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.

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

MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, MAY 9, 1903.

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.

FILTRATION PLANTS AND TYPHOID FEVER.

Once more the vital question of the filtration of city water supply as a preventive of typhoid fever has been brought forcibly to public attention by the ravages of typhoid epidemics in widely-separated districts. The most serious of these outbreaks, and the most pitiful in its results, is that which occurred recently at Ithaca, where the dreaded disease cut a wide swath among the students of Cornell University. The experience gained by those cities in America which within the past few years have installed filtration plants through which the whole of the city's drinking water is passed before it is turned into the city mains, has given the strongest kind of proof that the reports of the wonderful efficacy of such plants, which have reached us from time to time from European cities that have already made the experiment, are not in the least exaggerated. Prof. Siebert of this city, a leading authority upon the subject on both sides of the Atlantic, in a recent work upon the relation of typhoid to water filtration, gives statistics to prove that for the decade previous to the installation of filtration plants in certain of the larger European cities, the death rate from typhoid epidemics reached the high percentage of one in every 2,600 inhabitants; whereas in the six years immediately succeeding the use of filtered water in these cities, the death rate fell to 1 in every 11,000 inhabitants. The SCIENTIFIC AMERICAN always has been a most earnest advocate of the filtration system, and from time to time we have illustrated various plants that have been installed in American cities, notably those at Albany and Philadelphia. Although it is not claimed that filtration gives absolute immunity, this only being possible where the water is boiled, this dread disease can be so far controlled by this means that the possibility of an epidemic in a city so protected is extremely remote.

HIGH SPEED ON AMERICAN RAILROADS.

Although it cannot be disputed that the French railways hold the first place in respect of the number and speed of fast expresses that run over their principal lines—a distinction held up to a few years ago by Great Britain—there are some roads in this country which are running trains, that on certain stretches accomplish speeds that are equal to anything that is made on European roads. The most notable trains are those which are run from Camden to Atlantic City, where a train recently covered a distance of 59 miles in 44 minutes, which is a rate of 80½ miles per hour. These Atlantic City trains fully deserve all the credit for fast running which is given them, although it must be borne in mind that the conditions are particularly favorable to high speed, the line being straight and level, the engines of great power, and the trains, considering the weight of the engines, comparatively light. There is another service of fast express trains in this country which scarcely receives the credit that is due to it. We refer to the remarkable hourly service over the Reading route between Jersey City and Philadelphia, in which seven trains are started on the hour from each city, and make the run of 90½ miles in a couple of hours, many of the trains having to make several station stops in entering and leaving each city, when called upon to do so by signal. In a recent run from Philadelphia, in which six intermediate stops were made, we timed the mile posts by stop-watch, and found that several of the miles were run in from 45 to 48 seconds, the timing being taken at every post between mile posts 53 and 32. The average for this distance was 72 miles per hour, while the distance from mile post 46 to mile post 35 was run at the rate of a fraction over 76 miles per hour. Our readers may also remember the trip taken by the editor of this journal on the Twentieth Century Limited, when a 352-ton train was hauled from Albany to Spuyten Duyvil, 131.7 miles, in 131 minutes, one stretch of ten miles being run at the speed of exactly 75 miles an hour.

ACCELERATION TESTS ON THE GREAT EASTERN RAILWAY.

The powerful engine for suburban service on the Great Eastern Railway, England, which we illustrated in our issue of May 2, has undergone its trials successfully, and proved that it is capable of a rate of acceleration with a heavy suburban train that is altogether unprecedented for a steam locomotive. The engine was designed to start from rest with a suburban train of eighteen cars, fully loaded, weighing 350 American tons, and attain a speed of 30 miles per hour in 30 seconds, which is an acceleration of 1.46 feet per second. It will be remembered that the engine has only 3,010 square feet of heating surface for three 18½ x 24-inch high-pressure cylinders; and doubt was freely expressed as to whether this amount of heating surface would keep these cylinders supplied with steam in sufficient quantities for such a supreme effort. In the preliminary trials trouble was experienced with the priming of the boiler (a very natural result), but by modifying the steam supply to the cylinders, this trouble was remedied; and on a recent occasion, with a train of new cars weighing 377 American tons, and a new engine that had not worked down to its bearings, an acceleration of 1.40 feet per second was accomplished. It was, therefore, considered to be proved that the desired acceleration could be easily secured. The test was carried out by means of a series of evenly-spaced electrical contacts arranged alongside the rails, which were acted upon by a brush upon the engine, the time of contact being automatically registered in a cabin placed near the line. The results achieved are certainly very remarkable, and prove that the steam locomotive is certainly going to die hard before it is completely ousted by the electric motor from this class of service.

RAPID DEVELOPMENT OF THE STEAM TURBINE.

In the development of what might be called the epoch-marking inventions of the day, it is noticeable that there has been in almost every case a point at which the invention, having clearly demonstrated its commercial value, entered suddenly upon a period of rapid and widespread development. Evidently we have reached such a point in the history of the steam turbine. The story of the determination of the principles of operation of the steam turbine, and of the embodiment of those principles in a practical and commercially-useful machine, will be forever identified with the names of De Laval and Parsons, the first-named having proved the usefulness of the steam turbine for work that required a small, high-speed motor of moderate power, while Parsons met and satisfied the demand for a prime mover of lower speed and great power. Of late years other inventors have produced more or less successful machines of the turbine type, and chief among these are the Rateau turbine in Europe and the Curtis machine in this country.

