HYDRAULIC ELEVATORS.

The rudimentary lifts that are familiar to every one, and the simplest of which is a cable passing over a pulley, carrying at one end the load to be raised and acted upon at the other by animal or mechanical power, are

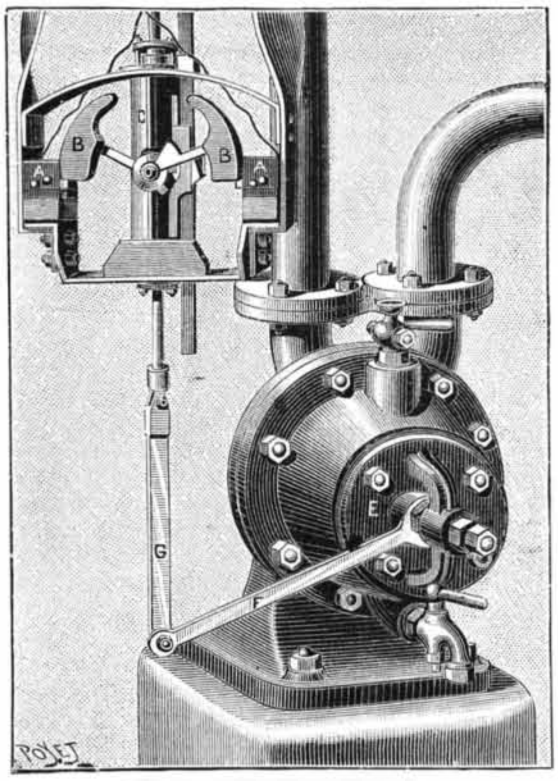

Fig. 1.—THE DISTRIBUTER.
The detail at the left is the hydro-electrical regulator.

the originals of what in our day have taken the name of elevators. For these primitive apparatus there have been substituted hoists provided with cages, the most improved of which carry a safety device designed to hold the cage in case the cable should part. This is the kind adopted in most mines. Safety apparatus are numerous, but the fact must be recognized that they are sometimes wanting. Apparatus constructed on

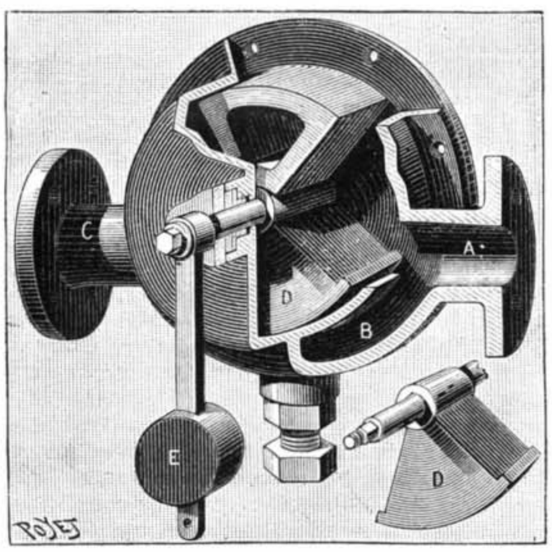

Fig. 2.—APPARATUS FOR REGULATING THE MOTION OF THE ELEVATOR.

these principles are scarcely employed for anything but lifting goods.

It was not till twenty years ago that the idea occurred of replacing chain or cable traction by direct-acting apparatus, in which the weight is lifted in such a way that the cage is always sustained by the column that supports it.

The first type of hydraulic elevator designed to lift persons with security was shown at the Universal Exposition of 1867 by Mr. Leo Edoux.

Every elevator consists of the following parts: (1) Of a car fixed to the extremity of a metallic column forming a piston; (2) of a cast iron cylinder placed in a well of a depth a little greater than the height of the car's travel, and in which moves the column that supports the car; (3) of various maneuvering and safety apparatus that permit of making a pressure of water act upon the piston in order to raise it, and, on the contrary, of suppressing such action, so as to allow the car to descend by its own weight; and (4) of a system of balancing.

The general arrangements of the piston, cylinder, and car are shown in Figs. 3 and 4. Driven wells are lined with cast iron piping, which constitutes the cylinder of the elevator. The pistons, which at first were likewise of cast iron, are now made of steel, and are sometimes inclosed in a cylinder of polished copper. They are composed of steel tubes fixed end to end by internal couplings.

