

tion with foreign labor impossible. Let the workmen, then, submit their views to arbitration peacefully and with moderation; and if the employers meet them, as we think they will, in a spirit of forbearance and reason, we have no doubt but that a compromise will be effected, satisfactory and honorable to both parties.

#### THE EAST RIVER BRIDGE.

The third Annual Report of the New York Bridge Company has recently been published and contains much interesting information relative to the progress in the construction of the great suspension bridge between New York and Brooklyn.

The tower on the Brooklyn side has been carried up to an elevation of 100 feet above high water and within 20 feet of the roadway. During the winter months, the old boom derricks have been removed and a new set of hoisting machinery placed in position.

On the New York side, the past eight months have been entirely occupied in sinking the caisson for the New York tower, an operation rendered especially disagreeable from the fact that the site selected had been, for some years past, a dumping ground for garbage and refuse, so that the mud was filled with decayed animal and vegetable matter. The total weight of the caisson is 7,000 tons, and it is considered twice as strong as its counterpart on the Brooklyn side. At a depth of 18 feet and under a load of 53,000 tons, not the slightest weakness or deflection of the roof could be observed even when the main frames and edges below were entirely dug out and not resting on the ground. Outside of the masonry, a coffer dam has been carried up to a height of 25 feet. The chief benefit derived from this structure was that the masonry could be laid below the water level during most of the winter, and the work of sinking the caisson could therefore proceed without interruption. At present, the coffer dam has been designedly filled up with sand and formed of the timber dock extending to the tower masonry.

Twenty-five courses of stone (granite and lime stone) have been laid on top of the timber reaching to a height of 50 feet and amounting to 11,700 cubic yards of masonry. Sand was removed from the caisson by means of the air system, being discharged at a depth of 60 feet through a 3 1/2 inch pipe continuously, for half an hour at a time, at the rate of one yard in two minutes. This represents the labor of fourteen men standing in a circle around the pipe and shoveling as fast as their strength would permit. The material passes from the pipe with tremendous velocity, stones and gravel often being projected to a height of 400 feet. In order to deflect the sand at the top of the pipe at right angles, both wrought and cast iron elbows were used, but as it was found that these were rapidly cut through by the blast, solid blocks of granite were substituted.

The concrete for filling the chamber in the caisson is all mixed above and let down through the supply shafts ready for distribution below. No brick pillars were used as under the Brooklyn caisson, the bearings of the frames being so wide as to be equal to all contingencies when once uniformly packed under with concrete. The stones, earth and sand, left in the caisson during the sinking, were sufficient to fill one third of the space; and since the concrete is going in at the rate of 80 to 100 yards per day, it is probable that the chamber will be filled in the early part of this month. Final exit will be had by the water shafts.

The effects of the compressed air in the caisson, on the workmen, were not so serious as at first anticipated, but two cases of death resulting directly therefrom. As the pressure increased, the working hours below were gradually reduced from four to two per day. An ingenious mechanical telegraph devised by Colonel Paine was used for keeping up communication between the upper and lower portions of the work. For illuminating purposes, ordinary street gas was used, sixty burners giving all the light required. It was noticed that in the compressed atmosphere all the gas lights became sensitive flames, answering to the stroke of a hammer on a piece of iron or even to the tones of the voice.

Chief Engineer Roebing, in concluding his report, recommends the early acquisition of the ground required for at least one anchorage, so as to make a beginning this season and utilize the coming winter by putting in the foundation.

Having proceeded thus far, the bridge company now ask the New York Board of Apportionment for more funds, requesting the sum of \$300,000, being a 10 per cent instalment of the subscription of this city toward the expense of the structure. An inspection of the statement of receipts and expenditures in the report before us shows that the receipts of the company, from stock paid in, rent, sale of New York bonds, etc., amount to \$2,923,624.26, while the expenditures reach the sum of \$2,905,389.49, leaving a balance on hand of but \$18,234.77. Consequently, from the original sum subscribed, \$5,000,000—\$1,500,000 from New York, \$3,000,000 from Brooklyn, and the balance from private individuals of both cities—nearly \$3,000,000 have been expended, and yet the structure is but little more than barely commenced. At war prices, the estimates of Mr. John Roebing, who planned the bridge, did not exceed \$4,000,000 for the entire work.

