and all its accompanying vices? Will the poet's dream come true?—

"Men, my brothers, men the workers, ever reaping something new:
That which they have done but earnest of the things that they shall do:

"For I dipt into the future, far as human eye could see,
Saw the Vision of the world, and all the wonders that would be;

"Saw the heavens fill with commerce, argosies of magic sails,
Pilots of the purple twilight dropping down with costly bales;

"Heard the heavens fill with shouting; and there rained a ghastly dew
From the nations' airy navies grappling in the eternal blue;

"Far along the world-wide whisper of the south wind rushing warm,
With the standards of the peoples plunging through the thunder-storm;

"Till the war-drum throbbed no longer, and the battle-flags were furled
In the parliament of man, the federation of the world.

"There the common sense of most shall hold a fretful realm in awe,
And the kindly earth shall slumber, lapt in universal law."

Whether these things will be realized we know not. In view of the past, we dare not say our wildest dreams and fancies will not to-morrow be realities. But this we know: that wherever it is possible to benefit mankind, to alleviate suffering, to elevate humanity, and to raise man more nearly to the true image of his Maker, there the aid of natural science will never be found wanting.

THE SECOR SYSTEM OF MARINE PROPULSION.

FOR over four years there has been in process of development in the city of Brooklyn a system of propelling vessels which it is believed will offer distinct advantages over the marine steam-engine. The following is a brief description, condensed from "General Information Series," No. VIII., of the United States Navy Department, for 1889:—

"The propulsion of vessels by the liberation of a large volume of gas by explosion and the displacement of water thereby has been tried, and has met with some success.

"The method employed is the invention of Mr. Secor, and is fitted to a vessel 100 feet in length, called the 'Eureka.'

"The apparatus consists of two horizontal tubes about twenty inches in diameter, placed fore and aft in the after part of the vessel below the water-line, the after ends being in communication with the sea. Petroleum in the form of spray, and air under pressure, are injected into the tubes at the forward ends, and exploded by electricity. The disengaged gas expels the water from the tubes, and the re-action against the forward ends of the tubes propels the vessel. The explosions are arranged to take place alternately in the cylinders, and the firing mechanism to work automatically. Sixty explosions a minute in each cylinder have already been obtained, giving quite a uniform motion."

In 1824 Sadi Carnot propounded the great principle that the useful effect of any heat-engine was independent of the nature of the working fluid, and depended solely on the extremes of temperature in the working cylinder; or, as it has been expressed, it depends on the range of temperature of the working fluid during its working cycle. Sir William Thomson determined the exact expression for this efficiency, and it was also deduced analytically by Rankine as follows:—

$$E = \frac{T' - T^2}{T'}.$$

T' is the temperature above the absolute zero at which heat is supplied; and T^2, that at which it is rejected.

In the "Encyclopædia Britannica" (edition of 1889), article "Steam-Engine," Professor I. A. Ewing points out that in the cylinder of a gas engine the efficiency would be 87 per cent, if it were possible to expand down to atmospheric temperature and dispense with a water-jacket: thus in Centigrade temperature,

$$\frac{2173° - 288°}{2172°} = .87 \text{ nearly.}$$

This would represent an efficiency six times greater than the most economical triple expansion steam-engine.

The conditions which are impossible in any cylinder containing a moving piston are obtainable by the Secor thermo-dynamic method. The necessity for the wasteful water jacket at once disappears. The degree of expansion with its concomitant fall of temperature is only limited by the temperature of the sea, which constitutes the thermo-dynamic cold body or refrigerator. It may be remarked that the discharged gases, consisting principally of air, nitrogen, and carbonic acid, are poor radiators of heat, thus limiting antecedent heat-waste.

The conditions of the Secor cycle are, then, an explosion or combustion at the highest temperature—the dissociation limit—within a heated chamber, from which the outflow of heat may be prevented by suitable linings, the non-radiating products of combustion expanding in re-action against the coldest medium provided by nature (the ocean); the cooling being coincident with, and not antecedent to, the mechanical effect.

Science is to-day making demands of the steam-engine which it can never satisfy. Science says, let no heat escape from smoke-stack, or radiate from boiler, steam-pipe, or cylinder; then increase the range of temperature four or five fold that of the quadruple-expansion steam-engine. Hitherto the reply of the engineer has been, that, inasmuch as no conversion of energy can occur without some loss, even 85 or 90 per cent is, after all, not too great a tribute to pay to nature.

