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(Illustrated articles are marked with an asterisk.)



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### THE ARTISTIC ELEMENT IN ENGINEERING.

Although we have recently spoken at some length on the question of the artistic element in engineering, we feel that the subject is of such practical importance as to warrant this early return to it. At the recent meeting of the American Association for the Advancement of Science, held in Buffalo, Prof. Frank O. Marvin made this matter the subject of a lengthy and admirable address, which will be found in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT.

It is gratifying, but not a matter for surprise, that the interest in this question, which has recently been awakened, or rather reawakened, by Commissioner Wales' suggestions regarding the new East River Bridge, New York, has met with a hearty response from engineers and the technical press in general. That there is no necessary antagonism between that which is useful and that which is artistic is a fact which appears to be now generally understood, and the day is coming when it will be realized that these two elements are, in the nature of things, closely associated in the best works of construction.

Prof. Marvin defines the three elements of design as the scientific, the æsthetic, and the financial, and claims that "the current engineering practice gives great attention to the first and last of these elements, but little comparatively to the second." While admitting the truth of this statement, it is but just to say that the fault does not lie with the engineer so much as in the conditions under which he works. The final voice which the financial element too often has in the determination of designs and the awarding of contracts has tied the engineer down to a hard and fast consideration of the scientific elements of design alone. His knowledge is directed to a calculation of the least possible amount of material that will serve the purpose; and the general outlines into which he forms his design are determined by the same considerations. When the boards which control our public works and the management of the great industrial corporations make it clearly understood that, in judging competitive designs and awarding contracts, the artistic element will receive its full share of consideration, we shall see a marked effect upon engineering work as a whole. While a structure which is designed upon purely utilitarian lines will always have a certain beauty in the eyes of the professional man, who understands the meaning of its proportions, it does not follow that its outline will commend itself to the eye of the artist. Indeed, judging from the criticism in which those who profess to be artistically gifted more often than not indulge when speaking of engineering works, it would seem as though a design which is essentially scientific, and nothing more, can scarcely escape being essentially ugly. After making allowance, however, for the tendency to exaggeration which seems to be inseparable from artistic criticism, whether it be directed to a china vase or a steel viaduct, it remains true that the most scientific construction is not necessarily the most beautiful, and that a design whose proportions and details are modified by abstract considerations of grace and beauty will probably cost something more, often considerably more, than one which is purely utilitarian—designed for the simple doing of useful work, without any regard for its appearance.

If the three elements of design, the scientific, the æsthetic, and the financial, were placed in the order in which, historically speaking, they have successively controlled the art of engineering in America, we should say that originally the financial element was the controlling influence. In the early days of engineering, when there was so much to be done and so little capital to do it with, considerations of imperative economy came first, and design had to be subordinated to the materials of construction. Where timber was cheap and metal dear, the more cumbersome material was freely used; and from the same motives of economy the more bulky cast iron was placed where wrought iron or steel would have given equally reliable service and afforded a lighter and more artistic appearance. With the coming of the age of steel, and a more generous supply of capital, engineering developed more exact scientific methods. The old method of design, which was largely experimental and of the rule-of-thumb order, gave place to the formula and the testing machine. So thoroughly have American engineers worked out the scientific method that they have evolved certain types of construction which are strikingly different from anything to be found in any other part of the world. Indeed, it is safe to say, that for illustrations of the strictest application of theoretical science to the art of construction, one must come to America.

Having said this much, it must be admitted, on the other hand, that, judged from the standpoint of artistic merit, our engineering works do not equal those of France, at least in the department of civil engineering. The Frenchman is an artist to his finger tips, and he has shown the world that in the erection of great public works it is possible to produce dignity of outline, harmony of proportions, and beauty of detail, without doing violence to the scientific elements of the design. Our engineers are masters of the science of design, and there is no race that can build so swiftly or at less cost than we. It remains for us to develop that taste for the beautiful, and that mastery of its principles, which is the crowning glory of a race of builders, whatever be their age or clime.

