SCIENTIFIC AMERICAN

ESTABLISHED 1845

MUNN & CO., - - Editors and Proprietors

Published Weekly at

No. 361 Broadway, New York

TERMS TO SUBSCRIBERS

One copy, one year for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845) .... $3.00 a year
Scientific American Supplement (Established 1876) .... 5.00 "
Scientific American Building Monthly (Established 1885) .... 2.50 "
Scientific American Export Edition (Established 1878) .... 3.00 "

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

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MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, APRIL 8, 1905.

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.

THE OCEAN RACE FOR THE GERMAN EMPEROR'S CUP.

With the recent closing of the entries for the German Emperor's cup, which occurred April 1, this great event, which in point of the size and number of yachts that are entered must rank as one of the most notable events in the history of yachting, begins to attract the attention which is surely its due. There is, of course, nothing new in the idea of a yacht race from Sandy Hook to some point on the English coast. There have been many such races, and the competing yachts were sailed with a reckless hardihood that has placed the records where it will be very difficult to surpass them in this or future races. Take, for instance, the "Henrietta," which, in 1866, made an average speed for the course of 9.36 knots and ran in one day a distance of 280 knots; and also the matchless "Sappho," which three years later made an average over the whole course of 9.66 knots, and ran in a single day 316 knots, a day's run which, however, was surpassed later by the "Dauntless," another famous schooner, which in 1887 reeled off 328 knots in twenty-four hours. This record of the "Sappho" stood until the year 1900, when the schooner "Endymion" averaged for the whole run across the Atlantic 9.66 knots, exactly the same average as that of the "Sappho." The "Endymion," moreover, broke the record for the whole course, which she still holds, crossing from Sandy Hook to the Needles in thirteen days, twenty hours, and thirty-six minutes. This fine run, however, was not made in a race, but in the course of an ordinary passage across the Atlantic, and therefore it stands in a class by itself.

There are so many variable conditions entering into a great ocean race such as this, that it is impossible, even for the self-constituted yachting sharp, to make any predictions either as to the winning yacht, or the speed at which the course will be sailed. Although all of the yachts are large vessels, the smallest of them being 86½ feet on the waterline, there is so much difference in their size, rig, model, and construction that it is futile to hazard a guess as to which boat would be the winner, even if they kept in close company all the way across, which they will not, and even if they should have steady, whole-sail breezes for the whole distance, which is even less likely. At the time of the year when the race will be sailed, the latter half of May, fair weather may be looked for, and in all probability not much reefing will have to be done.

If one were to endeavor to forecast the winner, he would have to prefix his guess with several "ifs" and a "but." We know that length means speed, and that size means ability to maintain headway in rough water; and hence, if winds from abeam to astern prevail, and strong winds at that, we should look to see the huge "Valhalla" lead the fleet into British waters; for with her waterline length of 240 feet, her ample sail spread, and big displacement, she should be able to reel off her 14 to 15 knots an hour with everything drawing. On the other hand, the form of the "Valhalla" is not nearly so fine or sweetly modeled as that, say, of the 101-foot waterline "Endymion" or the 135-foot waterline "Atlantic." This last named, a three-masted schooner, has certain recorded speeds to her credit which should enable her to drop the rest of the fleet in a reaching breeze and a fairly smooth sea.

It is interesting to note that there is one yacht entered in the race, the composite-built yawl "Ailsa," which is a fairly up-to-date racing machine. She was built in 1895 expressly as a competitor against the Prince of Wales's "Britannia," which at that time was sweeping everything before her. She has the light construction, fine model, deep lead, and large sail spread of the racing craft; and if she is so fortunate as to meet with weather that enables her to carry her full sail spread, she should make a creditable showing. The nearest approach to her in fineness of model and relative area of sail spread is the three-masted schooner "Atlantic." And, of course, the extra 36 feet of length of the latter will enable the "Atlantic" to leave the older racing yacht in a breeze of any strength.

