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NEW YORK, SATURDAY, NOVEMBER 21, 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.

GARBAGE DISPOSAL AND THE HARBOR CHANNELS.

The United States government is engaged in dredging a great 40-foot channel from deep water off Sandy Hook to the Narrows within New York Harbor. If a 40-foot contour line were drawn on the chart, it would be found to extend across the harbor mouth well inside of Sandy Hook lightship; and when the channel is completed, incoming vessels of the largest size will be able to sail from deep water to the Narrows without any of the tortuous and difficult navigation which at present is a source of more or less anxiety to incoming vessels, especially if they happen to be of the draft and length of our largest transatlantic liners. Unfortunately, the success of the scheme is menaced by the fact that the waters outside of Sandy Hook are used as a dumping ground for city refuse; and the enormous amount of refuse that is unloaded year by year from the city's scows would seem to be at last producing the disastrous results which have been feared by those who are interested in preserving unobstructed navigation into this harbor. A Sandy Hook pilot recently reported that in several places south-southwest and south-southeast from the lightship, and within a radius of three-fourths of a mile, the cast of the lead showed only 7½ fathoms where from 11½ to 16 fathoms are called for by the chart. Here is a matter that demands the immediate attention of the government. Seven and a half fathoms is within five feet of the depth to which the new channel is being dredged, and if this shoaling up is due to the dumping of city refuse it may be taken for granted that the formation of these shoals will be continuous. As matters now stand it looks as though we were undoing with one hand what we are doing with the other. In any case, the present method of garbage disposal is an extremely crude and provincial one for the metropolis of the western hemisphere. It is also distressingly "sloppy" and untidy. The neighboring shores of New Jersey give evidence of this, for they are adorned with a variegated fringe of domestic refuse and "cast-offs" that would do credit to the back alleys of a western mining camp.

THE WILLIAMSBURG BRIDGE FIASCO.

With the announcement by the Bridge Commissioner that the Williamsburg Bridge will be open for use by the first of December, the public is brought face to face with a fiasco which has been foreseen for many months by those who have watched the attitude of the trolley companies toward this great public work. It is a positive fact that when this great $20,000,000 thoroughfare is at last thrown open to the public, it will be practically useless, for want of transportation facilities to carry the people across it. It is a noble structure, its broad platform, one hundred and twenty feet wide, having provision for no less than six lines of railway; yet on the first of December, when it is officially declared open, there will not be a single elevated or trolley car ready to cross it, neither will there be a single yard of track laid upon it, nor the slightest prospect that any such tracks will be laid for many months to come.

The public of New York and Brooklyn, discouraged and disgusted with the crowded and indecent conditions of interborough travel across the river, have been longing for the opening of this bridge with an expectation begotten of very real and ever-present discomfort. For seven long years they have watched its growth, yet at the very hour when this great public work is at last pronounced at their service, it is found to be utterly useless as an immediate solution of transportation difficulties.

Thus do we add another chapter to the serial story of municipal mismanagement and civic discomfort.

The guilty parties in this matter are not far to seek. When the public is told that the administration solicited bids from the trolley companies for the privilege of using this $20,000,000 structure many months ago, and that no response whatever has been made, they will understand pretty clearly at whose door the responsibility for this fiasco is to be laid. If the press of the city is now openly charging that the trolley companies are holding back in the belief that the urgency of the situation will compel the administration to permit them to cross the bridge on their own terms, they have themselves to thank for the imputation. Whatever may have been the history of franchise-granting in the past, we cannot bring ourselves to believe that the transportation companies are so fatuous as to believe at this late day that they can lay hands upon enormously valuable franchises, such as the one in question, without rendering an adequate compensation to the city's treasury. A few months ago, when the SCIENTIFIC AMERICAN referred to the possibility of such a deadlock as that which now confronts us, reference was made to the fact that there was nothing to prevent the city from laying its own tracks across the bridge, and operating the line at the extremely low cost which was proved to be possible in the case of the Brooklyn Bridge. And if such tracks were laid, it would also be within the city's power to extend these tracks to a connection with its own Rapid Transit subways. Thereby it would rescue the Williamsburg Bridge from a tyranny which, if it is not contemplated, is at least very strongly suggested. There is not the slightest question that ultimately, as the Rapid Transit subway is extended, there will be a growing disposition to have the city construct, own, and operate its own system of transportation, and we believe that if the city government were to at once lay tracks across the bridge and connect them, as suggested, with the subway, it would merely anticipate a control which, as matters are now going, seems likely to be accomplished before many decades have passed. It is true that under the proposed arrangement double fares would be necessary in making the trip from New York to suburban Brooklyn or back; but judging from the present attitude of the trolley companies toward the bridge, the suburbanite will pay a double fare in any case.

IMPROVEMENTS IN TUNNEL-BORING PRACTICE IN LONDON FOR DEEP-LEVEL RAILROADS.

In view of the tunnel-boring operations that are now in progress through the bed of the Hudson River, and which we recently described in the SCIENTIFIC AMERICAN, a description of the methods employed in similar operations beneath the River Thames in England will be interesting.

There are at present several tunnels either completed or in course of construction beneath the River Thames, either for deep-level tube railroads or pedestrian communication between the opposite shores at the lower reaches of the river, where bridges cannot be constructed and a ferry system is not satisfactory. All of these tunnels have been bored upon the Greathead shield principle, with conspicuous success; but several precautionary measures have been adopted to insure to the men working in the borings absolute safety from the water pressure and other dangers, and several improvements, the results of previous experiences, have been effected in these boring operations and the erection of the tunnel.