Because of the wide variety of uses to which it may be put, and the unprecedented power of some of the larger machines that have been built and put into very successful operation, the Parsons turbine is the best-known machine to-day, both in this country and in Europe. It was already well established and had made its great reputation abroad, when the rights for the United States were secured by the Westinghouse Company, and with the powerful influence and prestige of this concern behind it, the Parsons turbine is having a remarkable growth both in this country and abroad. A case in point is the contract recently given to the British Westinghouse Company by the Metropolitan District Company of London, for four huge turbo-alternators. Each of these machines is designed for a normal capacity of 5,500 kilowatts, but will be capable of carrying an overload of 50 per cent, thereby giving for each unit a maximum output of 8,250 kilowatts, or say about 11,000 horse power. As proving how early in its career the steam turbine has shown its ability to compete in size of individual units with the largest reciprocating engines, we may mention that these engines will be not only the largest turbines ever made, but also the most powerful single-cylinder engines of any type whatever in the world. Indeed, very few multiple-cylinder engines in existence have greater maximum power. As showing the wonderful compactness of this type of engine, it may be noted that in spite of their enormous power, the Metropolitan turbines are only 29 feet in length by 14 feet in width and 12 feet in height, while the length over all of the turbine and alternator complete is only 51 feet, 9 inches.

If there is a drawback that can be urged against the steam turbine, speaking of it broadly, it is the extremely high speed which is necessary, if the best results in economy are to be secured. In the De Laval type the speed is so great that for almost every class of work to which it is put, some form of reducing gear is necessary; and the construction of a satisfactory gear for such work is rendered practical only by the comparatively small units in which the De Laval type is built. In the Parsons turbine, a more moderate speed of revolution is possible, but even here the speed is higher than is for many classes of work desirable; indeed, for marine propulsion the high speed of revolution has placed very arbitrary limits upon the type, size, and number of propellers that may be used. For this reason among others, great expectations are being placed upon the turbine that has been developed in this country, and is called by the name of its inventor, Mr. Curtis. This machine embodies some of the features both of the De Laval and the Parsons type. Like the former, the steam is fed to the moving blades by a series of steam nozzles, and like the Parsons type, the series of moving blades are arranged alternately with series of stationary blades, while it also embodies the compound and condensing features which have conduced so greatly to the success of the Parsons machine. An element that is greatly in its favor is the fact that the axis of the machine is arranged vertically, the turbine and its alternator, in turbo-electric plants, being arranged one above the other on a common vertical shaft. This results in considerable economy of engine foundation and floor space, and will prove to be a distinct feature in favor of this type in city power plants and in installations where floor space is limited and costly. Like the Parsons, the Curtis turbine has been taken in hand by a large electric manufacturing company in this country, the introduction and development of it being carried on by the General Electric Company at Schenectady. Already several large orders for this type are being executed.

The indications are that the steam turbine in its various forms will, before long, be in practically exclusive occupation of the electric lighting and electric power plant field. Regarding the range of its application in the merchant marine, it is less easy to prophesy. It seems to have proved its value as a motor for the propulsion of yachts, torpedo boats, and the smaller class of passenger steamships. Whether it will give equally good results in the slow freight steamer and the large, high-powered, fast-steaming Atlantic liner, and in big battleships and cruisers, has yet to be proved. The immediate obstacle to overcome is that of reversing, which at present can only be done under limited power; but outside of this difficulty, we are aware of no fact developed in the course of the extensive trials of the steam turbine in the propulsion of ships which indicates that it will not give as good, and probably better results, in the larger as it has in the smaller class of vessels.

NEW ELECTRICAL DISCOVERIES.

After maintaining that the numerous attempts made to show the existence of a back E. M. F. in electric arcs have all failed to give reliable results, W. Mitkiewicz, in a paper read before the Russian Physico-Chemical Society, goes on to examine more closely what happens immediately after breaking the circuit. In Blondel's experiments the current feeding the arc was broken periodically by means of a special rotating commutator. As the main circuit was broken, this commutator would immediately connect the circuit of a galvanometer with the electrodes of the arc, the time separating the breaking of the main circuit from the closing of the galvanometer circuit being about 1-600 second. As Blondel observed no back E. M. F. at all, the author tested the phenomena occurring during the interval of 1-600 second elapsing between the breaking of the circuit and the moment of observation, by investigating the curve of P. D. between the electrodes of an arc fed by an intermittent current of constant direction. This curve was found to be quite similar to that representing the E. M. F. at the terminals of a non-inductive resistance inserted in the circuit. As, however, no absolutely instantaneous break was obtained, the interval being about 0.0001 second, the author considers that his negative results afford no evidence of the non-existence of a back E. M. F. In accordance with Duddell's views, it is suggested that this force might be the difference of two thermic E. M. F.'s produced at the contacts of the incandescent gaseous medium with the ends of the electrodes, the higher E. M. F. corresponding to the hotter electrode. It is inferred that the slight difference of temperatures is compensated in an interval less than 0.0001 second, the E. M. F. of the thermo-element *carbon-gas-carbon* thus falling down to zero.

At a recent meeting of the German Physical Society, Mr. L. Zehnder read an interesting note on what may be termed "reversible luminous effects." A distinct image of an object placed in the way of cathode rays being produced on a photographic plate, let ordinary light be allowed to act on the latter; the points previously acted on by cathode rays will, after development, appear more brightly than the surrounding portions of the plate, which recalls the so-called solarization phenomena. Cathode rays will