The maneuvering and safety apparatus are quite numerous. We shall give a few examples of them:

The distributer permits of (1) putting the piston cylinder in communication with the water conduit; (2) of intercepting all communication; (3) and of putting the cylinder in communication with the exhaust pipe. Thanks to this apparatus, the car may be made to rise, to stop at any point, and to descend. Fig. 1 shows the arrangement of the Edoux distributer, which consists of a circular slide valve. It is maneuvered in all systems by acting upon a lever, F, by means of a rod, G, that is actuated from the car by means of a rope. At the top and bottom limits of the car's travel the distributer is automatically closed through a contact with tappets fixed to the car and the maneuvering rod, so as to prevent any inattention from causing violent or dangerous shocks at the ends of the car's travel.

Finally, a system of automatically maneuvered bolts permits only that door to be opened opposite which the car has stopped.

It has been found necessary, too, to have an apparatus for automatically regulating the velocity of the car. In fact, as the section of the piston is calculated for a medium pressure, and as the real pressure may undergo great variations, and, on another hand, as the weight of the passengers must also vary, very variable velocities might result from the addition of these two causes, and such velocities might in certain cases become dangerous. The regulator used is shown in Fig. 2. It consists of a valve, D, placed in the conduit. This valve is provided with a counterpoise, E, calculated in such a way that the lever at the extremity of which it is fixed remains in a vertical position for the proper velocity of water, either in one direction or the other; that is to say, for the ascent or descent. The valve closes the aperture, A or C, and, as the quantity of water distributed is diminished, the velocity of the elevator is regulated. The passage of water through the conduit, B, is permanent, and in this way such shocks as might result from the abrupt and entire closing of the orifice by the valve are prevented.

It has occurred quite recently to Mr. Edoux to add to his apparatus a safety device against the effects of air in elevators. The necessity of this was recognized from the following circumstances:

During the repairs of all kinds to the water mains of cities, the pipes become empty. When the work is finished the water is turned on, and the air that has taken the place of the water may be strongly compressed in the conduit. If, at such a moment, the distributer of an elevator be opened, the compressed air may act violently upon the piston and give the apparatus an ascensional motion that cannot be controlled by the regulating valve, since the latter is arranged for operating under the action of water. The consequence of so sudden an ascent or descent may prove fatal if the passenger, losing his coolness, commits the imprudence of leaving the car while in motion.

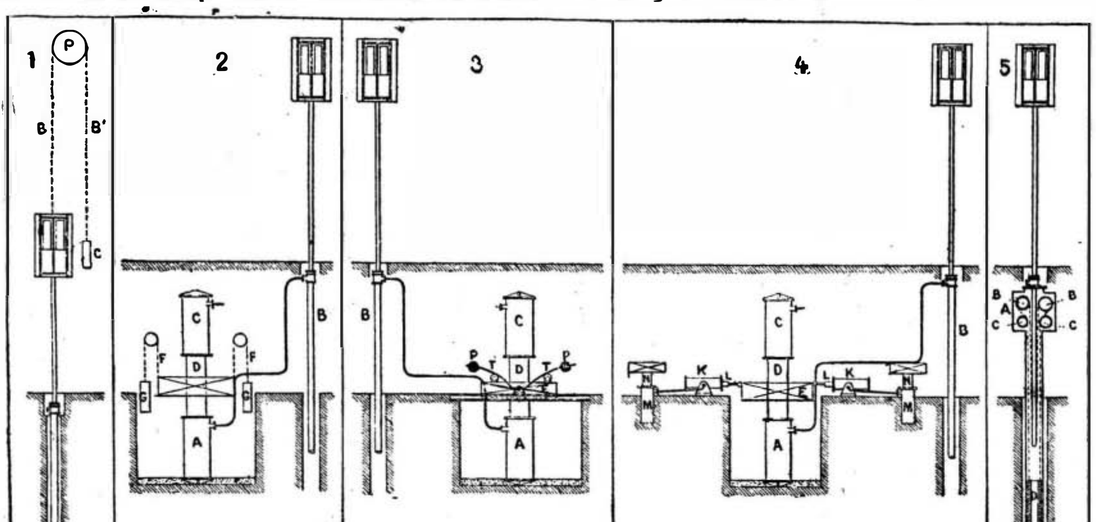

Fig. 4.—DIFFERENT SYSTEMS OF BALANCING.
1. Original Edoux system. 2, 3, and 4. Heurtebise system. 5. New Edoux system.

