SCIENTIFIC AMERICAN

ESTABLISHED 1845

MUNN & CO., Inc., - Editors and Proprietors

Published Weekly at
No. 361 Broadway, New York

CHARLES ALLEN MUNN, *President*
361 Broadway, New York.
FREDERICK CONVERSE BEACH, *Sec'y and Treas.*
361 Broadway, New York.

TERMS TO SUBSCRIBERS.

One copy, one year, for the United States or Mexico $3.00
One copy, one year, for Canada 3.75
One copy, one year, to any foreign country, postage prepaid, 18s. 6d. 4.50

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (established 1845)........ $3.00 a year
Scientific American Supplement (established 1876)........ 5.00 "
American Homes and Gardens........ 3.00 "
Scientific American Export Edition (established 1878)........ 3.00 "

The combined subscription rates and rates to foreign countries, including Canada, will be furnished upon application.

Remit by postal or express money order, or by bank draft or check.

MUNN & CO., Inc., 361 Broadway, New York.

NEW YORK, SATURDAY, OCTOBER 2nd, 1909.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

TRUE SIGNIFICANCE OF THE HUDSON-FULTON FESTIVAL.

The splendor of the Hudson-Fulton festival stands for greater things than the mere exploitation of two individual men. Back of the music and the shouting, the blaze of color, the roar of saluting guns, and the blended laudation of press, pulpit, and platform—back, indeed, of the two men whose names are in every mouth and before every eye, are two cardinal facts of world-wide and age-long import and endurance, to which we must look for an explanation of the stupendous scale of this festival and the universal interest which it has awakened.

Why do we give Henry Hudson such pre-eminence over Gomez and Verazzano, and place Fulton above Fitch, Symington, and Stevens?

The transcendent importance of Hudson's voyage to New York Bay and up the river which bears his name, is due to the fact that he explored and opened up to the world the great highway of travel which nature had laid down from the Atlantic seaboard to the heart of the American continent. Gomez and Verazzano dropped into New York Bay as they did into many another inlet, and probably gave it value as one of several convenient watering places encountered on their coastal voyage.

Although Verazzano made mention of a great river, it is evident that he made no exploration to ascertain whether it was a river or an arm of the bay. Indeed, the fact that it was saline and tidal must rather have suggested a closed arm of the sea than a noble fresh-water river. Henry Hudson, on the other hand, not only sailed through the river for its whole navigable length, but he noted its flora and fauna, the appearance and habits of life of the inhabitants, and everywhere appears to have made free use of the sounding lead, not only throughout the river, but in his exploration of New York Bay.

And just here we venture the suggestion that, when so astute a man as Hudson had reached the head of navigation, he probably made such investigation as sign language and other means of intercourse with the Indians allowed, of the nature of the country which lay beyond. It is not unlikely that from the Indians he learned of the extensive Mohawk Valley beyond the Hudson; of the chain of lakes to the north; and of the westward route through which by canoe and portage, the travel and traffic of the Indian tribes were maintained from the Atlantic Ocean to the inland seas of fresh water that we now know as the Great Lakes.

Bitter, indeed, must have been Hudson's disappointment when the shoaling of the water just beyond Albany proved to him that his hope of finding a north-western strait leading to the Pacific was merely a dream; but his regret was mitigated to no little degree if he realized that he had found a great natural highway into a vast continent, of whose extent the Indians probably were able to give him a not unworthy estimate.

But, setting all mere conjecture aside, it is certain that Hudson's careful and intelligent exploration of the Hudson River, as distinguished from the cursory and unappreciative glimpses obtained by Verazzano, and possibly by Gomez, produced immediate results among the enterprising Dutch traders, and led to the early founding of a city and colony destined to become the most famous and powerful on the whole of the new continent. To the *veni, vidi* of Gomez and Verazzano, Hudson added the *vici* of one of the most successful and, in its effects, momentous voyages of exploration that the world has ever known. Right worthily does Henry Hudson bear his honors.

