Dr. Carpenter is a Fellow of the Royal Society, and received about 20 years ago one of its Royal Medals in recognition of his researches on the Foraminifera. He is also a Fellow of the Linnæan and Geological Societies of Great Britain. In 1872 he was elected President of the British Association for the Advancement of Science at its meeting at Brighton. He is a Corresponding Member of the Institute of France, of the American Philosophical Society, as well as of many other foreign academies.

To the present generation of scientific workers, Dr. C. is best known by his "Treatise on the Microscope," the sixth edition of which embodies the results of nearly half a century of microscopic experience. And his treatise on "Mental Physiology," first published about nine years ago, has gained for him a large body of readers among those who desire to acquaint themselves with the constitution and operations of the human mind.

PROF. YOUMANS.

E. L. Youmans was born in Albany County, N. Y., in 1820—but grew up in Saratoga. He went to the Common School, but early contracted a disease of the eyes which blinded him for many years and leaves him still with very imperfect vision. This made collegiate education impossible. He early took interest in scientific subjects and had scientific books read to him. Chemistry was at first a favourite subject which he studied with the aid of his sister, Miss Eliza A. Youmans, who made the experiments. By the aid of a machine which he invented, and the partial recovery of sight he wrote the class book of Chemistry for Common Schools which was published in 1852. After this he lectured extensively before Lyceums and was perhaps the first to popularize the new doctrines of the Conservation and Correlation of forces, upon which he subsequently compiled a book. Always interested in scientific education he edited in 1864 a volume entitled "The Culture Demanded by Modern Life."

Mr. Youman's interest in the general subject of scientific culture and in the advanced philosophical ideas of the age which are the results of scientific progress, induced him to exert himself for the reproduction in the United States of the able works of British thinkers, such as Mill, Bain, Spencer, Maudsley, Huxley, Lecky, Tyndall, Darwin, Carpenter and others, and he exerted himself to bring about an arrangement on the part of the American publishers with whom he was associated to pay foreign authors in the same way that American authors are paid. By devoting himself much to the diffusion of their ideas and laboring to create a demand for their books his policy proved so very successful that the practice first systematically carried out by D. Appleton & Co., has been extensively adapted by other publishers with a corresponding advantage to foreign writers.

In 1872 Mr. Youmans became much interested in the question of International copyright and went abroad to organize the International Scientific Series on the basis of a simultaneous publication in different countries of scientific books under which equitable payment should be made to the authors. It was his hope that by establishing such an international arrangement spontaneously and getting the rights of authors conceded on a commercial basis by the voluntary engagements of publishers, that the American government might then be induced to recognize and give legal security to the literary property that has been thus far unprotected by law. There are but few symtoms of any such governmental action, but a valuable series of scientific books has at any rate been secured and all their authors handsomely paid.

In 1872 Mr. Youmans also established the *Popular Science Monthly* to give currency to a class of articles that but rarely make their appearance in the literary periodicals. The Magazine went up to a successful circulation at once and has continued to hold an influential position as an organ of scientific thought upon all the broader and higher questions of the time.

Mr. Youmans has never been able to devote himself to the work of scientific research, being crippled in this respect by his imperfect vision, but feeling that the work of diffusing the great results of modern scientific activity is only next in importance to that of creating science itself, he has worked industriously in this field and has won conspicuous success.

An examination of the wire suspension bridge across the Ottawa River below the Chaudiere Falls, shows that the metal is as sound and free from rust as when the bridge was built, 30 years ago.

Engineering, Civil & Mechanical.

THE HISTORY OF A GREAT INVENTION.—THE GIFFARD INJECTOR.*

Giffard has recently died. He was a great inventor, and every one has interested himself in the details of his life and with the recollection of his labors. We believe that it will prove of interest to all to learn the history of the discovery that has immortalized his name. The invention of the Giffard injector affords still another instance of the fact that it has always through serious studies, patient preparation, unremitting work, and persistent thought that those results of genius are reached which endow the industrial world with a new process or a new apparatus.

For many men, it would seem to be a sorrow and almost an offense to recognize the merit and superiority of an inventor; and to attribute to hazard and chance the occasion of a great discovery is to cause them genuine satisfaction.

If the inventor has benefited by a chance, by an accidental experiment, he is no more than a man, the equal of and like others—a fortunate of the earth; and people may envy him while esteeming themselves unfortunate in not having had the luck to make a similar "find" just as is envied the possessor of the ticket which drew the grand prize in the lottery, or the miner who finds an ingot of gold.

It is our intention to use Giffard as an example furnishing a new proof of the absolute assertion that if the discovery and appropriation of a material already existing, but for the moment hidden from the eyes of man, can be attributed to accident, to chance, the discovery by Giffard of his great invention, the injector—that treasure that he neither found nor invented, but created—can be attributed only to his genius and persevering labor.

Up to the present time it has always taken a combination of endurance, persevering effort in work, and of inventive genius to endow the world with those wonderful creations that mark an epoch, such as the printing press of Gutenberg, the enamels of Bernard de Palissy, the steam engine of Watt, the mule-lenny of Arkwright, the loom of Jaquard, and the works of Robert Fulton, Phillippe ne Girard, etc.

I have cited the names of inventions known to all, but, in aid of the assertion that I maintain, the examples are numerous, and all characteristic, from the manufacture of iron by Lord Dudley, in 1621, down to the manufacture of steel by Bessemer, in 1856, and of the Giffard injector, in 1858.

During the course of the year 1849, Giffard had Mr. Flaud construct the high speed steam engine that he (Giffard) had devised, calculated to draw an engine whose arrangements and proportions disagreed with all those ideas that had, up to that time, been admitted and accepted by constructing mechanicians.

Gifford relied on the admitted theory and mechanical formulas, but it was only to deduce from them ideas of surprising boldness. A single example will suffice to demonstrate this, since at that epoch he caused to be constructed and regularly operated a three horse-power engine, weighing only 45 kilogrammes, flywheel included, and running with a speed of 3,000 revolutions per minute.

Like many others, I visited Mr. Flaud's shop, in which a 45 kilogramme engine was running a dozen tools, the smallest of which was larger than the engine. What appeared singular, at first sight, was the large size of the bearings or plumber-blocks in which the little steel driving shaft revolved. A connecting rod, also of steel, transmitted to the driving shaft the motion from a piston rod that makes 6,000 strokes per minute in traversing from top to bottom and bottom to top the small vertical cylinder that the steam entered,

The bearings employed for the small steel driving shaft were wider than those used on ordinary steam engines running at the rate of 50 revolutions per minute, and with a large iron shaft, 10 to 12 centimeters in diameter.

At my observation Gifford contented himself with showing me, in a copy that he had made from one of our books of the Central School, the formula of the friction whose terms were independent of the surface; and I then understood in what manner he had utilized theory in order to pass to the practice of construction under new and fecund conditions.

The important thing for the builder, as well as for the inventor, was to earn money, since all resources were used up—by Giffard in experiments and the construction of his little

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*Emile Barrault, in *La Nature.*