ENGLISH VS. GERMAN ATLANTIC LINERS.

It is rumored in English shipping circles that the Cunard Steamship Company are going to construct two new liners, with the object of lowering the records for the transatlantic journey, recently established by the "Deutschland" and "Kaiser Wilhelm der Grosse." The rumor, however, is generally discredited, since the English shipping companies have abandoned the contest for speed records. The present tendency is not to build faster boats, but larger and more comfortable vessels. This fact has been irrevocably established by the White Star liner "Oceanic." This vessel was not built with a view to racing across the Atlantic at a tremendous speed, but was intended to carry a larger tonnage and a greater complement of passengers at a steady speed with the maximum of comfort. The "Oceanic" has been such a tremendous success that the White Star Line have another vessel, even larger than the "Oceanic," in contemplation, and the various other companies, profiting by this experience, are following suit.

There are several salient points which militate against the English companies attempting to lower the speed records. In the first place, the German steamship companies are heavily subsidized by their government. Therefore, they need not display that economy which the English companies have to observe. The latter receive not a farthing from their government, and if the German companies were deprived of their state subsidy, and were to continue their business on the same lines that they now practice, they would incur a very heavy loss. Then again there is the question of coal consumption, which is troubling the English companies a great deal just at present. It is estimated that if the "Lucania" or "Campania" were to run at 22 knots instead of 20, which is their present average speed, they would consume an extra 300 tons of coal a day. This would mean something like $2,250 over and above the present daily cost of running. Consequently, it will be readily recognized that the English companies will not incur such an extra heavy expense for the purpose of saving a few hours upon the journey.

THE TEMPLE LIBRARY AT NIPPUR.

The remarkable discoveries made by the Pennsylvania University expedition at Nippur under Prof. Hilprecht have awakened great interest, as by these discoveries the history of Babylonian civilization has been carried back to a period more than 7,000 B. C. Prof. Hilprecht has now returned to Constantinople, and has described some of the chief results of this year's work in the old city. The library of the great temple was the most important discovery which was made. Prof. Hilprecht stated some eleven years ago that the remains of the library would be found at the very place where the discovery was made. In three months no less than 17,200 tablets bearing inscriptions in cuneiform characters had been found. They relate to business contracts, conveyances, letters, etc. The latest discoveries disclose the fact that the tablets are historical, philological, and literary, treating of mythology, grammar, lexicography, science, and mathematics. It is thought that when they have all been deciphered, they will enable us to obtain a very adequate idea of life in Babylonia. None of the documents bear a later date than 2280 B. C. It is probable that the library was destroyed during the invasion of the Elamites, which occurred at this date.

Prof. Hilprecht considers that at the present rate of working, five years will be necessary to excavate and examine the contents of the great library. He considers that the unexplored part will yield 150,000 tablets. We know that the library was of great importance in early Babylonia, and was the chief college for instruction in law and religion, as well as in all other studies. It is probable that no example of a literary treasure trove in the world's history, not even in Egypt, will result in so complete a recovery of the records of ancient civilization. The work of exploration has been stopped on the library in order to continue the work at the temple and to complete the examination of the southern and eastern lines of the walls of the fortifications. The numerous weapons were found along the fortifications in the lower strata. This affords material for determining the methods employed by the besieging armies in the bloody early period of Babylonian history. In the course of the present excavations the palace belonging to the pre-Sargonic periods was uncovered beneath an accumulation of 70 feet of rubbish on the southwestern side, which divided Nippur in two parts. Prof. Hilprecht considers that this palace, which has a frontage of 600 feet, will probably be found to be the palace of the early priest-kings of Nippur. The few rooms excavated have given valuable results in the way of tablets, cylinders and figurines. It is hoped that statues will also be found. A large building with a remarkable colonnade, which was discovered in the first campaign, has been completely excavated.

An important tomb has also been discovered. The French expedition has done good work at Tello, on the southeast side of the great canal connecting the Tigris with the Euphrates. The chief finds of the year are about 10,000 inscribed tablets. A third expedition that Germany arranged has been at work in Babylonia since the spring of 1899. The greatest success of the year is that made by the American expedition.

DISTANT WATER POWERS.

BY ALTAN D. ADAMS.