From the standpoint of sentiment, interest will naturally center in that veteran yacht, the "Sunbeam," the story of whose wanderings was so delightfully written by Lady Brassey, many years ago. The "Sunbeam" has the length and the lines to maintain a fairly good speed if conditions are favorable. She has proved her staunchness in some of the most lengthy cruises in yachting history, and no doubt she will be able to carry her canvas with the rest of the fleet.

Of the eleven yachts that are entered, five were built in England, and six in America. Two of them will sail under the flag of the Royal Yacht Squadron; seven will fly the flag of the New York Yacht Club; one, the "Thistle" (which, by the way, will be sailed by her owner, Robert E. Tod, and will, therefore, be the only yacht in the race having an amateur skipper), will fly the Atlantic Yacht Club flag; and to a single yacht, the former Watson schooner "Rainbow," now the "Hamburg," which will fly the flag of the Kaiserlicher Yacht Club, will fall the honor of representing the yachtsmen of Germany.

THE DANGERS AND DIFFICULTIES OF TUNNEL BORING.

The joining of one of the twin passages of the 12¼-mile Simplon tunnel on February 24 last—which was fully described in recent issues of this journal and of the Supplement—brought to an end most of the difficulties the engineers of that great enterprise had to surmount, and made the completion of the work fairly easy. Never before in the history of land tunneling have such formidable obstacles been met and successfully overcome. Not only was there trouble from cracking and crumbling of the masonry walls by the great pressures they sustained, but also formidable springs of hot water were encountered, which made the temperature unbearable and flooded the workings. These hot springs made the boring of this celebrated tunnel through the Simplon range almost as difficult and dangerous a piece of work as is the boring of the North River and East River tunnels in New York city. Attention was called to this latter work, and the difficulties which attend it, by an accident which happened in the northernmost tunnel under the East River on March 27. This tunnel is being driven from the Brooklyn side of the river. It starts just west of Clinton Street, and has reached a point in the river 1,400 feet away, or about 20 feet beyond the stringpiece at the foot of Joralemon Street and between piers 17 and 18. It is being driven by a tunneling shield similar to that used in 1868 by the late editor of this journal, Mr. Alfred E. Beach, in constructing an experimental tunnel under Broadway. While this shield (with which our readers are doubtless familiar, as we have described it at various times) operates very well in solid earth, it having been used not only for land tunnels, but also for tunnels under water in various places, when it is used near the river bed in soft sand, such as is found in the East River, there are liable to be "blowouts," as they are termed, and these are exceedingly dangerous. As the shield is forced forward through the sand, the latter is kept from oozing in by means of compressed air. If it were possible to carry on the work with the air pressure at the point where it is equal to the pressure of mud and water at the top of the shield, there would be no difficulty; but as the bottom of the shield is nearly 20 feet below its top, a greater pressure than is needed at the top has to be employed in order to keep out the sand at the bottom. The result is that if the sand is not very firm or thick, the excessive air pressure at the top of the shield is liable to make an opening through the river bed and blow out, whereupon, if the air pressure is not maintained, water will flow in. It was just such an occurrence as this that cost the lives of twenty men in 1880, during the first attempt at driving a tunnel under the North River, although at this time work was being carried on without a shield and great risks were taken. The men doing the work in the East River tunnel knew that the river bed was treacherous, and they were provided with sandbags with which to stop up any small leak that might start, before it should have a chance to enlarge. In the accident mentioned, a workman in the upper part of the shield discovered a leak, and called to his mates below to hand up a sandbag. They did this, and he was about to stop up the leak when a large hole was blown through the river bed, and the rapidly escaping air forced the workman up through it and the water above and projected him, in a column of water, a few feet above the surface. He was rescued by men on the pier, and, save for a wetting, was unhurt. The other men in the shield managed to make their escape and shut the doors behind them. One of these men became wedged while making his escape, and it took half an hour to dislodge him. The air pressure meanwhile was kept at the point to which it fell as a result of the blowout. This was only a few pounds lower than the pressure that had been maintained.