To prevent such effects, a closed metallic reservoir, of a capacity a little greater than that of the piston, is interposed between the distributer and the regulating valve with which they are put in communication. The pipe from the distributer stops at the top of the reservoir, and the one going to the valve descends to the bottom. Under such circumstances, if the conduit is full of air and the distributer be opened, the water in the reservoir will be submitted to the action of the compressed air, and the piston will rise at a normal velocity, the entrance of water being moderated by the regulating valve. Upon the descent, the water in the cylinder will again fill the reservoir, and the air, giving way to the water, will escape freely into the atmosphere through the distributer.

Various systems of balancing have been adopted by

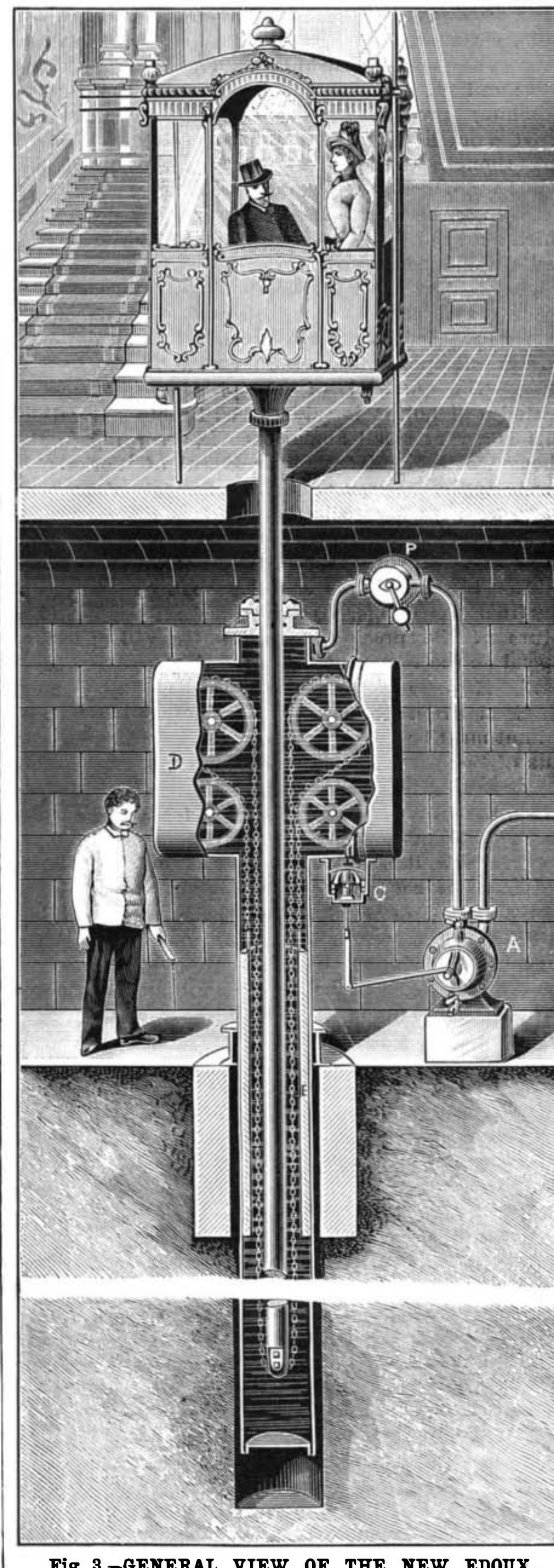

Fig. 3.—GENERAL VIEW OF THE NEW EDOUX ELEVATOR.

constructors. A rational system must consist of two parts, one fixed and the other variable, by reason of the fact that the piston varies in weight, according as it is plunging into the water or emerging from it. Up to recent times this result has been obtained mathematically in a very simple way, in Mr. Edoux's apparatus (Fig. 4, No. 1), by means of chains fixed to the car, passing over pulleys, P, at the upper part of the building, and carrying counterpoises, C. When the elevator is rising, these counterpoises and the chains descend, and, as a general thing, within hollow cast iron columns, that serve at the same time as a guide to the car.

