SCIENTIFIC AMERICAN

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SOME NOTABLE LOCOMOTIVES.

If, aside from the architectural display, the World's Columbian Exposition at Chicago was more notable for any one thing than another, the distinction lay in exhibits that mark progress in various arts, especially the mechanic arts. It is difficult to realize the advancement made in anything without a comparison of the new with the old, and as an opportunity for such comparison is seldom presented, the masses are apt to remain in ignorance.

The Columbian Exposition afforded an exceptional opportunity for studying everything relating to progress, but nowhere was improvement more noticeable than in the transportation exhibits, and especially among the locomotives. Here were shown the earliest and the latest, with all the intermediate stages. We have selected from the large number there shown three locomotives which mark epochs in railroading. The earliest of these is the Lafayette, designed and built by William Norris, of Philadelphia, in 1837. It was the first six-wheeled locomotive used on the Baltimore & Ohio Railroad.

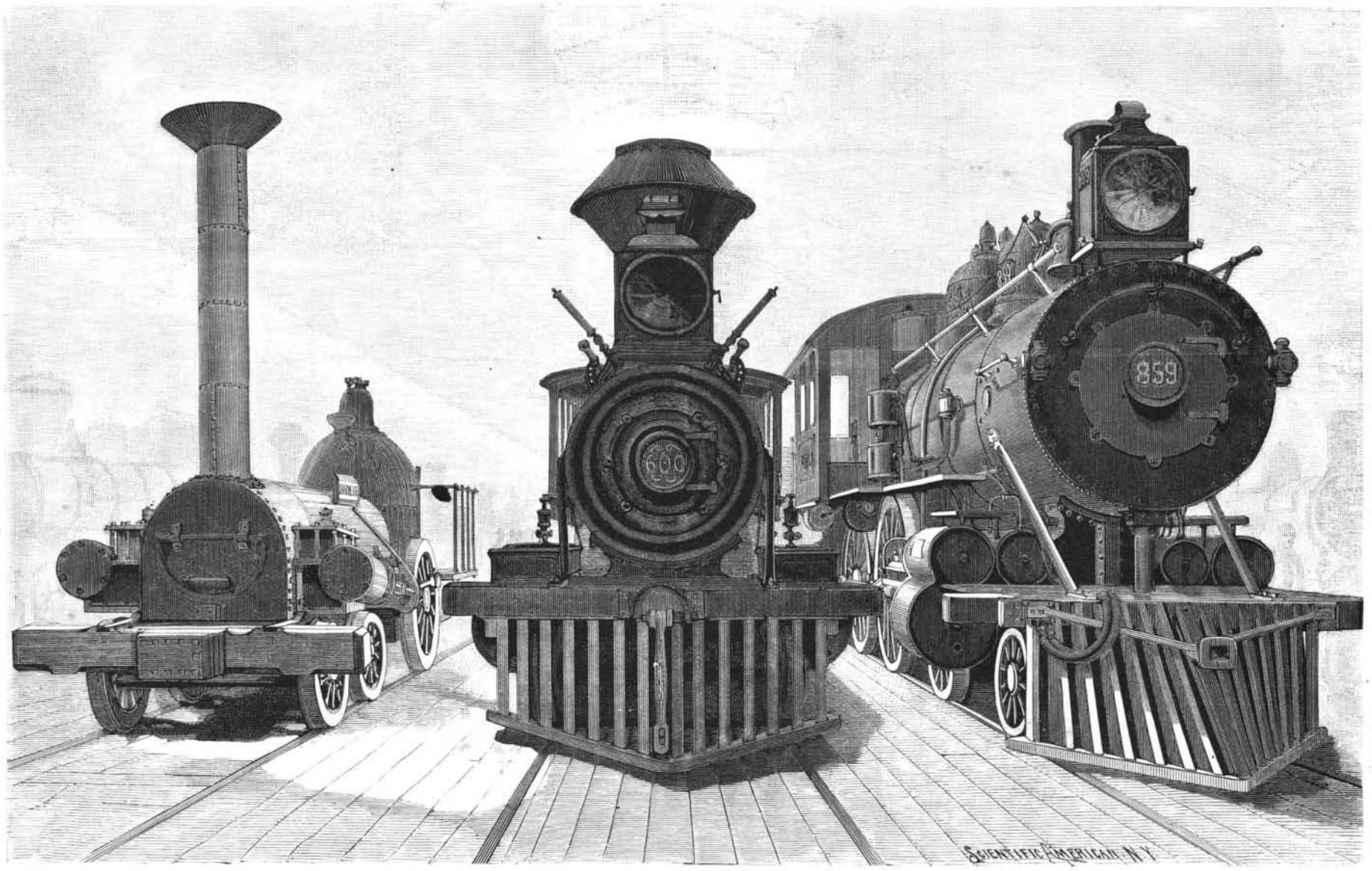
This type of locomotive created a revolution in construction, both in Europe and in America, and was the most famous of its time. We illustrate a full size working reproduction, constructed from the drawings and details furnished by the descendants of the inventor. The Lafayette, which was built expressly for the B. & O. road, was one of the great trio of locomotives produced by William Norris, in 1836–37–38. The Washington, one of the three, was the first locomotive to overcome the steep grade at the Columbia Incline from the Schuylkill River west, at Philadelphia, and its performance in accomplishing what was deemed an impossibility was heralded throughout the world. The Lickey Incline, on the Birmingham & Gloucester R.R., in England, had baffled all European locomotive builders, and it was the opinion that it would have to continue to be operated by endless chain or cable.

