

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, 50 cts. 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 Edition (Established 1885) 2.50
 Scientific American Export Edition (Established 1873) 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, corner Franklin Street, New York.

NEW YORK, SATURDAY, AUGUST 18, 1900.

ECONOMIES OF SUPERHEATED STEAM IN THE STEAM TURBINE.

The excellent results obtained with the best types of steam turbines are due in no small measure to the fact that they are not subjected to the cylinder condensation which is a fruitful source of loss in the ordinary reciprocating engine and the forms of rotary engines not of the turbine type. When the steam turbine is steadily at work the interior surfaces are at virtually constant temperature, and, for this reason, it might be supposed that the only gain which would result from the use of superheated steam would be that due to the increase of thermodynamic efficiency, corresponding to the wider range of temperature. It seems, however, that in the course of investigations carried out at Sibley College, it has been found that there is an actual gain of about 1 per cent for every 3° Fahrenheit of superheat, which is accompanied by an increase in the capacity of the turbine of about 100 per cent for 37° Fahrenheit of superheat. It is considered that the causes of each of these gains from superheating are identical, and are due to the removal of the friction which is present when saturated steam is passing through the turbine. In the latter case there is a retardation of the flow of the steam due to moisture in the form of drops and mist, the moisture clinging to the walls of the steam passages within the turbine. This explanation is corroborated by the fact that the gain, as far as the experiments have gone, is about proportional to the amount of superheating. Sibley College is to be congratulated on this the latest of many valuable truths which have been disclosed as the result of the careful investigations carried on under Prof. Thurston by this famous engineering school.

TOOL STEEL AT THE BETHLEHEM STEEL WORKS.

What is probably one of the most extensive tests of tool steel ever carried out has recently been made in the shops of the Bethlehem Steel Company. A special lathe was set aside for the purpose of experimenting with tool steel of different makes, with a view to the selection of a standard for use, and several picked men were set to work testing the relative merits, not only of the different tool steels then in the shop, but of all brands of established reputation. We are informed by the company that over 200 tons of steel forgings have been cut up into turnings on this lathe, and that over \$100,000 has been expended in labor and material alone in developing a new process for hardening tool steel. The results of the investigation are of a very surprising kind, as may be judged from the fact that the introduction of this process has enabled the company to speed up the main lines of shafting from 90 to one of 250 revolutions per minute. As the result of careful records, made from time to time of the average amount of metal cut per hour, per tool, throughout the shop, it was found that the cutting speed had risen from 8 feet 11 inches in October, 1898, to 25 feet 3 inches in January 15 of this year, a gain of 183 per cent; and that the pounds of metal removed per hour had risen from 31 in 1898 to 137 in 1900, a gain of 340 per cent.

The virtue of the new process lies in the fact that it gives to the steel the valuable property of retaining a high degree of hardness even when heated to a visible red heat, "it being possible with one of these tools to cut steel at a speed so great as to heat up the point of the tube to redness, and have it continue to cut for several minutes at this speed, leaving an unusually smooth finish on the work as well as cutting accurately as to size." We are informed that the effect of the new hardening process, which is applied after the tool has been dressed on the machine to shape, penetrates to the center of the steel, even in the case of tools used in the Bethlehem shops which are 4 inches square in section. While the standard brands of self-hardening steel are improved more or less by this treatment, it is preferred to use a steel of special composition in order to get the maximum results. We are free to confess that the facts as given above would be sufficiently startling to raise a doubt as to their accuracy, had they

come from any authority less qualified to speak on the subject than the company in whose shop the tests were made.

CHINESE ARTILLERY AND THE PRESENT CRISIS.

