This bridge was designed in 1867 by John A. Roebling, but he died in 1869, before any work on it had begun, and it has been built entirely under the guidance of Washington A. Roebling, the present Chief Engineer.

The bridge extends from the junction of Sands and Fulton streets, in Brooklyn, to Chatham street, in New York—a total length of 5,989 feet, the Brooklyn approach being 971 feet, the suspended part 3,455½ feet, and the New York approach 1,502½ feet.

The approaches will consist of a series of brick and granite arches, which, when finished, will be ornaments to the two cities. It has taken nine years to complete the towers and anchorages, construct the cables, and get everything ready for the suspension of the floor.

Preparing the foundations for the towers was one of the most difficult parts of the work. Huge timber caissons, each 170 feet long, 102 feet wide, and 25 feet high, containing over 1,600,000 feet of timber, were sunk below the bed of the river until they rested on rock or on an equally firm stratum. On the Brooklyn side this was reached at a depth of 45 feet below high water; but it was necessary to go 78 feet below high water on the New York side. The pneumatic method of sinking caissons is not new, but the operations here surpassed by their immensity everything of this kind that had ever been done before.

The towers are 278 feet high. The anchorages are 129 feet by 119 feet at the base, 117 feet by 104 feet at the top, and 89 feet high.

The total quantity of granite and limestone in the towers and anchorages is about 145,000 cubic yards, and it required the continuous work for four years of over 20 quarries in Maine, Massachusetts, Rhode Island, and New York to furnish the necessary supply. In the summer of 1876 the masonry was completed.

On the 29th of May, 1877, the first wire for the cables was stretched across the river. There are four cables, each consisting of 19 strands, each strand containing 280 galvanized cast steel wires, No. 8 gauge. These cables are 15¾ inches in diameter. For wrapping the cables galvanized annealed iron wire was used. March 1, 1879, the four cables were completed just 21 months after they were commenced.

The platform of the bridge, which is 5 feet wider than Broadway, is sustained by the iron cross beams, and stiffened by six longitudinal trusses. It is divided into five parts, two outer ones intended for horse-cars and general vehicle traffic, two intermediate divisions intended to accommodate the rapid transit passenger cars, and a central promenade, a little above the level of the main floor, and intended for pedestrians. The stiffening trusses will be of iron, six in number, the two outer ones 9½ feet high, the other four 16 feet each in height. The total weight of the bridge will be 13,300 tons. It is proposed to move the cars on this bridge by means of wire ropes and stationary engines. This method is considered preferable to the use of locomotives on account of the steep grade of the bridge.

It is estimated that the bridge, when completed, will have cost $13,500,000, of which $9,500,000 will be spent on the bridge itself, and $4,000,000 in acquiring the necessary real estate. It is hoped that in 1881 the bridge will be open to the public.

All of the twisted cables, stays, and suspenders used in the construction of these four bridges were manufactured at the John A. Roebling's Sons Company's works, at Trenton, N. J. Some of the stays are so large that special machinery has been built for the purpose of making them, and no other establishment possesses the facilities for doing such heavy work properly.

Education in China.

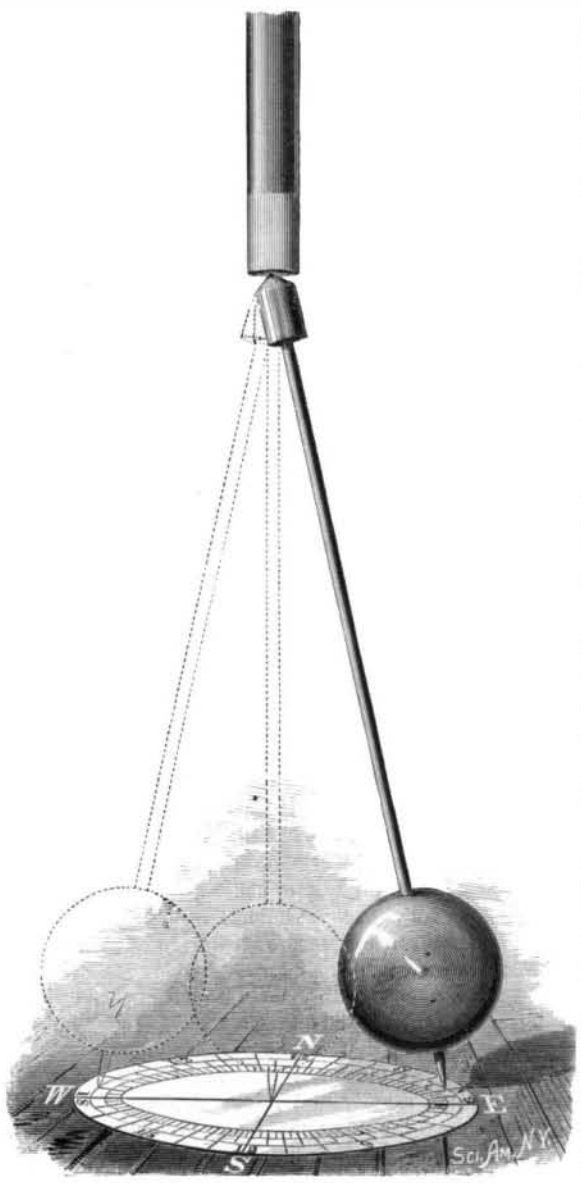
We have been apt to consider China as a heathen country, and such it is from our Christian standpoint, but it is far from an ignorant land. It has, without doubt, according to *Barnes' Educational Monthly*, over 400,000,000 people, of which vast number there is scarcely one who cannot read and write. It has 2,000 colleges, and their libraries outnumber ours ten to one. There are in that land of pig-tailed Mongols 2,000,000 highly educated men, while there is hardly a woman who is educated of all the vast number of its people, and not one who is thought to have a soul. Education is principally a discipline of the memory, and their schools are based upon an entirely different idea from ours. A live Yankee schoolmaster would find little employment in China, even though he understood the Chinese language and literature perfectly.