The performance of the Washington and of the Lafayette, in America, led to an order for a similar engine for the Lickey Incline, as an experiment. Norris built the Philadelphia, sent it to England, and it climbed the incline with comparative ease. So successful was its work that five additional engines were at once ordered, and the entire system of the operation of the incline changed. The demand in Europe for Norris engines assumed such large proportions that he eventually established himself in Vienna, designing and building the Royal Works there. Norris, in early life, was a druggist in Baltimore, and becoming acquainted with Col. S. H. Long, when the latter was associated with the surveys for the B. & O. road, the two subsequently entered into a copartnership to build locomotives. Long shortly afterward withdrew, and the Norris engines were for years the foremost in America. Joseph York, the first engineer of the Lafayette, is still living, and was in attendance upon the exhibit during the Exposition.

The second of which we make mention is the Baltimore & Ohio Company's engine 600. This engine was the company's model locomotive at the Centennial Exposition, 1876, and the first passenger Mogul built by the B. & O. R.R. Co. It was shown here just as at Philadelphia, having been taken from service and placed in original form. The 600 was regarded as representative of the highest type of the American locomotive seventeen years ago. Forney, in "Recent Locomotives," 1883, gives data as follows: Diameter of cylinders, 19 inches; stroke of piston, 26 inches; length of steam ports, 15½ inches; width of steam ports, 1¼ inches; width of exhaust ports, 2¾ inches; diameter of driving wheels, 5 feet; of truck wheels, 2 feet 7 inches; wheel base of engine, 22 feet 11 inches; total wheel base of engine and tender, 50 feet; diameter driving axles, 6¾ inches; length, 8 inches; outside diameter of smallest ring of boiler, 4 feet 2 inches; number of tubes, 165; length of tubes, 11 feet 10½ inches; outside diameter of tubes, 2¼ inches; length of fire box inside, 8 feet 3 7/16 inches; width, 2 feet 10⅝ inches; grate surface, 23 feet 7 inches; heating surface in fire box, 122 square feet; heating surface in tubes, 1,150 square feet; total heating surface, 1,272 square feet; weight of engine in working order, 90,400 pounds; weight on driving wheels, 76,550 pounds; weight of tender loaded, 60,400 pounds; total weight of engine and tender ready for service, 150,800 pounds, in round figures 76 tons. The 600 was built to run upon the division extending from Keyser to Grafton, which includes the Seventeen Mile Grade, averaging 116 feet to the mile, with curves of 600 feet radius. Forney, giving weight of average through trains, baggage, postal, passenger and Pullman cars, as 235,000 pounds, adds facts as to the schedule time showing an average of 27 miles per hour over the entire mountain division between the points named and one hour and five minutes up the Seventeen Mile Grade.

The Director General, 1893, the third of this series, is now the standard type of the Baltimore & Ohio Company's eight-wheel passenger engine, with Vauclain compound cylinders. It was built by the Baldwin Locomotive Works from designs, other than the compounding of the cylinders, by Mr. George B. Hazlehurst, general superintendent of motive power, B. & O. R.R.

The Director General will be assigned to service on the "Royal Blue Limited," between Washington and New York, and it is believed will equal, if not eclipse, the record now held by a Royal Blue engine of a mile in thirty-seven seconds, which is at the rate of ninety-seven and three-tenths miles an hour. The Director General's actual weight in working order is 126,780 pounds. Weight of tender with fuel and water, 72,080 pounds, making the whole weight in service in round figures a hundred tons. The wheel base of locomotive is 22 feet 4 inches, and of tender 17 feet, and the total length of engine and tender over all is 59 feet 6½ inches. The diameter of the high pressure cylinder is 13½ inches and of the low pressure cylinder 23 inches;



Lafayette. 600. Director General.