### Consumption of Petroleum for Fuel.

No official figures on the consumption of petroleum for fuel have been published since the statement presented in the columns of the Shipping and Commercial List on January 17, 1894. Then it was shown that the Ohio and Indiana oil fields had furnished for fuel purposes 7,000,000 barrels crude in 1890, a trifle over 9,500,000 in 1891, about 11,000,000 in 1892, and 9,000,000 in 1893. The consumption dropped to 8,000,000 barrels in 1891, and last year the total sales of fuel were 7,600,000 barrels. Since January 1 the movement of crude for that purpose has continued at about the same ratio. The decline is owing to reduced production and higher prices. In 1892, when consumption was at its highest point and producers were pushing the use of oil for fuel, the cost of Lima oil at the wells was 15 cents per barrel, in comparison with 72 cents as the average last year. The decreased yield of Pennsylvania crude compelled refiners to give more consideration to the so-called Lima oil. By improved processes they brought the Ohio refined to perfection, and it is now as acceptable for export as any other grade of petroleum. For that reason much less crude is used for fuel, and unless production should largely increase, the volume of business in fuel oil will continue to decrease, so far as the Ohio and Indiana fields are concerned.

A different story comes from California, where the production last year was 800,000 barrels, against 400,000 in 1894, half of which was used for fuel and the balance refined. Developments are rapidly increasing the oil wealth of that State, and until the oil is otherwise used great efforts are being made to push it forward as a fuel. It is now being used in locomotives with success, this feature being taken from Russia. The comparatively new fuel is meeting with favor on the Pacific coast, as it cheapens the cost materially to many industries and prevents a surplus.

### The Electric Sucker.

In an article in Ueber Land und Meer on "Electrical Phenomena in the Animal World," Dr. Frölich tells about a sucker first found in the Nile and its tributaries by modern scientific men in 1881, but well known to the ancient Egyptians as the "sucker thunderer god," being worshiped as such in a sucker god temple in the city of the thunder sucker, or Oryrrhynchos. The reason they called it the thunder sucker instead of the "thunder fish," was because they knew of another fish, known to the English-speaking people as the electric cat (fish), to the Germans as the Zitterwels, or the shad that makes one tremble. It grows to a length of about a foot, of which the head and nose take up a quarter, and at the deepest part measures more than a quarter of its length.

Just why the modern scientific men did not know of this fish before is a question a layman finds it hard to answer, except that the sucker is a bottom fish. The old Egyptians probably learned of the animal after a Nile flood, when some philosopher was meditating over a mud puddle left by the receding water. He saw a funny fish struggling in the water, and, out of a desire for knowledge, reached for the fish and touched it. If there were any disciples of the philosopher hard by, they probably saw the philosopher act surprisingly—as the stoic Indian did when he got hold of a galvanic battery. Thereafter the fish was worshiped, having a name which associated it with the "thunder god of the skies," although the ancients knew nothing of electricity according to the learned of to-day.

A peculiar thing about the various electrical fish is that should one swim, even at a considerable distance from a human bather, the bather would know of its proximity by an "electrical sensation," while many of them have batteries actually fit to kill a horse on contact. These fish are far ahead of human beings in the matter of weapons, "for they stun their prey at a great distance in the water."

### Heat of Flowers.

Herr G. Kraus has investigated the extent and purpose of the rise of temperature at the time of flowering within the spathe of various species of Acaceæ, Cycadeæ and Palmæ. In Ceratozamia longifolia he found this elevation to take place only in the daytime, the maximum attained being 38·5° C., or 11·7° above that of the air. Similar results were obtained with Macrozamia. In the Acaceæ examined the period of maximum elevation is more variable, but it is never in the night. In this order the seat of the elevation of temperature is not the reproductive organs themselves, but the club-shaped appendix to the inflorescence, and it is accompanied by a rapid consumption of starch and sugar. All the plants in which this phenomenon occurs are entomophilous, and Dr. Stahl sees in it a contrivance for attracting insects to assist in pollination.—Annales Jard. Bot. Buitenzorg, 1896.