In order to resume work, it was necessary to stop up the hole in the river bed. This was done by sinking a large sheet of canvas and loading it with bags of sand. The water was then pumped out of the shield, and work was begun once more. The river bed above the shield is only 8 or 9 feet thick where the accident occurred, and there is about 19 feet of water. The air pressure in excess of atmospheric used to hold up this weight of water and sand was only just sufficient to balance the pressure of the water and sand at the bottom of the shield, and it caused a few pounds per square inch more pressure than was needed at the top. A bowlder was encountered and blasted a short time before the leak was discovered, and it is probable that the blast so loosened the sand that when the air once started to escape, it easily broke through a large passage for itself, and kept escaping until the air and water pressures became equalized. This accident is an example of what may happen when boring a tunnel under a river and near the surface of the river bed. In constructing the North River tunnel, it was necessary to thicken the river bed on the line of the tunnel, in order to prevent blowouts. In the present instance these have been avoided only by the greatest vigilance.

The system of constructing a tunnel from the surface by putting together the upper half, sinking it, placing it on piles, and then constructing the bottom half on a concrete foundation beneath—a system which was employed in the subway tunnel beneath the Harlem River successfully, and which we described in our July 2, 1904, issue—does away with the dangers we have mentioned and is also more expeditious. We understand it is to be employed in constructing a tunnel across the North River at 42d Street in the near future.

ELECTRIC STREET RAILROADS VERSUS MOTOR-PROPELLED VEHICLES FOR PASSENGER TRAFFIC.

During the past two or three years the conversion of the various street surface railroads in Great Britain to electricity has been carried out very extensively. But now a halt has been called in this development. During the past few months innumerable experiments have been carried out with motor-propelled omnibuses and the results have been somewhat remarkable. From these experiments it is evident that this type of vehicle and means of propulsion has been brought to the requisite standard of efficiency and reliability for this class of work. There are several motor omnibus services already being maintained in various parts of the metropolis, and as they have been introduced in competition with the electric railroads, some interesting comparative results have become available. From this it is conclusively demonstrated that for all-round work the motor vehicle is far more satisfactory, especially in crowded thoroughfares. In the first place, while its speed may not be so great as compared with what the electric vehicle running on the railroad can attain when the road is clear, yet, owing to its greater mobility, it can thread its way in and out of the other traffic with greater facility. It has been shown on numerous occasions that when the two types of vehicles have started from one point for another distant station, the latter has been reached by the motor omnibus in the shorter time. In one instance the motor omnibus service is able to maintain an average speed of 12 miles an hour through ordinary thoroughfares, whereas the electric car has only been able to average a speed ranging from 7 to 9 miles per hour.

At the present moment there are 162 motor omnibuses in course of construction for the various companies of London, which number, in the course of the next two years, is to be increased to 1,000. These vehicles cost on the average $4,000 apiece and have accommodation for 34 passengers. One of these 'buses has just completed a 2,000-mile reliability test. The vehicle is propelled by a four-cylinder motor developing 24 horse-power. The average daily run was 100 miles, the total weight of the car when loaded representing 5 tons. On average roads a speed of 16 miles an hour was maintained. The longest run made without any involuntary stop was 971 miles, which, considering the fact that no overhauling, cleaning, or other adjusting work was permitted upon the vehicle during the whole time, is in every way satisfactory. The gasoline consumption throughout the whole 2,000 miles aggregated 297 gallons, representing an average of approximately seven miles per gallon. Another important point in regard to these vehicles is their economy in operation as compared with their earning capacity. A motor vehicle running 700 miles per week can earn on the average from $250 to $350, while the working expenses for the same distance and period aggregate only $90.

At the present moment the London County Council are converting the whole of the surface railroads under their control to electric power. In one district, owing to the advance of the gasoline vehicle, the scheme of electrification, however, has been abandoned. It is estimated that to convert the section in question to electricity over $9,000,000 would have to be expended. The existing railroad would have to be torn up, heavier rails laid down, and the conduit for the accommodation of the current cable and collecting shoe installed, while special vehicles would have to be constructed.