THE Water Commissioners of Troy, N. Y., have awarded the contract for the extension of the water works of that city to the Holly Manufacturing Company, of Lockport, N. Y., for the sum of $235,000.

Pendulum for Showing the Rotation of the Earth.

To the Editor of the Scientific American:

The following description of a simple device for indicating the rotation of the earth on its axis may be of interest to



some of your readers. I secure a large permanent magnet to the ceiling of a room or a steady tripod, and from it suspend a wooden pendulum rod of any length, having at the top a cone-shaped tip of soft iron, which is turned to a smooth round point to allow it to swing freely in any direction. To the lower end of the rod is hung a ball of one half the weight required to pull the rod from the magnet. This pendulum, once set in motion, will swing in the same plane for 30 hours. By placing a dial under the pendulum the apparent change in the plane of oscillation of the pendulum may be observed. However, this change of position is not in reality in the pendulum, but in the dial, which is moved under the pendulum while the latter preserves its plane of motion. Placed at the poles, this simple instrument would indicate 15° per hour, which is exactly the rate of the earth's rotation. In this latitude it would indicate an hourly motion of 9° 47′. With this simple instrument, which any ordinary mechanic can construct at a small cost, the movement of the earth may be clearly demonstrated in fifteen minutes.

April 5, 1879. W. W. LE GRANDE.

Employment and Labor in Massachusetts.

Discussing the present condition and the future prospects of labor, with reference to past and possible Congressional action, the Boston *Journal of Commerce* remarks that since the date of resumption, January 1, the leading industries in that State have continued to show improvement in many instances and to hold their own in all. In all the great manufacturing centers there is an increased activity and a consequent improved demand for labor. In Massachusetts the improvement has become remarkably conspicuous. The Lowell factories are all busy, and several are on extra time; the Essex county mills are, with one or two exceptions, kept fully employed on orders; and throughout the shoe towns there is, late as it is in the season, plenty of employment for willing hands. The great paper mills of Western Massachusetts experience so active a demand for their goods as to stimulate new enterprises in this line, which we may be assured have not been undertaken without a mature survey of the field of operations. In a word, manufacturing help is well employed, at prices which, if not up to the high rates prevailing a few years ago, are far preferable to the wages of idleness.

Manufacture of Tin Plates in New York.