The work of Robert Fulton, two hundred years later, was the natural complement of that of Henry Hudson. Because of the inadequate means of transportation the new colony was unable, for fully two centuries, to reap the full fruits of Hudson's discovery of this great highway to the West. It is difficult for us to realize the crude condition of travel prior to 1807. There were but few really good roads; the majority were not much better than cleared tracks through the primeval wilderness. Travel by road was laboriously slow, and sailing up or down the Hudson in the cumbersome sloops of those days was little, if any, better. But the beat of the paddle wheels of the "Clermont" ushered in an entirely new method of transportation, which was destined to do more for the development of the country in a few decades than had been achieved in the two centuries preceding. The success of the steamboat was one of the causes which led to the construction of the Erie Canal. The rapid opening up of the country which followed upon the superior means of transportation thus afforded was exceeded only by that even more swift and complete settlement and exploitation, which followed on the institution of steam railroad travel. This in turn followed the same great highway through the Hudson and Mohawk valleys to the Great Lakes and the far West.

Hudson in 1609, and Fulton two centuries later, may have had some glimpses of the ultimate outcome of their respective achievements; but in their wildest flights of imagination, did they dream that a thousand ships would join with a city of 4,500,000 souls to grace the scene of their early labors, and render them the present stupendous tribute?

ONE HUNDRED YEARS OF THE MARINE ENGINE.

Reminiscence and comparison will be rife during the week of the Hudson-Fulton Celebration, and never will they be more active, surely, than when that curious marine craft, the "Clermont," slowly creeps, under the impulse of her antique engine, over the waters of New York Bay and the Hudson River.

In the "Clermont" engine, as in all the Watt engines of that day, the low steam pressure of four or five pounds above the atmosphere, was made necessary by the weakness of the copper boilers. The pressure being low, the condenser was, necessarily, of vital importance; yet the vacuum could scarcely be called satisfactory, for during the trial trip of the replica of the "Clermont," we noticed that the vacuum stood at about 22½ inches. Wood was used for fuel; and probably the consumption per horse-power per hour was equivalent to not less than five or six pounds of coal.

The marine boiler and engine are greatly indebted to the activity of the Hudson River steamship builders for their early improvement. We know that compound engines were used on this river as early as 1824, and that they showed satisfactory results. Furthermore, steam pressures of as high as 50 pounds to the square inch were used on the Hudson River long before the middle of the last century.

The marine engine made slower progress in ocean navigation than on the rivers, and particularly on the Hudson. The earliest transatlantic steamers, say of the period from 1845 to 1855, used boiler pressures of from 10 to 20 pounds to the square inch, and the approximate consumption of fuel was from 4½ to 3½ pounds per horse-power per hour. From 1855 to 1865, when the paddle wheel gave place to the screw propeller, the approximate boiler pressures were from 20 to 35 pounds, and the consumption of fuel was reduced from 3½ to 3 pounds per horse-power per hour. In the ten years, from 1865 to 1875, of the development of the transatlantic marine engine, the compound took the place of the simple engine, and steam pressures rose from 35 to 60 pounds, while fuel consumption was reduced from 3 pounds to 2.2 pounds per horse-power per hour. With the introduction of triple-expansion engines during the period from 1875 to 1885, the boiler pressures were doubled from 60 pounds to 125 pounds, and the approximate consumption was reduced from 2.2 to 1.9 pounds per horse-power hour. Then, in that notable period from 1885 to 1895, came the twin-screw quadruple-expansion engine, with boilers using forced draft and carrying pressures of from 125 to 225 pounds per square inch. The resultant economies were remarkable, the fuel consumption per horse-power per hour falling from 1.9 to 1.4 pounds per horse-power per hour.

Then came the most radical improvement in the marine engine in all the hundred years since the days of Fulton, when Parsons introduced the steam turbine, whose advantages ultimately proved to lie not so much in a further reduction of fuel economy, as in economies of weight, engine room space, consumption of oil, the great reduction of the cost of repairs and general up-keep, and above all in a great increasing of speed. Strange to say, boiler pressures, which had been mounting steadily upward, fell from the maximum of 225 pounds, as used with multiple-expansion engines, to about 150 or 160 pounds, which was found to be the most economical pressure for a turbine. The fuel consumption in high-speed turbine vessels is approximately the same as that of the very best reciprocating engines using all the modern contrivances of forced draft, superheaters, etc. Such are the conditions which obtained during the period from 1895 to 1905.