THE BALTIMORE & OHIO RAILROAD COMPANY'S EXHIBIT AT THE WORLD'S COLUMBIAN EXPOSITION AT CHICAGO.

stroke of piston, 24 inches; steam ports, 24 by 1½ inches; circular exhaust ports, the same. Piston valve. The diameter of the driving wheels is 6 feet 6 inches; truck wheels, 3 feet; length driving springs, center to center of hangers, 4 feet; steel boilers, 251 tubes of two inch diameter; length of tubes over the tube plates, 11 feet 10 inches; inside length of fire box, 107 1/16 inches; inside width of fire box, 33⅜ inches; diameter of dome, 31½ inches; height, 22 inches; working steam pressure, 180 pounds; grate surface, 24¾ square feet; total heating surface, 1,693 square feet; heating surface of the tubes, 1,544 square feet; height from top of rails to top of smokestack, 14 feet 10¾ inches.

Planet Notes for February.

Mercury will be "evening star" during February. During the first half of the month he will be close to the sun, but in the latter part will be visible to the naked eye for a short time after sunset. He will be at greatest elongation, east from the sun 18°, on the evening of February 25. His greatest brilliancy will be attained on the evening of February 21. Mercury will be 10° due south from Venus at 9 h. 41 m. P. M. February 8, central time.

Venus will be visible as evening planet for but a few days in February. On the 16th, at 3 h. 4 m. A. M., she will be at inferior conjunction, *i. e.*, between the earth and sun. Venus will be in conjunction with the crescent moon, 11° north of the latter, at 3 h. 3 m. P. M. February 6.

Mars will be visible in the southeast after 4 h. A. M., but at too low an altitude for good observations in our latitude.

Jupiter will be at quadrature, 90° east from the sun, February 11, at 1 h. 52 m. A. M. He will be in excellent position for observation during the early part of the night. Jupiter will be in conjunction with the moon, 4° 24′ north of the latter, February 13 at 3 h. 16 m. A. M.

Saturn may be observed after midnight. Look toward the southeast in the constellation Virgo, about 5° northeast from the star Spica. The rings of the planet are easily seen with quite a small telescope. They are now turned at an angle of 14° to the line of sight, so that with telescopes of moderate power the divisions may be seen. Saturn's apparent motion among the stars during February will be westward. He will be in conjunction with the moon, 4° north, at 8 h. 2 m. P. M. February 23.

Uranus rises about midnight, and is in position for observation from 3 to 6 A. M. He is in the constellation Libra, about 1° 45. east and 26′ south of the star *α*. Uranus will be at quadrature, 90° west from the sun, February 3 at 7 h. 4 m. P. M. He will be stationary in right ascension February 18, and after that will move slowly westward. He will be in conjunction with the moon, 3° 36 north, at 9 h. 58 m. A. M. February 25.

Neptune will be at quadrature, 90° east from the sun, February 29, at 2 h. 36 m. A. M. He will be in good position for observation during February. He is almost stationary in Taurus, a little more than one-third of the way on a straight line from *ι* to *ε* Tauri. There is no star of equal brightness, *i. e.*, 8th magnitude, within a radius of 1°.—*Astronomy and Astro-Physics.*

Deep Sea Depths.

In a recent number of the *Popular Science Monthly* G. W. Littlehales gives the following as the latest reliable result of the sounding of the different oceans:

	Latitude. Deg.	Min.	Longitude. Deg.	Min.	Depth in Fathoms.
North Atlantic ocean	19	39 N.	66	26 W.	4,561
South Atlantic ocean	19	55 S.	24	50 W.	3,284
North sea (Skagerack)	58	12 N.	9	30 E.	442
Baltic sea	58	37 N.	18	30 E.	233
Mediter anean sea	35	45 N.	21	46 E.	2,405
Black sea	42	55 N.	33	18 E.	1,431
Caribbean sea	19	0 N.	81	10 W.	3,427
Indian ocean	11	22 S.	116	50 E.	3,393
North Pacific ocean	44	55 N.	152	26 E.	4,855
South Pacific ocean	24	37 S.	175	08 W.	4,428
Behring sea	54	30 N.	175	32 W.	2,146
Sea of Japan	38	30 N.	135	0 E.	1,640
China sea	17	15 N.	118	50 E.	2,350
Sulu sea	8	32 N.	121	55 E.	2,549
Celebes sea	4	16 N.	124	02 E.	2,794
Banda sea	5	24 S.	130	37 E.	2,799
Flores sea	7	43 S.	120	26 E.	2,799
Arctic ocean	78	05 N.	2	30 W.	2,469
Antarctic ocean	62	26 S.	95	44 E.	1,975

A Long Siphon.