There would have been less astonishment expressed at the strength of the resistance developed by the Chinese troops if the public, and, indeed, in some cases the military authorities themselves, had borne in mind the fact that for over thirty years China has been making rifles and heavy cannon in her own arsenals and under the supervision of European officials. The Engineer, of London, has recently republished an article which was written in 1898 by a correspondent who had recently paid a visit to the Kian-Nan Arsenal, near Shanghai. These works have been under foreign control since 1870, and they employ 2,500 men. They are equipped for making magazine rifles, rapid-fire guns of small caliber, and heavy ordnance up to 12-inch bore. A number of fifty-ton 12-inch guns of the Armstrong pattern have been manufactured there during the past ten years. The correspondent states that all of the product, whether it was in the shape of rifles, machine guns, heavy ordnance or complicated gun carriages, had the appearance of being of excellent quality. "Annually for many years past large quantities of war material have been turned out here, and what becomes of it nobody knows. It is somehow absorbed, I am told, without the defenses of China appearing to be strengthened by the process." The allied forces know by bitter experience what has become of much of this Chinese-made war material, and there is no question that those thirty years of work in the Kian-Nan Arsenal will prove to be a most potent factor on the Chinese side in determining the course of the portentous events which are now transpiring in northern China. There is no question that the small-bore rifle and the machine gun are great levelers of the vaunted superiority of the so-called civilized over uncivilized races. Great Britain has found this to her cost in South Africa, and the allied forces are learning the same lesson in the valley of the Peiho.

A SUGGESTION AS TO STREET SIGNS.

The question of the size, style and position of street signs, particularly in the larger cities, touches very closely the daily life and comfort of the citizens; while to the visiting stranger the provision of conspicuous street signs is a positive necessity whether his stay in the city be for business or pleasure. We sincerely hope that there are no large cities in this country that are worse supplied in this respect than New York. During the Strong administration a serious, and, as far as it went, very successful attempt was made to supply New York city with suitable street signs, and many of the principal thoroughfares were equipped throughout with special sign-lamp posts containing the name of the street and the number of the nearest house or building. For reasons best known to the members thereof, the present government of the city has seen fit studiously to ignore this admirable provision, and the sign-lamp posts have been allowed to fall into disuse or decay, until probably one-half of them are now missing from the street corners. If the present city administration is anxious to obliterate these street signs, the least they can do is to offer some decent substitute in their place; and they surely would not have to seek far for a suitable sign. We notice in a recent issue of Municipal Engineering a letter from Mr. C. H. Topp, City Engineer of Victoria, B. C., stating that that city is making use of large letters, countersunk into the concrete walks within the stone curb, the name of the thoroughfare being inserted parallel with the street, and within a few feet of the corner. The device has obvious advantages, and if it were used in conjunction with elevated signs, it would afford all the direction that could be desired. Although sidewalk signs would scarcely be sufficient to meet the necessities of street-car travelers, they would form a very effective sign for pedestrians.

THE LEADING RAILWAY SYSTEMS OF THE UNITED STATES.

The process of absorption of smaller concerns by large corporations is fully as marked among the railroads as it is among the great manufacturing industries. The growth in mileage of the largest roads is truly phenomenal, and it will surprise our readers to learn that upon this continent there are three separate systems, each of which has a total mileage which is almost half as great as the total mileage of Great Britain. The largest aggregation controlled by any one company is that of the New York Central Railroad, which totals 10,410 miles; making a very close second is the Pennsylvania system with 10,392 square miles, while the great Canadian Pacific Overland route and connections total 10,018 miles. Another trans-continental line of almost equal size is the Southern Pacific, which owns and controls 9,362 miles. There are four companies controlling from 7,000 to 9,000 miles; seven companies controlling from 5,000 to 7,000 miles; three companies from 3,000 to 5,000 miles, and nine companies controlling from 2,000 to 3,000

miles of track, the total mileage controlled by twenty-eight companies being nearly 150,000 miles. Of the five great trans-continental companies, the Canadian Pacific and the Southern Pacific with over 10,000 and 9,000 miles respectively are by far the largest. The Atchison, Topeka and Santa Fe comes next with 7,880 miles, followed by the Union Pacific with 5,584, the Northern Pacific with 5,449, and the Great Northern with 5,201 miles of track.