Unfortunately for the average investor in schemes for long distance transmission of water power by electric methods, the demonstration of financial success in this line has not been made as complete as that of engineering possibility. It seems timely, therefore, to call attention to a few facts in the interest of the man who pays the bills. An attempt is here made to show that the fundamental objection to the electrical transmission of energy at high pressures, over long distances, under ordinary conditions, lies not in the limits of practical voltage, but in the large cost of and material losses in the necessary equipment. The great problem that must be solved in order to make electrical transmission of water power generally practical, over long distances, lies not so much in the direction of higher pressures as in the discovery of cheaper apparatus for its transmission to towns and cities where coal can be had at usual prices.

Before the wholesale transmission of energy from falling water, over long distances, is generally adopted, it must be shown that the transmitted energy can be delivered at the points of use for not more than the cost of the same amount of energy there developed from coal. When those who see great advantages in the delivery of power at long distances from the place of its development have found their Utopia, in a source of absolutely free water power, they will still be unable to transmit it to far-away cities, in competition with the steam or gas engine, with coal at ordinary prices, because of the large investment for lines and machinery and the labor item of operation. So limited are the possibilities of electric power transmission, under the conditions imposed by long distances, that if cheap water power were only a single mile distant from large cities, it would not pay to transmit it, if the long distance equipment had to be employed for the purpose. In other words, the cost of, and losses in, the electrical machinery necessary for the transmission of power to great distances more than offset the usual difference between the cost of water power at a cheap source and the cost of its production at the point of use from coal at ordinary prices. Again, the transmission of power on a large scale, between distant points, cannot be fairly confounded with the distribution of power over even great areas to small consumers, since widely scattered small power users are not in a position to have their power economically generated at the points of use. The measure of warrant for the transmission of power between distant points is the difference in the cost of power production at the points in question. If it is proposed to transmit the energy of falling water to a distant city or great manufacturing plant, the inducement to the project is the difference between the cost of unit energy from the water power and the cost of the same energy unit produced by fuel consumption at the point of distribution or use. The power of falling water is so easy to grasp, and apparently so cheap, that it has long been regarded as peculiarly suited to long distance electric transmission. It is a matter of history that many of the best water powers in the United States have cost sums to develop on which the power delivered furnishes but a poor return. Without discussing the actual cost of water power development which often runs from $100 to $150 per delivered horse power, a moderate yearly price for such power may be assumed at $15 per horse power year. The combined efficiencies of the electric transmission equipment is 62 per cent, assuming 90 per cent each for dynamos and motors, 95 per cent each for two sets of transformers, and 85 per cent for the line efficiency. The cost of water power for each horse power year delivered at the receiving station is, therefore, $15 \div 62 = 24{\cdot}19$ dollars. The cost of the electrical transmission equipment is 86·15 dollars per horse power of delivery capacity at the center of distribution or use at prices of $25 per horse power capacity of dynamos and motors and $10 per horse power for transformers, the total dynamo and motor capacity being 2·45 and transformer 2·49 times the power delivery. Allowing $60 per brake horse power capacity for the machinery of a steam plant at the point where the transmitted power is to be used, the additional expense involved by the transmission equipment is $86{\cdot}15 - 60 = 26{\cdot}15$ dollars per delivered horse power. Taking 16 per cent of this extra outlay for the electric equipment gives $26{\cdot}15 \times 0{\cdot}16 = 4{\cdot}18$ dollars, the annual charge for interest, depreciation, repairs, insurance, and taxes on the additional investment per delivered horse power. Adding the above cost of water power and the annual charges just found gives $24{\cdot}19 + 4{\cdot}18 = 28\ 37$ dollars, and this sum, less the cost of coal per horse power year at the steam plant, or $28{\cdot}37 - 11{\cdot}25 = 17{\cdot}12$ dollars, is the excess in cost per horse power year delivered by the electric transmission over the cost of the same power from a local steam plant. In order that the electric transmission may deliver power at the same cost as a local steam plant, the cost of water power per delivered horse power year must not exceed $11{\cdot}25 - 4{\cdot}18 = 7{\cdot}07$ dollars, and this reduces the charge per horse power year at the water power to $7{\cdot}07 \times 0{\cdot}62 = 4\ 38$ dollars, on the basis of no outlay whatever for line conductors.