With chains whose weight is proportioned to the volume of the piston, the latter is balanced. Let us, in fact, suppose the elevator at the center of its travel (Fig. 4, No. 1), then, the two lengths of chain, B B′, counterbalancing each other, the counterpoise, C, in order to produce an equilibrium, will have to represent the weight of the car, *a*, and of the piston half immersed in water. If the piston rises a certain distance, a meter for example, it will increase in weight, *p*, equal to the

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volume of water that has taken its place in the cylinder. The part of the chain to the right of the counterpoise will have become two meters longer than that near the car. In order that an equilibrium may be maintained, the two meters of chain must equal the weight, p, and the meter of chain must therefore weigh $\frac{p}{2}$.

The conditions of a permanent equilibrium in all positions are, therefore, the following: (1) Counterpoise equal to the weight of the car and semi-immersed piston; (2) balancing chain, weighing to the meter half of the weight of the volume of water corresponding to a displacement of one meter of the piston.

This system of overhead balancing presents certain inconveniences, and there are sometimes difficulties in the way of installing transmissions above. Various other arrangements have been devised, and, to cite only what has been done in France, we may mention the Heurtebise system (Fig. 4, Nos. 2, 3, and 4). This system is based upon the use of a compensator formed of two cylinders, A and C, one of which receives the pressure of the water, while the other communicates with the well of the elevator. In these cylinders moves one piston in common, D, whose weight compensates that of the car and the column—the whole constituting a sort of hydrostatic balance.

It will be remarked that if the travel of the piston and compensator are in the ratio of 1 to 10, the latter will have to have a weight and section ten times that of the former. So the trouble with this system is the difficulty of establishing and maneuvering so large masses. Besides, the compensator balances nothing but the invariable part of the dead weight. The arrangements adopted for counterbalancing the variable part of the load have farther complicated the apparatus.

The successive arrangements to which recourse has been had are shown in Fig. 4 (Nos. 2, 3, and 4). The first consists in the use of chains, F, and counterpoises, G, which are huge by reason of the ratio of the travels. This arrangement operates under the same conditions as the balancing by counterpoised chains shown in Fig. 4 (No. 1). An endeavor has been made to attain the end by the action on the compensator of counterpoises, P, fixed to the extremities of large levers, T, whose variable inclination, connected with the motions of the compensator, vary the action exerted upon it (Fig. 4, No. 3).

Finally, an application has been made of oscillating cylinders (Fig. 4, No. 4). The cylinders, K, being in a horizontal position when the elevator is in the center of its travel, the action of the piston is null, but if they are revolving on their axes in one direction or the other, the compensator will receive a vertical thrust from them whose energy will increase in a certain proportion in measure as they depart from a horizontal position. However, it must be remarked that, to the detriment of the useful effect, while the modification of the weight of the piston is always equal per unit of distance traveled, the same is not the case with the vertical component of oscillating pistons. These latter must, besides, be provided with special accumulators, M, which, although they prevent variations in the pressure of water conduits, and diminish the surface of the pistons, are nevertheless a still further complication of the apparatus.