Instead it is resolved to allow the existing rails to remain and to supersede the present horse-drawn vehicles by cars equipped with oil or gasoline motors. By this decision the expense will be simply confined to the purchase of the motor vehicles, which will cost approximately from $4,000 to $5,000 each. No expensive generating plant, stations, and transformers or cable will have to be laid down, such as would be the case were electricity adopted.

The electric conversion of street railroads in London especially is being brought to a stop owing to the rapid strides of the motor-propelled vehicle. The majority of engineers interested in the project are realizing the fact that as electricity has superseded steam so the internal combustion motor system of propulsion is rivaling electric motive power, and there is no doubt that within a very short time the motor vehicle for all-round street service will largely replace the electric trolley car.

While the gasoline omnibus may prove to be even more economical than the electric trolley car, there is little doubt that a large number of these machines running in the city streets would greatly vitiate the atmosphere, owing to incomplete combustion and the burning of lubricating oil. That this will eventually become a problem with private automobiles may be appreciated by any one who sees a high-powered machine emitting clouds of smoke as it moves through the streets. Therefore it would seem as though the New York Transportation Company was taking the right course in adopting electricity as the motive power of the new thirty-passenger 'buses it expects to be operating soon on Fifth Avenue. In this city most of the commercial vehicles are electric, even to the heaviest trucks; and in the present state of the storage battery, these are operated at a saving over horse-drawn trucks. Therefore the new electric autobuses will doubtless prove profitable, besides giving New Yorkers clean. cheap, and rapid transit on one of the principal avenues in which the transportation facilities have always been wofully poor.

AN ANTITOXIN FOR LAZINESS.

BY HUGO ERICHSEN.

If the conclusions drawn from experiments detailed in a recent issue of the Muenchener Medicinische Wochenschrift (No. 48, vol. 51) are substantiated, fatigue and exhaustion will be a thing of the past. To banish sleepiness, it will only be necessary to drink an antitoxin (a substance that renders a toxin or poison inactive), which will invigorate you, no matter how jaded you may be. Henceforth such a thing as a somnolent policeman will be unknown on the force, and the speed of the messenger boys will only be comparable to that of the winged Mercury himself. Women who are fond of talking will be able to enjoy their gossiping proclivity to the full, and renew the flagging interest of their victims with an occasional hypodermic injection of the new stimulant. Factory and office employes will lead a strenuous life indeed when the vigilant inspector makes the rounds with a syringe full of the new serum, so called after one of the fluid constituents of the blood from which it is derived. Indeed, when one comes to think of it, the application of this marvelous discovery would be almost illimitable. Race horses, sustained by the antitoxin, would be sure to win, armies enabled to endure forced marches in order to snatch victory from the jaws of defeat, and worshipers prevented from falling asleep in church during a dry sermon and suffering the consequent disgrace. Possibly at some time in the remote future, it will become customary to politely offer a fellow mortal a dose of antitoxin, whenever he yawns or exhibits any other sign of weariness, much as a pinch of snuff was proffered, as a matter of course, in centuries past.

But, seriously, if we believe the eminent authority mentioned, Dr. Wolfgang Weichardt, of Berlin, has made a very important contribution to the science of physiology, a discovery that is destined not only to be of service to acrobats but in the treatment of neurasthenia, better known as nervous exhaustion, and the convalescence from acute diseases. Briefly, his experiments may be described as follows: A guinea-pig was drawn backward, on a rough carpet, by means of a string, until it no longer resisted interference with its motion and was totally exhausted. Stimulation was continued, by means of electricity, until the animal was in a state of autointoxication, that is to say, a condition of infection from the toxin or poison generated by itself. During the experiment, the temperature of the guinea-pig fell from 39.2 to 34.8 deg. Celsius. When exhaustion could be carried no further, the animal was killed. Immediately after death, the toxin (or poison) was obtained from the crushed muscles of the animal. When dried in a space exhausted of air, the toxin was found to consist of yellowish-brown scales, that were not very stable and had to be kept in sealed glass tubes, preferably in liquid air. This toxin or poison, injected into other guinea-pigs, produced symptoms of exhaustion followed by death within twenty-four hours. The same poison could not be obtained from the muscles of non-exhausted animals.

