weight, 299,000 pounds.

1920—Baltimore and Ohio Locomotive No. 4400. Class Q–4, the latest type of *Mikado*, 2-8-2 type, designed by George H. Emerson, and built by the Baldwin Locomotive Works. Cylinders, 26 x 32 inches; boiler pressure, 220 pounds; tractive power, 63,200 pounds; total weight, 327,400 pounds.

1926—Baltimore and Ohio Locomotive No. 6200. Class S–1a Santa Fe type (2-10-2). A development of the *Mikado* type by the addition of another pair of driving wheels for heavy mountain freight service. Designed by George H. Emerson and built by the Baldwin Locomotive Works. Cylinders, 30 x 32 inches; drivers, 64 inches in diameter; tractive power, 84,300 pounds; boiler pressure, 220 pounds; weight on drivers, 347,230 pounds; total weight, 436,500 pounds; weight of engine and tender, 734,900 pounds.

BALTIMORE AND OHIO FREIGHT TRAIN

1919—Baltimore and Ohio Locomotive No. 7151. Class EL–5a, simple articulated Mallet, 2–8–8–0 type. Converted from compound engine, Class EL–5 at company shops from designs of George H. Emerson, chief of motive power and equipment. Cylinders, 24 x 32 inches; 58-inch drivers; boiler pressure, 220 pounds; tractive power, 118,800 pounds; weight, 245½ tons.

Equipment

Box Car. Closed car for hauling grain and perishable goods. Class M-15-a; 40-ton; 40-foot; steel underframe and steel end; weight, 43,800 pounds. Built in 1920.

Box Car. Closed car for hauling grain and perishable goods. Class M-26-a; 50-ton; 40-foot 6 inch; all steel; weight, 45,300 pounds. Built in 1926.

Gondola Car. Drop-end steel car for open freight and structural materials. Class 0-27-a; 70-ton; 40-foot 6 inch; weight 51,000 pounds. Built in 1922.

Hopper Car. Four-door steel car for hauling coal, coke, ore, sand, crushed stone etc. Class W-2-1; 70-ton, 41-foot 3 inch; weight 53,100 pounds. Built in 1926.

Hopper Car. Self clearing steel hopper car for transportation of coal, sand, crushed stone, etc. Class N-12-k; 50-ton; 30-foot; weight, 41,400 pounds. Built in 1925.

Gondola Car. Fixed end, all steel car for open freight, rails, coal for industrial use. Class 0-17-a; 50-ton; 40-foot 6 inch; weight 42,500 pounds. Built in 1905.

Gondola Car. Composite drop end car for open freight and structural materials. Class 0-16-b; 50-ton; 41-foot; weight 44,000 pounds. Built in 1912.

Flat Car. Steel car for hauling stone and rough castings. Class P-11; 50-ton; 40-foot; weight 40,600 pounds. Built in 1911.

Well Car. Steel car for hauling large, heavy castings. Class P-13; 67½ ton, 25-foot; weight 61,800 pounds. Built in 1911.

Stock Car. Single deck, steel underframe and superstructure car for hauling live stock, horses, cattle and loose rough freight. Length, 45 feet; weight 38,000 pounds. Built in 1915.

Stock Car. Double deck, steel underframe and superstructure car for hauling live stock, horses, cattle and loose rough freight. Length, 45 feet; weight 42,000 pounds. Built in 1915.

Caboose. Steel underframe and superstructure car, with lookout for transportation of train crew. Class I-5; length, 24 feet.

THE CAPITOL LIMITED

1927—President Washington, Baltimore and Ohio Locomotive No. 5300. Class P–7, 4-6-2 *Pacific* type, high speed locomotive of the President series. Designed by George H. Emerson and built by the Baldwin Locomotive Works for Washington–New York heavy passenger service. Cylinders, 27 x 28 inches; drivers, 80 inches; boiler pressure, 230 pounds; tractive power, 50,000 pounds; weight, 159 tons; weight of engine and tender, 270 tons. The engine is equipped with Walschaert valve gear, Westinghouse air brake and signal, steam heating system, Superheater Company's superheater, power reverse gear, stoker, Nicholson syphon, automatic train control.

Tender has a water capacity of 11,000 gallons, 17½ tons coal, fitted with a water scoop.

Equipment

Club Car. An all-steel car equipped with a baggage compartment, shower bath, barber shop, card room, and large observation room furnished with leather covered chairs and sofas, tables, reading lamps and writing desk. A Japanese valet, a train secretary and other special attendants for service to passengers.

Twelve-Section Drawing Room Car. Accommodating twenty-four persons in twelve sections, and one drawing room suitable for three people. Large lavatories for men and women. An all-steel car with the interior finished in walnut with brown upholstery. Lighted by electricity with modern standard lamps and fans.

Ten-Section Compartment Car. Similar to the twelve-section car, with the exception that twenty people are accommodated in the open sections, two each in the two compartments, and three in the drawing room.

Dining Car. Of Colonial design, accommodating thirty-six people. Every detail of the car and its fittings harmonize with the scheme of Colonial decoration. It is finished in cream white tone, and the chairs are upholstered with blue hair cloth. The lighting fixtures and the design of the large windows are also Colonial. The kitchen as well is enameled in white.

Observation Car. Designed with a large observation platform and observation room. The latter is equipped with desk, writing materials, and telephone connection and is furnished with comfortable chairs and lounges of mahogany. There is a separate lounge room for ladies.