THE ENTRANCE TO THE MISSISSIPPI RIVER.

It is a fact, perhaps not generally known, that one of the principal objects which led to the purchase of Louisiana in 1803, was to obtain control of the outlet to the great central basin of the Mississippi River with its 15,000 miles of navigable waterways. Commencing in 1837, the government of the United States made at different times more or less serious efforts to increase the depth of the channels at the delta mouths, which ranged from 8 to 15 feet. The results obtained, however, were not permanent. It was in May, 1875, that Congress awarded a contract for the deepening of the Southern Pass to the late Captain James B. Eads, for a sum of \$5,250,000, payments on which were to be made only as results were secured. In the face of natural difficulties and political opposition, which would have staggered a less resourceful and resolute man, Captain Eads verified the correctness of his theories by securing a channel 26 feet deep and of 100 feet surface width. This channel has been maintained and is still available for navigation; but the twenty-five years' contract having now expired by limitation, and the draught and size of vessels having greatly increased in the interim, the country is confronted with the problem of immediately providing additional channel facilities.

On June 7 of last year, the Board of Engineers reported a project for securing a channel of 35 feet depth and adequate width through the Southwestern Pass of the Mississippi River. The plan consisted of two parallel, straight jetties, placed 2,400 feet apart, which were to commence on the seaward slope of the bar and in about 30 feet of water, and to extend for about seven miles up the pass, the total estimated cost of this improvement being \$13,000,000, while the estimate for the extension of the jetties and for maintenance is equal to an interest of three per cent on \$13,000,000 more. The plan being purely a tentative one, a second board was appointed, which on January 11 of this year advised that the main reliance should be placed upon dredging, assisted by a bottle or coffin-shaped plan of jetties which would aid in maintaining the channel. These jetties were to be about three or four miles in length; were to extend out to the 20-foot depth of water on the outer slope of the bar; and their distance apart was to vary from 7,000 feet at their greatest diameter to about 3,000 feet at the seaward entrance. It is evident that a national work of improvement of this magnitude, costing, according to the first estimate, \$26,000,000 for construction and maintenance, should receive, as regards its engineering features, the fullest investigation before a pile is driven or a yard of sand removed.

The problem of maintaining a channel at the entrance to a river like the Mississippi, which brings down annually and deposits at its mouth enormous volumes of sand, has been the subject of a vast amount of study and careful experiment by engineers who, like Captain Eads, have made a specialty of this class of work; and the elements of the problem are fairly well understood by the public at large. As long as the effluent waters maintain a certain velocity, the silt is carried along in suspension; but as soon as the outflowing waters spread out at the river mouth, the current becomes slack and the silt is deposited, choking the channel and reducing its navigable depth. The contour of a natural channel, such as the Southwestern Pass of the Mississippi, shows a decreasing depth until a minimum is reached at the crest of the bar, which will usually be found extending approximately at right angles to the course of the channel, and parallel with the sea-coast. After passing the crest of the bar, the depths decrease somewhat rapidly to deep water. The object of parallel jetties is to confine the effluent water and cause it to flow with sufficient rapidity to keep the silt in suspension until it is carried past the mouths of the jetties and out to deep water beyond the bar. Unfortunately, a parallel jetty system fails in two particulars. In the first place, it merely pushes back the bar further seaward, necessitating the constant extension of the jetties to cut through the fresh bar thus formed; and, in the second place, it not infrequently occurs that an inner bar is formed within the jetties themselves.

We have recently received from Professor Haupt, whose work in connection with rivers and harbors is well known, a pamphlet in which he suggests an alternative scheme for the Mississippi River improvement which is well worthy of consideration; particularly as its principles are based upon the laws which govern the conformation of the natural bars and channel ways of rivers. The whole paper, which is accompanied with illustrations and diagrams, is published in the