Thurston shows that the cannon does much better, yielding nearly 50 per cent of thermo-dynamic efficiency. The electrician working in a new field, undeterred by precedent, guided only by a knowledge of the laws which relate to the conservation and correlation of energy, has accomplished still greater results. An efficiency of 90 per cent in the dynamo is one of the grandest achievements of applied science.

Although the method of propulsion in the Secor system involves a radical change as compared with the screw, it is not impossible to estimate the efficiency of an air-jet under the circumstances indicated. The limited area of a jet of air or water has been supposed to involve a great loss of efficiency. This idea has arisen principally from erroneous conceptions in respect to the screw.

It was at one time an axiom in engineering, that the larger the exposed area of the screw, the more effective would be its action. Experience has shown the fallacy of this idea. Data of the trials of three large transatlantic steamers, showing the comparative merits of large and small screws under similar conditions, are given by Arthur I. Maginnis, Esq., in a paper read before the Institution of Naval Architects. He remarks, that "by these results it will be seen that propellers of small diameter have in each case proved the most economical and effective, both increasing the speed and decreasing coal-consumption." Mr. Isherwood has shown that decreasing the number of blades in a screw causes no falling-off in speed. Mr. Ericsson's theory was directly opposite in the early days of screw navigation. It was considered a peculiar advantage in the Ericsson screw that it had six blades. Mr. Griffiths has proved that increasing the hub area up to one-fourth the total diameter does not lessen the speed. Speaking of the tip of the blade, Mr. Barnaby says, "The tip of the blade is very little good, only you must have a tip." The exposed area need be only sufficient to absorb the engine's power: more than this is a loss.

Not only were the early engineers mistaken in regard to area, they were equally erroneous in the theory of slip. Mr. W. Froude remarks, "that to assert that a screw works with unusually little slip is to give proof that it works with a large waste of power." He remarks further, "Experiments which have been in progress since this paper has been in type show conclusively that the decrease of efficiency consequent on increasing slip, with screws of ordinary proportion, is scarcely perceptible."

In 1867 the British Government built the "Water Witch," a 1200 ton vessel, to test the value of hydraulic jet-propulsion. Engineering records show that several jet steamers have been built since that date; the latest being the "Duke of Northumberland," completed in 1890 for life-saving purposes.

It is now well known that theorists were wrong in their conceptions of the efficiency of a jet. The eminent authority, Mr. S. W. Barnaby, has shown that the efficiency of the jet is 75 per cent, as against 65 per cent for the screw: in other words, it is 15 per cent better than a remarkably efficient screw. Why, then, has not the jet entirely superseded the screw? Mr Barnaby has shown that it is due to pump inefficiency. This is a loss which may be reduced, but cannot be entirely avoided. Friction and inertia in the pump more than neutralize the enormous advantage possessed by the jet over the screw. The average pump loss is about one-half the total power.

Mr. R. H. Tucker of Boston, in 1880, tried direct-air propulsion on a canal-boat. An 8-horse-power engine drove a No. 4 Root blower, the air being discharged directly against the water astern. The Root blower has an efficiency of about 75 per cent. The result, four miles per hour, showed a good efficiency for the fuel expenditure.

As a whole, the Secor system provides those thermo-dynamic conditions which science demands, but which cannot be satisfied in a reciprocating, rotating heat-engine. In every known method of propulsion, whether paddle, screw, or jet, there is a considerable expenditure of power between the cylinder and the propeller. In the Secor system, friction and inertia of moving parts are eliminated, and, without anterior loss of heat or power, that method of propulsion is adopted which is suggested by the most advanced science.

The purpose of the present paper is to state briefly the theory of the system rather than to discuss its commercial or naval advantages. It may, however, be mentioned that a first-class transatlantic steamer carries a weight of 5,500 tons in engines, boilers, fuel, and water. To offset this permanent ballast, there is the passenger accommodation, and capacity for less than 1,000 tons of paying freight,—$10,000 in coal, about $600 in oil,—and 180 men are required to keep the leviathan in motion for one trip. In view of this situation, the advantages of the Secor system, in theory at least, are evident.

NOTES AND NEWS.

THE eighth congress of the American Ornithologists' Union will convene in Washington, D.C., on Tuesday, Nov. 18, at eleven o'clock A M. The meetings will be held at the United States National Museum. The presentation of ornithological papers will form a prominent feature of the meetings; and members are earnestly requested to contribute, and to notify the secretary in advance as to the titles of their communications, so that a programme for each day may be prepared. The address of the secretary is John H. Sage, Portland, Conn.