Weichardt's antitoxin is produced very much like that of diphtheria, by injecting the toxin into the circulation of horses. When dried in a vacuum, the resulting scales—unlike those of the toxin—are permanent; in fact, the substance retains its activity even after months. It is readily taken up by the stomach, but generally injected under the skin by means of a hypodermic syringe. It was determined that ten milligrammes of the toxin are neutralized (or rendered inactive) by one-tenth of a milligramme of the antitoxin. Small animals, into which the toxin was injected, remained in a perfectly normal condition when treated with the antitoxin, but succumbed to the poison when the antitoxin was not administered. After taking four doses of a quarter of a gramme of the antitoxin, in pastilles, a young lady was able to lift two kilogrammes 2,478 meters with the middle finger of her right hand, whereas she had only been able to lift the same weight 1,533 meters alone. The ingestion of the antitoxin did not produce any disturbance whatsoever; on the contrary, it was followed by increased vigor and energy. Dr. Weichardt's findings are based upon a large number of experiments.

TURBINES VS. RECIPROCATING ENGINES IN MARINE SERVICE.

BY OUR ENGLISH CORRESPONDENT.

Although the Parsons marine steam turbine is being extensively adopted in Great Britain for the propulsion of vessels, yet for the most part this application has been based upon the theoretical advantages of this system over the ordinary reciprocating engines. Now, however, actual comparative results of the two methods of propulsion are available, since statistics and data have been gathered during the day-by-day commercial use of the marine turbine in competition with the older form. These results abundantly justify the confidence entertained by the inventor in this system.

In June, 1901, the first turbine-propelled vessel intended for commercial traffic made her trial trips. This was the vessel "King Edward," which was built for the service between Greenock and Campbelltown on the River Clyde, and was maintained in service by the syndicate especially formed to prove the efficiency of the Parsons turbine for such work. This syndicate comprises the Parsons Marine Steam Turbine Company, of Wallsend-on-Tyne, Messrs. W. Denny & Sons, the well-known shipbuilders of Dumbarton, and Capt. John Williamson, to whom we are indebted for much of the information contained in this article. The "King Edward" was duly described, together with the results of the trial trips, in the Scientific American at the time. In general design the "King Edward" is similar to the existing vessels engaged in this class of traffic, being 250 feet in length by 30 feet beam, and depth to promenade deck of 17 feet 9 inches. The vessel is equipped with three sets of Parsons turbines—two low-pressure and one high-pressure—capable of developing a speed of 20 knots per hour. So satisfactory were the results with this vessel, that another ship of somewhat larger dimensions—"Queen Alexandra"—was built for the same service.

These two vessels have now been running for four and three seasons respectively. Recently the turbines of each vessel were opened, and no perceptible wear and tear on the machinery was found. The turbines were as bright and as clean as the day when they left the builders' shops. There is so little oil used in connection with the turbines that the boilers are kept thoroughly clean, and consequently this adds considerably to their life. The total amount of oil used per month is the low average of about one gallon. Of course, oil is employed for the auxiliary engines, but this factor is not considered in the present calculations.

In some quarters it is maintained that owing to the high speed at which the turbines revolve, the repair bill must be unduly heavy. But this contention is not supported by actual work. So far as the "King Edward" is concerned, the extent of repairs is so trifling as not to be worth consideration, being confined to the refilling of the bushes once or twice.