A system of swindling and corruption has been proved to exist in the management of the affairs of the company which is simply disgraceful. The New York World, having made investigations into the matter, states the members of the New York and Brooklyn rings, who formed the majority of the private subscribers, have not paid in a cent of their subscriptions. The latter were shams, employed merely to hide the too palpable intention of defrauding the corporations of New York and Brooklyn. An individual by the name of William C. Kingsley, a corrupt and notorious member of

the Brooklyn ring, holds the position of general superintendent. This man has been authorized to receive five per cent on the expenditures incurred in the work, so that for his proportion of the spoils he has secured \$125,000 on disbursements of something over \$2,000,000. Chief Engineer Roebing is the actual superintendent, and fulfils the requirements of the position; while Kingsley's duties seem to consist in selling material from his own mills to the company at an enormous profit, and then pocketing, in addition, five per cent of the expenditures therefor. So far from the cost of the entire structure being but four or five millions, it is evident that, unless some measures be taken to rid the company of such vampires as the Brooklyn ring, forty millions will not cover the amounts that will be squandered and stolen. The whole course of the management is an outrage upon the tax payers of both cities, and we trust that no further funds will be allowed until reforms are instituted.

We pointed out, when the question of a suspension bridge across the East River was first agitated, that the expense of such a structure in the location selected would be much greater than the estimates published. If such a means of crossing were absolutely necessary, it might as well have been thrown over near Blackwell's Island, where the stream is much narrower. In our opinion, bridges are not the most suitable means of transit that can be devised.

Tunnels can be bored under the bed of the river with the utmost facility. The present bridge will at a low estimate, even if honestly managed, cost at least twenty million dollars and will require several more years to be brought to completion. On the other hand, the same company that are making the excavations at Hell Gate, we are informed, offer to construct a tunnel under the river for one million dollars, and we have no doubt but that the work could easily be performed, with the aid of the greatly improved machinery now in use, within a year's time. In fact, for the amount which will be expended on this single bridge, at least six tunnels can be opened between different points of the two cities, thus affording much more extensive, effective and less costly means of intercommunication.

[Special Correspondence of the Scientific American.]

#### LETTER FROM PROFESSOR R. H. THURSTON.

PITTSBURGH, Pa., June 25th, 1872,

*A visit to the iron and steel works at Trenton, N. J. Cutting iron beams with toothless saws. The Siemens furnace and the Martin steel. The eight hour strike. Iron ship building in Pennsylvania.*

A professional tour of observation among the great iron and the most interesting mining regions of the country can hardly be made as comfortably, at this season, as a trip to the seashore; but, when engagements forbid attempting such an excursion in May or October, it may be still found quite profitable enough to justify an engineer in taking the summer months for it.

Leaving New York on such an errand a few days since, we made our first stop at Trenton for the purpose of visiting the works of

#### THE NEW JERSEY IRON AND STEEL COMPANY, AND THE TRENTON IRON COMPANY.

The first named, unfortunately, were not in operation on that day, and we were compelled to satisfy ourselves with an inspection of cold furnaces and of rolls at rest.

Between 600 and 700 men are usually employed at these works, in the production of 2,000 tons of iron and steel annually, of a quality that has made their proprietors deservedly celebrated. Many large iron beams and "channel bars" are rolled here, some of the former being fifteen inches in depth. We had the pleasure of witnessing the interesting and somewhat singular operation of sawing some of these immense beams to length, while cold, with a saw made of soft steel and without teeth. The work was done rapidly and well, and the edge of the saw, when its work was done, was left so cool that the hand could be placed upon it without great inconvenience, although the showers of burning iron torn from the beam during the operation had led us to suppose that the saw itself would become highly heated. The saw, we were told, wears well and saves considerable expense by enabling the beams to be cut to length when cold.

At these works a Siemens gas furnace is used in the manufacture of "Martin Steel" on the open hearth. The process consists simply in the reduction of the proportion of carbon in selected brands of cast iron, by adding to it, when melted, the necessary quantity of wrought iron, and working in spiegeleisen, as in the other methods of steel making, to correct any defects arising from the presence of impurities. It is beautifully simple, and when carried on in the Siemens furnace, where the flame can be made oxidizing, deoxidizing, or neutral, and where the temperature can be kept perfectly under control, it possesses many advantages over older processes, where it is worked with carefully selected stock. As the steel need not be tapped off until it is of the desired quality, the product may be made uniformly right.

We noticed here that all the heavy tools about the mill were driven each by its own engine, making them all independent of the main engine and saving the expense of driving heavy shafting many hours to do a few minutes work. The Trenton Iron Company employ about 300 men, and produce the finest grades of iron wire in the market—hard and tough and wonderfully uniform in quality. Both of these firms have acquired this very great reputation by a constant and conscientious attention to quality of product even more than by their great enterprise.