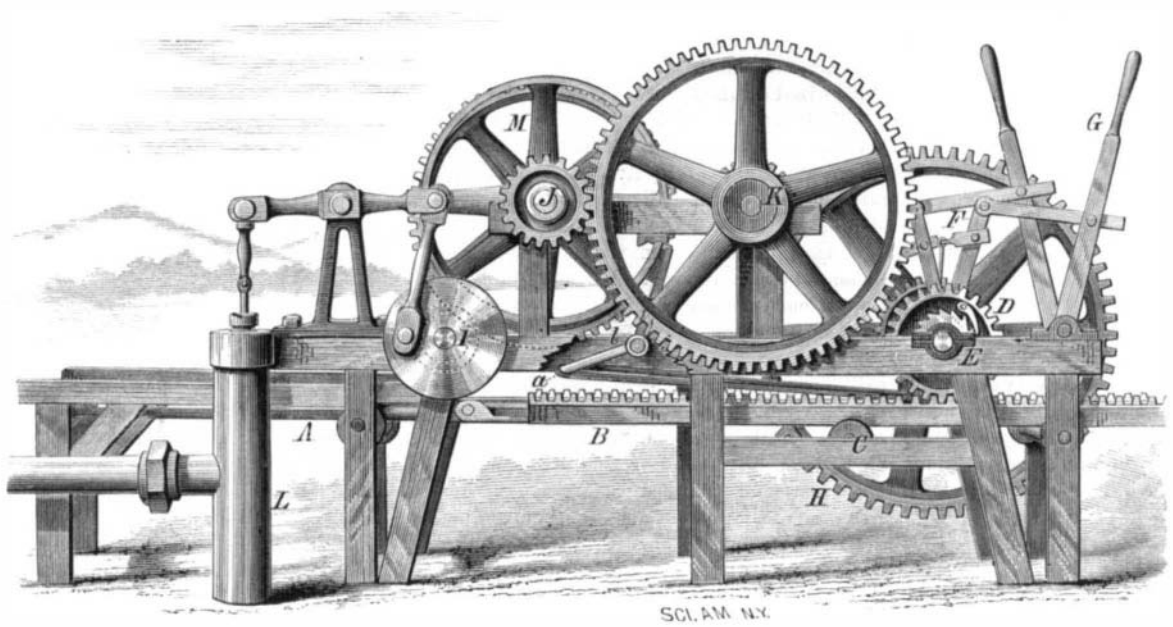
The Monitor Tin Plate Company of New York occupies a building in Horatio street, where the tinning is done; but the iron is rolled at a mill in Pittsburg. The tinning house is 100 feet square, fitted with every modern appliance. The sheets are rolled in the ordinary way, then cut or sheared to size, and immersed in a pickling bath. They are then cold-rolled again, annealed and pickled, and put into baths of Russian tallow or palm oil. Then they pass through several baths of tin melted at a high temperature, and again through sawdust and bran to cleanse the surface. Finally, they are polished with lamb's wool buffers, and assorted, ready for boxing and shipping.

A NOVEL MOTOR.

Our engraving illustrates a simple and manageable motor recently patented by Mr. Joseph Plattenburg, of Allegheny, Pa. It depends for its action upon a series of contractile rubber springs put under tension by an arrangement of pawls, ratchets, pinions, and racks, and the power is conveyed from rubber springs to the machinery to be driven, through a train of gearing, and the motion is controlled by a very simple and ingenious governor.

The rubber springs, A, are rigidly secured at one end to the main frame of the machine; their other ends are attached to the ends of the racks, B, which rest upon rollers, C, and mesh into pinions, D, placed loosely on the shaft, E. To one side of each pinion is secured a ratchet wheel, and upon the opposite side there is a pawl which engages a ratchet wheel keyed to the shaft, E. It will be understood that there is one rack, one pinion, and two ratchets to each rubber spring, and for each set of apparatus of this kind there is a stout lever, F, fulcrumed on the shaft, E, and carrying a pawl that engages the ratchet fixed to the side of the pinion, D. The lever, F, is connected with a longer hand lever, G, by which, through the agency of the parts just described, the springs are put under tension.

Upon the shaft, E, there is a spur wheel, H, which drives the crank shaft, I, through intermediate wheels and pinions on the shafts, J, K. In the present instance the power is employed for working the pump, L, but the inventor does not confine himself to this application.



PLATTENBURG'S MOTOR.

As this apparatus, without some kind of a governor, would run with great speed when first set in motion, and with a rapidly diminishing speed toward the end of the work given out by the spring, the inventor has devised a simple contrivance for controlling the action of the machine with regularity. It consists in elastic rubber strips, *a*, attached to the free ends of the racks and connected with an angled lever, *l*, fulcrumed in the main frame, and carrying at its longer end a brake shoe, which bears upon the friction wheel, M, with more or less force according to the tension of the rubber strips, *a*. When the rubber springs, A, are under the greatest tension the strips, *a*, are also under their greatest tension, and the brake exerts its greatest pressure on the friction wheel and as the springs, A, contract, the brake pressure is diminished while the speed remains unchanged. The inventor claims that, for running machinery of any kind, this motor is more economical both as to its first cost and maintenance than other motors made for a similar purpose, and he states that it is especially adapted to pumping oil or water, and to the performance of other continuous work where steam is not available.

Further particulars may be obtained from the inventor, or from Mr. F. J. Hoyt, 733 Broadway, New York.