— Platinum has long been recognized as an extremely refractory metal to use in electroplating, the difficulties mainly arising from the fact that the strength of the bath cannot be maintained, as with other metals, by using a plate of platinum as the anode, as the metal will not dissolve. The consequence is, that both the richness and conductivity of the bath are continually altering, and a satisfactory deposit can only be obtained by the most constant attention. In a recent paper on the subject which was read before the chemical section of the Franklin Institute, according to *Engineering* of Oct. 10, Mr. William H. Wahl states that it occurred to him that it might be possible to maintain the strength of the bath by greatly increasing the surface of platinum at the anode, which was accomplished in the following way: a plate of carbon was saturated with platinic chloride and dried, thus impregnating the plate with the salt, from which the platinum was finally reduced to the metallic state by heating the whole plate in a crucible. In this way a deposit of platinum in an extremely fine state of division was obtained in the pores of the carbon plate, and this plate was then used as the anode of the electrolytic bath. On passing the current, the platinum proved to be readily soluble in a bath of hydrochloric acid, and so far the experiment was a success; but the process proved useless from a commercial point of view, as the metal still remained insoluble when the bath consisted of oxy salts of platinum, which alone give good deposits. It was therefore necessary to devise some other plan, and after many fruitless experiments Mr. Wahl claims to have succeeded by using platinum hydroxide for maintaining the strength of the metallic solution. For this purpose the salt, which is readily soluble in alkalies and in many of the acids, may be introduced into the plating bath from time to time, and dissolved therein by stirring; or it may be permitted to remain in the bath in excess, either at the bottom or suspended in a canvas bag adjacent to or surrounding the carbon anode. A weak aqueous solution of caustic soda or caustic potash, especially the latter, will dissolve a large quantity of platinum hydrate; and the solution has the advantage of being freely conductive of electricity, and of yielding bright, regular, and adherent deposits of platinum on electrolysis. Further, with currents of moderate strength, the platinum hydrate only is affected; and hence the constitution of the bath can be easily maintained constant by adding fresh supplies of platinic hydrate. Other solvents have also been tested by Mr. Wahl, but for these details we must refer our readers to his paper, contenting ourselves with giving the main outlines of his discovery.

—The United States Coast and Geodetic Survey Office has received from the Government Printing Office Appendices Nos. 12 and 13 to the "Report of the Superintendent for 1888," in pamphlet form. Their titles are "No. 12. Hypsometry: Heights from Geodetic Levelling between Arkansas City, on the Mississippi River, and Little Rock, Ark., 1887–88 (field-work by J. E. McGrath, sub-assistant; reduction by C. A. Schott, assistant);" "No. 13. Astronomy: Differential Method of computing Star Places," by E. D. Preston, assistant. The levelling-work in Arkansas was continued in 1889 by Sub-Assistant Isaac Winston, who ran the line from Little Rock, Ark., to Fort Smith, Ark. Mr. Winston will probably extend the same work during the coming season, beginning at Fort Smith, Ark., and running northward toward Kansas City, Mo., where eventually this line will be connected with the main transcontinental line of levels. The results that are now being obtained are immediately utilized by the Arkansas Geological Survey and others.

— A meeting of a committee of Harvard students has been held to consider the best means of raising a fund for building a new library reading-room. For several years students and instructors alike have felt the need of such a room, capable of being lighted and open in the evening. Two years ago a petition signed by nearly every student of the university was presented to the corporation, asking to have Gore Hall lighted by electricity. The corporation deemed this unsafe, since the present building is not fire proof; and impossible, since they had not the funds necessary to make it fire-proof. To a letter asking what the cost of such a reading room would be, the president replied, "A proper reading-room attached to the present library building would cost from $100,000 to $200,000, according to its size and general style. A plain stone building of sufficient size, made fire-proof and lighted with electricity, could hardly be built and furnished for less than $100,000. If the design were elaborate and handsome, as well as sufficiently spacious, it could not be built for that sum." Ill ventilation, bad light, and early closing of the library, together with the feeling that no remedy was forthcoming, brought the matter forcibly before the students. The committee above referred to considered the advisability of taking active steps in the matter, and voted to make a canvas of the college in order to raise as large a portion of the fund as possible among the students themselves, and then, by a circular letter, to appeal to the alumni for the rest. Accordingly the college has been canvassed; and, notwithstanding the many demands upon the students for money consequent upon the opening of a new college-year, 789 men have already contributed $3.530, or $4.40 per man. According to the last quinquennial catalogue, there are about 5,500 living graduates of the college proper. It is to be hoped that from so large a number at least $150,000 will be speedily forthcoming.