IMPROVEMENTS AT THE HARLEM RIVER BRIDGE.

There are three railroad bridges across the Harlem River, the estuary connecting the water of Long Island Sound with the Hudson River. The principal one of these bridges, situated in the line of Fourth Avenue, is used by the New York Central, the Harlem, and the New Haven Railroads for their passenger traffic principally. An immense number of trains pass over it daily, so much so that it has become insufficient for its uses. It included always a center swinging draw. This draw was struck so often by passing boats that apprehensions were entertained as to its working perfectly. Accordingly, to preserve the integrity of the river navigation, and also of the railroad transit, an auxiliary draw was erected adjoining the swinging draw. This second one, from the designs of Mr. G. H. Thompson, of the New York Central road, was of the lifting type. In the upper cut, this draw is seen in position nearest the front of the picture, while immediately back of it is the old swinging draw. The floor of the new drawbridge was carried on the top of plate girders, which were free to swing up or down on horizontal pivot or hinge joints immediately adjoining the front of the tower. To open the draw, it was simply pulled upward, rising into a vertical position. To effect this operation, cable hoisting machinery was provided, and to give scope to its operation, the tower, shown in the cut, was erected.

The tower is an iron lattice work structure, 126 feet high, with a base 34 feet 6 inches wide and 48 feet 6 inches long. Its front pillars are vertical, and within them counter weights were provided to relieve the hoisting machinery of most of the strain of lifting the draw. It will be seen that in raising the bridge from a horizontal position, less and less power is required. Accordingly, the system was so arranged that as the bridge rose, counterweights were successively detached, thus compensating for the decreased moment of the structure. The bridge has now to be removed and replaced by another structure. Independent of the requirements of present traffic on the Harlem River, it is obvious that when the improvements now under way shall have been completed by the Federal government, it will become a waterway of considerable importance to the city. The bridge also is of increasing importance with regard to the railroad traffic, and the opening of its draw, even now, has had to be restricted, owing to the number of trains which have to pass it. A new bridge is to be built, elevated nearly 30 feet above the water, so that the majority of boats can go under it without the draw being opened. In accordance with the requirements of the Federal government, the new draw in the new bridge will have to give a minimum opening of 100 feet at right angles to the axis of the stream. As the bridge runs at an angle with this axis, the full opening of the draw will exceed 165 feet on each side of the center pier. The drawbridge truss which will swing in its center therefore will be about 400 feet long, and will carry four lines of tracks. The bridge will be the continuation of the elevation of the tracks in Fourth Avenue—a colossal work soon to be begun.

To enable the new bridge to be constructed, a temporary bridge is to be built at one side of it, which is shown in the upper cut. When this bridge is finished, trains will use it, and the old structure will be demolished and replaced by the elevated bridge just mentioned. The temporary bridge, however, must have a draw, and the Federal engineers exacted a minimum width, requiring trusses 106 feet long. The old trusses of the lifting draw spanned but a little more than 90 feet. To provide the new draw for the temporary bridge, it was determined first to move the tower bodily into position in line with the temporary bridge, and to use it to raise and lower the lattice girder draw, 106 feet in span. The line of travel of the tower having been decided on, rows of piles were driven; caps were placed on them, and on these 12 by 12 longitudinal timbers were placed. Rails were then spiked down on the timbers so as to form a horizontal sliding way. The tower was jacked up bodily 3 feet after being stripped of counter weights and other material so as to make it as light as possible. It is calculated that 100 tons weight were thus removed, of which 85 tons were represented by the counter weights alone. Even when this was done, the residual weight was in the neighborhood of 180 tons. When the tower was thus elevated, slideways in continuation of those laid on the outside were placed under it. The rails were lubricated with Dixon's plumbago lubricator and the tower was lowered upon them. A six-spool hoisting engine with falls of very large size, with great sheave blocks, being 18 inches in diameter, was arranged to draw the tower away from the bridge along the line of the slide. Some apprehension was felt as to the success of the operation, but it was found that the tower might be moved a distance of 8 feet without interfering with traffic, so it was decided that here, at least, was room for experiment. Accordingly, before the final operation, the tower was moved back and forth to distances of a few feet to test the practicability of the operation. When everything was ready, the final operation of moving, illustrated in the lower cut, was executed. It was done at night, in order to avoid interruption to traffic. At 12:30 A. M., the tracks were cut by the railroad company, and the way was cleared for the tower to be drawn out from its position. The foreman in charge of the work, as a signal code, arranged at one motion of his hand to indicate one revolution of the engine. When all was clear, the engine was started, first slowly, and then more rapidly, and in 21 minutes the great mass was moved 54 feet. The railroad company replaced the tracks, and by 3:30 A. M. all was ready for traffic once more. There was absolutely no interruption to traffic. The tower is to be moved along on its present course until the line of the new temporary bridge is reached, when it is to be moved forward in position. When installed here, the lattice girders will be put in position. As this will then be the only drawbridge, hoisting machinery of double the power of the original will be put in, so as to insure rapid operation.