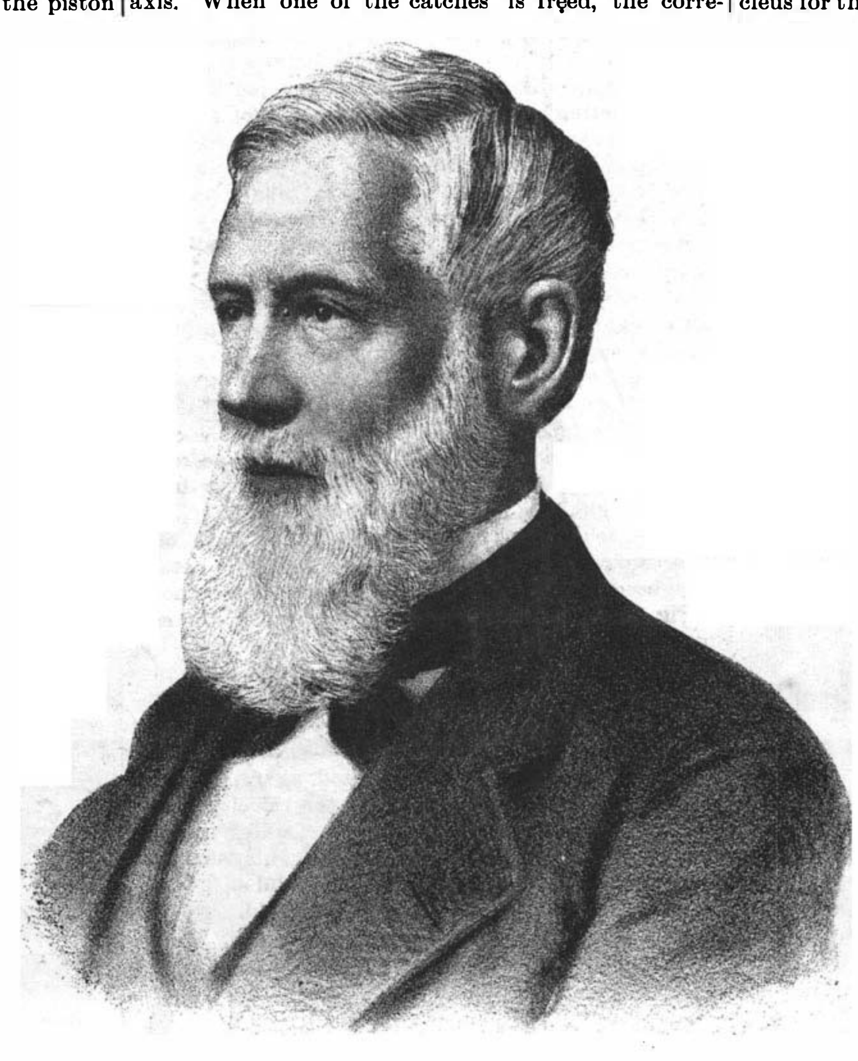
Mr. Abel Pifre has recently replaced the apparatus for balancing dead weights by a float that receives a thrust which counterbalances the useless weights. This float is placed at the lower extremity of the piston supporting the car. This is one of the simplest of solutions, but no regard is paid to the variations in the weight of the piston.

From what precedes, it will be seen that the system of balancing by weights and chains is the completest and least complicated. Originally, when the pistons were of cast iron, it was even the only one applicable, and it is only as a consequence of the progress of metallurgy that the system of balancing beneath has become possible.

Mr. Edoux has adopted a new arrangement of this kind without in any way modifying the principle of his first one. The chains and counterpoise play exactly the same role as before, the transmitting parts alone being shifted. In this new arrangement (Fig. 3, and Fig. 4, No. 5), the cylinder terminates at the top in a tight metallic box of small size, in which are inclosed all the transmitting and guide pulleys. A chain passing beneath the piston winds around these pulleys and supports an annular counterpoise through which the piston passes, and which runs up and down the entire length of the cylinder. In determining the weight of the counterpoise and chain, regard is evidently paid to the influence of the liquid in which they move—a circumstance that is an advantage, for, in fact, it involves an increase in weight per meter of the chain, and, as the weight that the latter has to support remains the same, there results a further guarantee of safety. Moreover, in this system, a breakage cannot affect the safety of the passengers, nor even occasion any material damage.

Mr. Edoux has also introduced an improvement into the distributer, which he maneuvers through a small hydro-electric apparatus (Fig. 1). This auxiliary motor is a multiplier of force.

The maneuvering lever of the distributer is connected with the rod of a small hydraulic double-acting piston, C, which is provided at the center with a distributing cock. Four pipes end in this, one leading water under pressure, two carrying the water to the extremities of the cylinder, and one allowing it to escape. The cock is maneuvered through levers which carry, each of them separately, two counterpoises, B. At rest, these levers are raised, and the counterpoises bear against two spring tappets which are set free by passing an electric current into the electros, A. The levers are loose under the rod of the cock, and are maneuvered through the intermedium of a disk keyed upon the axis. When one of the catches is freed, the corresponding weight falls, its rod revolves and carries along the disk keyed to the axis; the cock opens, and the water acts against one of the faces of the small piston whose rod maneuvers the distributer.



PROF. ASA GRAY.

The counterpoises are raised and put back in place automatically, by means of a vertical bar connected with the piston rod, whose motion it follows.

In the car, and at each landing, there are two contact buttons, by means of which one or the other of the electros is made to act. In this way, the ascending or descending motion of the car is arrested. Fig. 3 shows, in one group in common, the latest improvements introduced into the elevators just described.—*La Nature.*

A Monkey's Trick.