A large number of men are employed in the iron works and the potteries of Trenton, but there seemed to be no indications of a desire to "strike." It is hardly probable, how-

ever, that it is because they have learned from that experience which has driven work from London within the past few years, and which has just seriously crippled many branches of trade in New York by driving business away to other parts of the country.

#### THE EIGHT HOUR STRIKE.

It is unfortunate that our people have yet to learn, by bitter experience probably, that if labor is worth fifty cents an hour, the great economical law which controls the relations of supply and demand will defeat the attempt of any combination of capital to get the hour of labor for less money, and that, if labor is worth but thirty cents an hour, no combination of labor and no amount of "striking" will secure more for it except by simultaneously raising the price of the necessaries of life in even higher ratio, thus leaving the working man worse off than before. They have, apparently, also still to learn that a reduction of working hours means a reduction of production and corresponding increase in price of all products of labor in full proportion. So long as these simplest laws of political economy are not taught in our common schools, it remains the duty of the press to teach conscientiously one of the most important lessons which our people have to learn, and to impress upon working men the fact that if capital receives more than its share of profit, a fair distribution can only be secured by the working men becoming capitalists, by combination and coöperation—the true object of "trades' unions," and the only way in which their members have been really and permanently benefitted.

#### IRON SHIPBUILDING IN PENNSYLVANIA.

From Trenton we went to Philadelphia, where we visited several very extensive ironworks, and where we were particularly interested in the iron shipbuilding yard of Messrs. W. Cramp & Son. This firm are building four large iron steamers for the American "Atlantic S. S. Company," and are employing upon them over 1,000 men.

These vessels are over 350 feet long, more than 40 feet wide, and, when laden ready for sea, will weigh about 5,000 tons. Their hulls will probably weigh 1,600 tons.

They will be driven by engines of 2,000 horse power, as measured by the usual engineer's standard, but the real power required to propel such vessels can be best imagined by those unfamiliar with such things when they are told that, to do the work of such steam engines as they do it, day after day and even week after week without stopping, would require a stud of nine thousand good draft horses, and such a number would make three "string teams," to work eight hours per day each, that would be more than four miles in length each, or if all driven together, would extend thirteen miles.

All of the materials entering into the construction of these vessels are American, and the iron of the hulls is of much better quality than that usually put into British built vessels. The workmanship is excellent. I have seen none better in the best shipyards of the Tyne or the Clyde. They have beautifully "fair" and graceful models.

#### COMPOUND STEAM ENGINES.

The engines are the most effective form of "compound" engine—the form which, it has been recently stated, could not be built in this country because, as alleged, our constructing engineers are unfamiliar with its construction (!)

I was kindly allowed to examine the drawings very minutely, and admire the neatness of their design, their excellent proportions, and the evident familiarity of their designer with the principles involved in this latest form of the marine steam engine.

It is singular that our builders are so slowly taking hold of this style of engine. They have seen it coming forward, steadily gaining ground, for many years past, as steam pressures have gradually risen; and in spite of occasional failures until within a few years, the introduction of surface condensation has removed the great obstacle to the use of high pressures, and has led the way to the adoption of the compound engine by the leading builders of the world.

The cause of our conservatism can hardly be a difficulty in finding engineers capable of designing such engines, for although it is true that it requires a more thorough acquaintance with principles and methods than the old engine, we still have many engineers who can produce quite as good designs as any found abroad.

Messrs. Cramp & Sons are among those who do not propose to be left behind in this matter. R. H. T.

#### DESIGN PATENTS TO FOREIGNERS.

Strenuous effort was made during the last session of Congress, by some of our large carpet manufacturers, to get the law allowing protection to foreigners for designs repealed.

The bill was not reached, therefore no action was taken before the adjournment; but we learn that it is contemplated, at the next session, to attach a repeal clause to other amendments of the Patent law which the Commissioner will recommend, and so cut all foreigners off from protecting their designs for carpet patterns and other fabrics. This will be a retrograde step, and Congress may as well go a step further and repeal all law for the protection of inventors from abroad.

But there is no knowing what these gigantic carpet corporations may not accomplish; therefore we advise all foreign manufacturers to avail themselves of the present law to protect their designs before the next meeting of Congress.

AMONG the best conductors of sound are iron and glass. Through them sound is transmitted at the rate of 17,500 feet, or over three miles, per second. But in air sound travels only 13 miles per-minute, or 1,142 feet per second.