The present decade is being devoted to the development of the marine turbine, by the removal of certain defects, which at present seriously limit its usefulness. As matters now stand, the turbine drive gives its best results only when applied to comparatively high-speed vessels, and when they are driven at their maximum power. As the speed decreases, there is a loss of efficiency. Furthermore, the economical speed for the propeller is an uneconomical speed for the turbine. The present development is in the direction of combining the reciprocating engine with the turbine, using the former for the higher ranges of expansion and the turbine for the lower ranges. This combination gives an engine which can run economically at a low or cruising speed; that can reverse; and that can show as good economy on a cargo steamer as an all-turbine engine on a high-speed vessel.

Figures have recently become available of the first ocean-going installation of this kind, which was placed in the cargo steamship "Otaki." Since her delivery in November, 1908, this ship has completed a voyage to New Zealand and back. She is a sister ship, except in her engines, to two other vessels, the "Orari" and "Opawa," fitted with reciprocating engines. The "Otaki" is driven by two sets of triple-expansion reciprocating engines, one on each wing propeller, and a low-pressure turbine driving a center propeller.

A comparison of the relative performance of the two ships shows that at the full-speed trial, the "Otaki" developed 5,880 horse-power, as against 5,350 horse-power shown by the "Orari." Her coal consumption between Liverpool and Teneriffe was 11 per cent less when steaming under similar conditions and at practically the same speed. A comparison of the coal consumption for the whole of the voyage shows a gain for the "Otaki" of 8 per cent, or 500 tons of coal. The engines made a non-stop run from Teneriffe to New Zealand of 11,669 miles. The coal consumption, on the run from the Clyde to Liverpool at about half the power, worked out at 1.387 pounds per horse-power for all purposes—a most satisfactory result.

In the steam turbine we have apparently reached the limit of efficiency in the history of the steam marine engine. The indications are that the developments of the future will be in the direction of an internal-combustion engine, using either oil or producer gas.

COMBATING INJURIOUS INSECTS WITH THE AID OF THEIR NATURAL ENEMIES.

An interesting instance of successful warfare waged against injurious insects with the aid of their natural enemies is reported from Hawaii, where the sugar plantations have in recent years been threatened with annihilation by the ravages of a small cicada, little more than ⅛ inch long. Prof. Kirkaldy, the director of the Honolulu entomological station, has described the little insect and named it *Parkinsiella saccharicida*. It pierces the stem of the sugar cane and extracts the sap, causing the plant to wither and die. The formidable character of this insect pest is due to the amazing rapidity with which it multiplies. Six generations are produced annually and, on the assumption that 20 females of each brood live to reproduce their kind, it is estimated that the progeny of one female, produced in the course of a single year, numbers 64 millions. The insect was undoubtedly introduced with the sugar cane from other countries into Hawaii, where it has multiplied enormously, as its natural enemies, which limit its numbers elsewhere, do not appear to have been imported with it. Entomologists were, therefore, sent abroad to discover the original home of the little cicada, to find its natural enemies, and to bring these to Hawaii. It was necessary to extend these laborious and costly investigations to every part of the world from which sugar cane plants had been imported. The home of the insect was finally located in Australia, where two of its most formidable enemies were also found. These are two species of ichneumon fly, of the genera *Paranargus* and *Ovetertastichus*, which lay their eggs in the eggs of the cicada. The first-named species destroys only the cicada eggs in which its own eggs are deposited, but the other species pierces only one egg of each cluster of cicada eggs and its larva destroys the entire cluster. Both species have been successfully colonized in Hawaii and the prodigious increase of the sugar cane cicada has thus been checked.

The first steel steamship ever built in the maritime provinces of Canada is under construction at Yarmouth, Nova Scotia. A great development is expected in this industry, which, in the days of wooden vessels, was such an important factor in the prosperity of the provinces bordering on the Atlantic coast.