There are two tunnels at present approaching completion beneath the bed of the river, one a footway tunnel connecting Greenwich on the southern shore with the Isle of Dogs on the northern bank, and a railroad tube forming a section of the Baker Street & Waterloo Tube Railroad.

The footway tunnel is 1,217 feet in length and is entered at either end from a shaft. In constructing this tunnel the contractors had to build it at such a level that it was possible to dredge a channel in the river 500 feet in width and 48 feet deep at high tide. This stipulation necessitated the tunnel shelving downward from either shaft to a point in the center of the waterway. This gradient is generally 1 in 15. The tunnel itself is of 12-feet 9-inch internal diameter, and is built up in the usual manner of cast-iron segments bolted together.

Boring was carried out from a caisson sunk on each bank. These caissons were composed of two skins of steel segments bolted together, the inner or smaller caisson having an internal diameter of 35 feet and the outer one an internal diameter of 43 feet. The 4 feet all-round space between the inner and outer walls was filled with Portland cement. The most distinctive feature of these caissons was the absence of any taper or batter on the outer wall. They were also provided with two airtight doors, one of a permanent nature, and the other only temporary, placed above the tunnel opening. These caissons were sunk into position by the aid of compressed air, and the work was satisfactorily accomplished without disturbing the surrounding ground.

The tunnel opening in each caisson, i. e., the entrance from the shaft to the tunnel below, was plugged up by steel plates between girders, preparatory to sinking. When the caisson was safely sunk this plug was removed. The latter was constructed in such a way that the steel plates of which it was constructed could be removed singly. As the plates were withdrawn a wooden diaphragm was constructed in their place 4 feet to the rear, and the space between this diaphragm and the face of the earth was filled with pugged clay.

The shield employed was of the "trap" or "box" type, and was 13 feet in external diameter. There were thirteen segments constituting the cutting edge, each segment being provided with two 6-inch teeth. Behind this cutting edge was a circular-built box girder. The method of boring was similar to that previously adopted for this class of work, and an average progress of 10 feet per day was maintained throughout the greater length of the tube.

In the bolting together of the plates with which the tunnel is lined, an improvement was adopted to insure better watertight joints. The bolt holes were provided with a bevel. The bolts were inserted with lead washers between the bolt heads and the holes. When the bolts were screwed home, the leaden washer was forced into the beveled space, thus completely filling and packing the joint tightly, and rendering it impossible for water to leak through. Also soft lead wire was hammered between the joints of each space, which was then calked.

Special precautions were adopted to insure the men working at the face of the shield being provided with pure atmosphere. The vitiated air was drawn off and pure, fresh air substituted. Experiments were also carried out to remove all traces of carbonic acid gas from the fresh air supply by cleansing it, previous to inhalation, with caustic soda. This cleansing apparatus comprised a number of rectangular wooden tubes superimposed, left open at one end and fitted with a sliding door at the other. The ends with the doors were connected with the air inlet of the tunnel through a conical box. In each tube were placed eight wire boxes filled with broken pumice stone which had been immersed in a caustic soda solution. These boxes were movable and could be withdrawn from the wooden tubes, which were also fitted with movable sides to enable the pumice stone to be removed, cleansed, and resaturated from time to time. The experiment was attended with success, for the percentage of carbonic acid gas in the pure atmosphere supplied to the workmen at the shield face was very appreciably reduced.

The boring of the tunnel beneath the Thames in conjunction with the Baker Street & Waterloo Railroad proved more difficult. Throughout the land sections of the track London clay had been encountered, but when the Thames bed was reached at the point of crossing, the clay stratum dipped abruptly, and the depression thus caused was filled with clean gravel and sand, and this was very water-bearing and treacherous. This necessitated boring under compressed air. There are two tunnels, for the down and up traffic respectively. They lie parallel and on the same level for a short distance after leaving the northern bank, but then there is a falling gradient of 1 in 107 in the case of the former, and an incline of 1 in 111 in the latter, toward the southern shore.

In this instance boring and construction was carried out from a temporary pile staging 370 feet in length by 50 feet wide, erected in the river 150 feet from the northern bank. From this staging two vertical shafts were sunk, each of 16 feet diameter, to the requisite level. The excavated earth, as it was removed from the boring, was conveyed to the top of these shafts and discharged straightway into lighters moored alongside, and subsequently transported down the river to be used for reclamation purposes.

Owing to the treacherous nature of the soil to be excavated, a hood was fitted in front of the tunneling shield to afford protection to the excavators while engaged at their task. There was also a fountain trap behind them which constituted an air seal against a horizontal water surface should the flooding of the tunnel appear imminent, through a sudden rush of water. There was furthermore a top screen forward of this trap. The latter was always close behind the miners, and it provided an easy and ready means of escape to the men in case of a water rush. This safety provision was found of great value and eminently successful for this purpose. The shield was divided into two complete halves in front of the fountain trap by a vertical girder. This enabled only a small part of the face of the soil to be excavated in either half should any accident befall the face planking. Another prominent feature of the shield, which was rendered imperative under the peculiar prevailing conditions, was a steel cylinder stiffened by a circular box girder behind the hood. At the rear of this cylinder was a strong ring of cast iron carrying fourteen hydraulic rams. The cylinder was continued for a considerable distance to the rear of these rams, and in the after section the tunnel rings were erected as the shield was moved forward.

When the tunneling beneath the river bed was first