A few days since, for the third or fourth time within a year, a monkey figured as an incendiary, firing the well known steam yacht Norma, lying at a wharf in New York. It seems to have gone about the job with the greatest deliberation, too—gnawed through the ropes with which it was tied up, cleared out a match safe in the cabin, and then started the blaze in a place which only a monkey would have thought of, between the deck and the ceiling of the coal bunkers. It took the crew all night to locate and put out the fire, which was filling the boat with smoke, the monkey, whose part in the affair was established by indisputable circumstantial evidence, being afterward found on an eccentric bar in the engine room, quietly grinning over the rumpus which it had raised. *Fire and Water* suggests that monkey risks will be next heard of in insurance circles if this kind of thing keeps up.

PROF. ASA GRAY.

The great botanist who did so much for American science, and who contributed as much or more than any other scientist of this country to its reputation abroad, died at his home in Cambridge, Mass., on the evening of January 30, 1888. For several days he was in a semi-conscious state, from which he never rallied. For over a month he had been helpless from paralysis.

He was born in Paris, Oneida County, N. Y., on November 18, 1810. He studied medicine, graduating from Fairfield Medical College in 1831. He did not practice his profession, but devoted himself to botany. A few years later he received the appointment to the position of botanist to the Wilkes Exploring Expedition. This was about 1835. But as delay after delay occurred he became weary of waiting, and resigned the position. In the period of waiting he began work upon Torrey and Gray's "Flora of North America," whose first volume appeared in 1840.

The chair of botany in the University of Michigan was offered to him, which he accepted on condition that he be allowed a year of study in Europe. He was one of the first professors appointed to a chair in the young college which has since acquired a high standing among the country's educational institutes. He visited Europe, carrying with him the commission to purchase a library for the college. He selected a nucleus for the collection of books with great judgment. It is said that the collection thus selected is still looked upon with great pride by the university. He never entered upon the duties of the position of professor there; but at its semi-centennial celebration last summer the university conferred upon him the degree of LL.D.

His year in Europe he devoted to the study of the herbaria. In these he found many examples collected in the early expeditions to America. Thus his life work was commenced in the study of these old type specimens of North American flora. On his return, he resumed work upon the flora, the second volume of which appeared in 1845. Three years earlier, he began his long service in Harvard College, accepting, in 1842, the newly established Fisher Professorship of Natural History. He died while still an occupant of this chair, though relieved from the duty of teaching and care of the botanic garden in 1872.

The herbarium under his charge acquired great dimensions, and became of immense value. He kept up his literary pursuits. His great work was the study of the North American flora, begun about fifty years ago. About 1871, this took the form of a work entitled "Synoptical Flora of the United States." It is not yet finished. Besides this, he wrote many monographs and special studies. In 1854, his work on the "Botany of the Wilkes Expedition" appeared. In 1859, he published his work on the "Relations of the Japanese Flora to those of North America." This work, he thought, did more to make him known in the old world than any other single production. His educational manuals attained an immense success, and it is not saying too much to affirm that the botanists of this continent have been brought up upon the pabulum supplied in them.

His work on the Japanese flora tended toward evolution, and he was one of Darwin's most esteemed friends and powerful advocates in this country. At the same time he never could find in natural selection a satisfactory cause for the law and order he beheld so clearly in the world. Like Clerk Maxwell, he found it an insufficient explanation, and back of it recognized the existence of a first cause. His religious and scientific beliefs are best summarized in his own words:

"I am scientifically, and in my own fashion, a Darwinian, philosophically a convinced theist, and religiously an accepter of the 'creed commonly known as the Nicene,' as the exponent of the Christian faith." His reasons for this position were fully given in a short course of lectures before the Theological School of Yale (1880).

He wrote many reviews and other papers for the journals of the day. He was one of the regular contributors to the *Nation*, of this city. He was an associate editor of the *American Journal of Science and Arts.* In the latter paper he published annually the necrology of the botanists who had died during the year. On his writing table he left the unfinished necrology for 1887.

ACCORDING to native journals, Japan can boast of a phenomenal giantess. Though only twelve years and five months of age, she is said to stand eight feet high and to weigh over two hundred and seventy pounds; her hands measure over nine inches in length, and her feet fifteen inches.

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