According to *Indian Engineering*, a long siphon has lately been added to the water supply system of the Nusseerabad cantonment in India. The water is drawn from a well in the overflow channel of a lake; a weir below the well preventing any serious fluctuations in the water level in the latter. Until recently, the water has been pumped by bullocks from the well into a main leading to the cantonment. Toward the end of August this method of supply was discontinued and a siphon service put in. It is an eight-inch pipe, about four miles long, having a variation in level between its summit and the water in the well of from two to twelve feet, and a difference between its summit and the water in the service reservoir of from nine to seventeen feet.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 943.

For the Week Ending January 27, 1894.

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THE MUNICIPAL ART SOCIETY.

Some of our most able and distinguished citizens have lately formed an organization under the title of the Municipal Art Society, having for its object the promotion of a more artistic and refined taste in the embellishment and decoration of public buildings, parks, and places.

For lack of such an organization various crude devices, under the name of art, are constantly being imposed upon the city. It will be the aim of the society to look after and correct all such matters.

The society intends to expend large sums for the encouragement and realization of municipal art works, the money being secured from the annual dues, at five dollars each, of many thousands of members. This is a movement worthy of the active support and assistance of every intellignt citizen.

Expiration of the Bell Telephone Patent.

At last the long-waited date is at hand. With the expiration of this month comes the expiration of the second fundamental Bell telephone patent. Over a year ago the undulatory current passed into history. Next to disappear from life is the iron or steel diaphragm magneto-telephone, exemplified in the telephone receiver now in use. For many services this instrument can be used as a transmitter—of course far inferior to the microphone, but capable of service on short lines. The carbon transmitter is still protected to a great extent by fundamental patents of uncertain validity. Among these the Berliner patent of November 17, 1891, has become celebrated; its tenure of life is now the issue in a suit brought by the United States government for its annulling. It is hoped that the case will very soon come to a hearing. Then there is the Edison patent of May 3, 1892, of uncertain validity, owing to the English patent for the same invention, which expired before the American patent was granted. The fate of this patent will depend largely on a decision in a case now pending in which the same point is involved. The whole affair is quite complicated, and its complication appears greater when the quantity of minor patents held by the Bell Telephone corporation are considered.

The National Exhibit of Cycle Sundries and Accessories in Madison Square Garden, New York.

The recent cycle show held at the Madison Square Garden in this city during the early part of the present month was an impressive demonstration of the great development of this manufacturing interest and of the allied branches of industry. At it were shown, not only the many varieties of cycles, now for the most part built on the same general lines, but the trades tributary to the cycle world, from India rubber manufacturer, drop forger and steel ball maker to the supplier of bicycle riders' clothes and shoes, were there represented. The entire display, occupying the greater part of the floor space of the great building, and overflowing into the galleries, was most impressive and beautiful.

The bicycle exhibits were so numerous that a description of all is out of the question. For men riders the diamond frame type with long head and ball bearings throughout rules supreme. The geared ordinary, front-driving safety, and giraffe or high frame safety are the exceptions, but are only exceptions. For ladies the drop frame is made. As the fair sex seem inclined to adopt rational dress for wheeling, a modified drop frame, approximating to the diamond frame, was shown for them.

The driving gear is almost universally the sprocket and chain. It is a curious fact that while on the frame, wheels, etc., of a bicycle there will be perhaps a dozen ball bearings, using nearly a hundred steel balls, there being no plain bearing left, the chain may by itself present a hundred plain old-fashioned bearings, of the type used for centuries before modern machinery was thought of. This is now the troublesome part of the modern cycle. All attempts to improve it by roller sleeves and the like are imperfect. Another peculiar thing in this connection is that the chain is exposed to rain, dust and mud to further develop its bad qualities. The perfect chain and gear case, keeping off rain and dirt, and supplying oil *ad libitum*, seems to be still in the future.

One method of doing away with the chain was shown by the League Cycle Co., of Hartford, Conn., who have substituted for the chain a bevel gear, inclosed in the tubing and in cases. This not only abolishes the chain, but affords a wheel ridable in every day clothes without any special precautions, such as trouser clips. How the frictional resistance of bevel gear and of sprocket gear will compare is uncertain. The exhibitors contrast the four pieces of their gear with the two hundred and four parts found in some chains with their sprockets.

Another wheel was built, in one sense, on the opposite principle, as the front as well as rear wheel was fitted with a sprocket and chain gear. On the front wheel it operated by pumping the handle bars up and down, thus adding the power of the arms to that of the legs. This was shown by Mr. H. J. Bauer, of Elizabeth, N. J.

Several examples of changeable gear were exhibited.