The work of moving the tower was done by the firm of Coffrode & Saylor, of this city, who were its original constructors. All the operations were in charge of their foreman, Mr. Maylan, and the entire work was successful in every sense of the word.

On Smoke Prevention.

Professor William Ripper, of Sheffield, recently delivered, in connection with the Sheffield Technical School, a lecture on the important subject of "Smoke Prevention Appliances." At the outset, the professor said that although it might be impossible in some branches of manufacture without considerable difficulty to prevent smoke, it was now generally admitted that so far as steam boiler chimneys were concerned smoke may be almost entirely abolished. Notwithstanding between two and three thousand patents have been taken out for smoke prevention appliances, smoke is still with us, not because of lack of inventors or good inventions, but because it is cheaper and less troublesome to make smoke than to prevent it. If it had been shown to be cheaper to burn smoke, there would have been no need for acts of Parliament to prevent it. Smoke is the result of incomplete combustion. The conditions necessary for complete combustion are sufficient air, its intimate mixture with the gases to be burnt, and high temperature. A common oil lamp smokes, but when a chimney is fitted to it, it burns brighter and the smoke disappears. This is precisely the effect of a funnel or chimney on a boiler furnace; and the power of the furnace to effectively consume fuel depends upon the draught. Insufficient draught to burn the quantity of combustible gases proceeding from the fuel must result in smoke. High temperature —at least 1,000° F.—is necessary for ignition of the gases; the presence of a relatively cold water jacket round the furnace is not conducive to complete combustion.

The smoke trouble is largely due to want of appreciation of the importance of the boiler. No care or expense is considered too great to save 5 per cent with the engine, but while engineers were racking their brains to make a small saving with the engine they often lost sight of the fact that two or three times the economy might be obtained by turning their attention to the boiler. Every engineer who knows his business recognizes that the boiler is as important a machine as the engine, and requires just as much skill and intelligence to properly manage it. The phenomenal 1·3 pound of coal per indicated horse power per hour says a good deal for the boiler engineering on steamships, and where such results are obtained the shovel has probably more to do with it than the valve gear. A fireman's life—especially a marine fireman's—is certainly not a happy one, but it is none the less certain that the skill and intelligence with which he does his share of the work have a good deal to do with the efficiency and economy of the engineering department.

Professor Ripper mentioned the fact that the medical officer of health for Sheffield had told him that the cases of smoke nuisance are more often due to want of care than to want of appliances, and this, the professor said, he could confirm from personal observation. It has been said a good stoker is the best smoke burner, and (said the lecturer) there is much truth in this, though he did not like to press it, as it might be considered a reflection on the stokers of our smoky towns. Hand firing is still the common method of firing boilers, and where a boiler is not overpressed, a good stoker can fire so as to make very little smoke.