This comparison assumes the same labor of operation and building cost for the two stations and electric transmission as for the single steam plant. Turning again to the electric transmission equipment, consisting of dynamos, two sets of transformers, motors, and the line conductors, and omitting from the consideration the line loss, the combined efficiency of the other elements is $0{\cdot}95 \times 0{\cdot}90 \times 0{\cdot}95 \times 90 = 0{\cdot}73$, so that for each horse power delivered by the motor, $1 \div 0{\cdot}73 = 1\ 37$ horse power must be supplied to the dynamo. The capacity of each element now is, making that of the motor as 1, step-down transformer $1 \div 0{\cdot}9 = 1{\cdot}11$, step-up transformer $1{\cdot}11 \div 0{\cdot}95 = 1{\cdot}16$, dynamo $1{\cdot}16 \div 0{\cdot}9 = 1{\cdot}22$. On the same basis as above the cost of the electrical equipment is now, motors and dynamos $(1 + 1{\cdot}22)\ 25 = 55{\cdot}50$ dollars, transformers $(1{\cdot}11 + 1{\cdot}16)\ 10 = 22\ 70$ dollars, a total of 78·20 dollars for each horse power of delivery capacity. The yearly charges on this sum for interest, insurance, taxes, depreciation and repairs, taken at 16 per cent, as above, amount to $78{\cdot}20 \times 0{\cdot}16 = 12{\cdot}51$ dollars. As the cost of coal at $3 per ton is only 11·25 per horse power year, for a first-class steam plant, the delivered power from a system of long distance electric transmission is $12{\cdot}51 - 11{\cdot}25 = 1{\cdot}26$ dollars per horse power year more expensive than the same power from a local steam plant, it being assumed that the transmission line costs nothing and that there is no power lost in it. Or, to illustrate the case, suppose that great central power stations could have free water power if they would use it to drive dynamos, send the resulting energy through two sets of transformers and then into electric motors to be used in driving their regular electrical equipment for local service, the interposed dynamos, transformers, and motors being paid for at above prices. Should the central stations accept such a proposition, power delivered to their regular electric generators would cost 1·26 dollars more per horse power year than the value of the fuel outlay they would save, though there would be no line loss or cost.

These figures are based on the operation of steam engines; if gas engines, which only consume about two-thirds of the coal for an equal output, are used, the result is still less favorable to the electric transmission. It is thus evident that no possible increase in practical voltage, which can only decrease but never do away with the cost of and losses in line conductors, can ever warrant the long distance electric transmission of water power to points where coal can be had at common prices, since such transmissions would not pay if the line dissipated no energy, cost nothing, and water was free at the generating station.

EXPORTS OF AMERICAN COAL.

Exports of coal from the United States during the year 1900 are likely to reach $20,000,000 in value, against $10,000,000 in 1896 and $6,000,000 in 1890. The figures of the Treasury Bureau of Statistics show that the exports of coal from the United States during the 7 months ending with July, 1900, are 50 per cent in excess of those during the corresponding months of last year and double those of the corresponding months of 1898. In the 7 months ending with July, 1898, the exports of coal from the United States were 2,375,451 tons; in the same months of 1899 they were 3,006,032 tons, and in the corresponding months of 1900 they were 4,601,755 tons. During the period from 1890 to 1900 the exportation of coal from the United States has quadrupled, but the principal growth has been in the years 1898, 1899, and 1900. While this growth is observable in the exports to all parts of the world, it is especially marked with reference to our exports to the American countries. To British North America, the exports in the 7 months of 1898 were 1,788,398 tons and in the 7 months of 1900, 3,253,803 tons. To Mexico the exports in the 7 months of 1898 were 243,938 tons and in the corresponding months of 1900, 415,834 tons. To Cuba the exports have more than doubled, being in the 7 months of 1898, 114,655 tons and in the 7 months of 1900, 241,712 tons; while to Porto Rico the exports increased from 2,621 tons in the 7 months of 1898 to 15,313 tons in 7 months of 1900. To the Hawaiian Islands, the exports of the 7 months of 1899 were 10,381 tons and in the corresponding months of 1900, 21,001 tons, thus more than doubling in a single year. To the Philippine Islands the exports in the 7 months of 1898 were 4,810 tons, and in the 7 months of 1900, 41,068 tons, or eight times as much in 1900 as in 1898.

The experiments with American coal which the Europeans have made in the last two or three years seem to have proved successful, as the exports to Europe, which in the 7 months of 1898 amounted to only 4,507 tons, were in the corresponding months of 1900, 278,572 tons. Of this, 187 tons went to the United Kingdom, 4,028 tons to Germany, 77,407 tons to France, and 196,950 to other European countries.