It is also urged against the turbine that there is an abnormally heavy consumption of coal involved in maintaining the high speed developed as compared with the amount required to develop the maximum power with a reciprocating engine. On this point there is a great diversity of opinion, but Capt. Williamson, who superintended the operation of these two turbine vessels, has prepared some interesting tables on this point, which are rendered additionally valuable since he is able to offer comparative data concerning this problem. The vessel which he has utilized for comparative purposes is a vessel in every respect similar to the "King Edward." The dimensions and tonnage are identical; the boat is quite modern, and is fitted with the most up-to-date type of reciprocating engines. The vessel furthermore is employed in similar traffic to that in which the turbine vessels are engaged. These comparisons are as follows:

	Turbine steamer.	Steamer with reciprocating engines.	Turbine steamer.	Steamer with reciprocating engines.
	1901.	1901.	1902.	1902.
Speed on trial trip	20½ knots	18 knots.	20½ knots.	18 knots.
Mileage	12,116	15 604	15,605	14,850
Coal consumption	1,429 tons.	1,758 tons.	1,897 tons.	1,744 tons.
Days sailing	79	111	110	105
Mileage per ton	8.47	8 87	8.37	8.51
Average coal pe day	18.2 tons.	15.17 tons.	17.5 tons.	16.6 tons.
Working average per hour	18½ knots.	16 knots.	18½ knots.	16 knots.

From this it will be observed that there is very little difference between the mileage per ton of the two types of vessels. But at the same time, the fact must not be overlooked that the difference in speed is 2½ knots per hour in favor of the turbine boat, which represents a considerable increase. Further comparison on this point is afforded by comparison with another river steamer of a similar type and driven at the same average speed, fitted with reciprocating engines. The results are as follows:

	Steamer with reciprocating engines.	Turbine steamer.
Distance steamed	12,106 knots.	12,116 knots.
Days sailing	80	79
Daily average speed	18½ knots.	18½ knots.
Coal consumption	1,909 tons.	1,429 tons.

The efficiency and economy of the turbine vessel are even more decisive in this case. Not only did it cover a greater distance, by 10 knots, than that recorded by the other vessel, but the coal consumption, even including the slightly increased mileage, shows a balance of 480 tons in its favor. It may be pointed out that the above service speed of the "King Edward" represents about two-thirds of full power on trial. For the past two seasons the economy of the two turbine vessels is equally well marked, though in the case of the "Queen Alexandra," which is of greater dimensions and speed than her consort, the results show an even better record.

An exception may be taken to the comparison of the above-mentioned steamer fitted with the ordinary reciprocating machinery; it may be explained that she is fitted with compound engines. The builders state, however, that if she were equipped with triple-expansion engines, the coal consumption could be reduced; but even under these advantageous conditions, to maintain an average speed of 18½ knots per hour would involve a coal consumption of 22 tons per day, which is four tons in excess of that required by the turbine steamer to maintain the same average speed, corresponding to an economy of 20 per cent in favor of the turbine steamer.

In connection with the foregoing results, however, there is one prominent fact that must not be overlooked. To obtain the maximum efficiency and economy of the turbines, they must be driven at full pressure. The maximum speed of these Clyde vessels is 20½ knots, while in the above comparison their speed is only 18½ knots. At the latter speed, therefore, they are less economical than they otherwise would be. With these particular vessels, however, this difference is not so very marked. The deficiency in economy when running at a lower speed than that for which they are designed is more emphasized in the case of war vessels, where for the greater part of the time a cruising speed only is required. In strictly commercial vessels, the opposite is invariably the practice—full speed, that is, running at the designed power of the turbines, with a minimum of reduced speed. In the aggregate, therefore, the loss in economy is very slight. In the case of the "King Edward," practice has demonstrated that it is necessary to reduce the speed of the vessel to between 17 and 18 knots before ordinary engines under similar conditions and at the same speed show a less fuel consumption per knot of speed. This 17 or 18 knots speed corresponds to about 50 per cent of the total maximum power of the turbine engines of the "King Edward." Up to the highest speed at which this vessel has been driven, an always increasingly favorable consumption of coal in proportion to the speed of the vessel has been found.

One noticeable feature in connection with these two turbine vessels is the regularity of their running. In no instance has the daily service of either craft been interrupted. No breakdowns have ever occurred, nor has there ever been the slightest hitch. In fact, it has been possible to maintain a better daily service on the River Clyde than has hitherto been possible.