The most approved method of firing is to fire lightly and often, and on each side of the furnace alternately, so that the gases from the green coal on one side may be burnt by the bright fire on the other side. In addition the grid on the fire door might be open, and air admitted at the back of the bridge. Admitting air at the back of the bridge is a common method in some places, and it certainly consumes the smoke. But such an arrangement should be fitted with a door for regulating the supply of air, otherwise, although the smoke might be burnt, a large amount of heat might be wasted by the passing of cold air through the flues during the time there was no smoke to burn; and if the chimney temperature was say 500° F., then each pound of air not required for combustion was carrying with it about 105 units of heat to waste. In some devices for at least half the day cold air was going through to no purpose, and seriously affecting the efficiency of the boiler. Some boilers are fitted with automatic arrangements for opening the air supply to back of bridge or in fire door when it is opened, and with a regulator for allowing of the gradual closing of the air supply. These automatic fittings are an improvement, but they are not perfect, as they have to be set to suit the average needs of the furnace, in which case, after firing or raking, they are sometimes open too long and sometimes not long enough to burn all the smoke.

Now, the object of the air is to burn the fuel, and the best place to burn it is in the furnace, where it should pass either through or over the fuel. Air admitted at the bridge spoils the draught through the fire bars. The cold air takes the line of least resistance to the chimney, and will not go through the fuel if it can find a short cut through the bridge. Air through the fire door and steam jet air injectors cure smoke. A great advance upon our present methods would be the admission of hot air in the front of the furnace to pass over the fire, the air being first heated by the waste gases. This is now being done with much success by Messrs. John Brown & Co., Limited, with marine boilers and induced draught; and for stationary work there is certainly a future for hot air supply to the furnace.

As a natural result of the endeavor to increase the economy of the boiler as well as of the engine, many devices have been proposed to feed the furnace by mechanical means, and so obviate the necessity for the frequenting opening of the fire door and the consequent admission of large volumes of cold air. There have been many mechanical difficulties in the way of their introduction, but these difficulties are now largely overcome. The machine stoker has not yet been found practicable with marine engines, but for stationary work it is undoubtedly finding considerable favor. The advantages claimed for the mechanical stoker are: More water can be evaporated per pound of coal, the cheapest kinds of fuel can be used, more steam can be produced per hour, and there is little or no smoke when the stoker is not driven too hard. In some instances these stokers, where adopted, have been taken out again, and a return made to hand firing; but this fact should not condemn the mechanical stoker without further knowledge of the circumstances. Strong evidence can be brought to show that in many districts throughout the country these stokers are giving great satisfaction, and it may be taken for granted that where they receive as much ordinary care and attention as is needed by any other machine, and where they are not hard pressed, they will do good work—burn the smoke and soon pay for themselves.

If a manufacturer requires more steam, and it is a choice between having another boiler or a mechanical stoker to the existing boilers, he should choose the additional boiler. In some instances the manufacturers have chosen the stoker, overworked it, been disappointed at the results, and discarded it.

To sum up, Professor Ripper maintains that smoke can be prevented by care in firing, assisted by automatic devices for admitting air at the door and bridge. But such a method is not perfectly satisfactory in point of economy. A mechanical stoker, especially a stoker receiving ordinary attention, and not overpressed, will burn the smoke, consume cheaper fuel, and pay for itself.

Gum Arabic.

About a year ago it was noticed that the extensive falsification to which gum arabic was being subjected, owing to the disturbances in inner Africa, had made good gum rare and expensive. In consequence of this scarcity other substances are introduced from Australia, South America, etc., as substitutes for gum arabic, but none of them is equal to the genuine Soudan gum.

A. Jacksch, in a paper on this subject, states that inferior materials mixed with gum Gheziri are coming into Germany in large quantities, and being sold as "gum in granulo," and that many of the best firms have been deceived.

It is impossible to recognize this imposition by simply dissolving the substance, for the gelatinous particles, being very fine, are suspended in solution and remain invisible; but the adulteration can easily be detected as follows:

Some of the suspected sample is mixed with ten times its weight of hot water, and then allowed to stand for three or four hours, stirring the mixture occasionally. The insoluble matter will settle down, and then about half of the liquid should be poured off, and the same quantity of cold water added to make up the original bulk, which is then stirred and again set to stand, and this repeated twice.

A RED fir tree in Chehalis County, Wash., is 400 feet high, and nearly 54 feet in circumference six feet from the ground.