THE MAIN INTERSECTING SEWER OF THE CITY OF BROOKLYN, N. Y.

The city of Brooklyn is on the verge of completing an intersecting sewer of large dimensions for the purpose of relieving what is known as the flooded district of Brooklyn from the effects of heavy rainfalls. The drainage district whence the water is derived comprises about 1,300 acres. During storms the first rush of water as it reaches the low districts and finds the mouth of the sewers perhaps closed by tidal water, backs up, throws off the manhole covers in the lower streets and floods both streets and houses. To do away with this trouble, the present structure, known as the main relief sewer, has been built. It is carried across the drainage area, intercepting about two-thirds of the surface water falling on the district. Its course runs through Greene Avenue, Fourth Avenue and Butler Street, and meets the head of the Gowanus canal. The regular street sewers are to be connected to it in such a way as to deliver storm water only to it. In this way the surface water during heavy rains from two-thirds of the area will be effectually provided for; and from their points of intersection with the relief sewer, only the normal amount of drainage will pass on toward the regular outlets.

The principal portion of the sewer is circular in section, starting with a diameter of 10 feet and 12 inch wall, and enlarging successively to a diameter of 12, 14, and 15 feet with 16 inch walls, except where in some places a 28 inch side wall has been introduced. Of this circular portion, there are 11,400 lineal feet, of which over 9,000 feet were laid by tunneling, and as shown in our sectional drawing, part of it is far under ground. At its end however it is near the surface, and there the section changes to an approximate rectangle, whose bottom is an invert arch of long radius, and which is covered by regular I beam and brick arch construction. At its end it delivers into a silt basin, and through twenty pipes of 36 inch diameter each into the canal. The silt basin is trapped, although such would seem hardly necessary, as the pipes are 8 feet under the tide level. The basin is 60 feet long and 84 feet wide. Its bottom is about 8 feet below the bottom of the sewer, and the pipe outlets are on the level of its bottom. Arrangements are provided for the use of screens, if desired, for separating solid material, and unquestionably if silt finds its way there, a large portion of it will be deposited by subsidence.

Our drawings refer more particularly to the tunnel portion of the structure, which was built by the use of the pilot tube under the well known Anderson method of construction, formerly employed on the Hudson River tunnel. The pilot tube of sheet iron, circular in section, and 5 feet 6 inches in diameter, and occupying the center of the tunnel area, was kept about 30 feet in advance of the completed excavation. From its exterior radical braces were employed to support the shell plates and wooden lagging.

The large tunnel was cut as nearly as possible to the true size desired, and for most of the sections two-inch plank were laid on the bottom of the circle, determining the extrados of a portion of the invert. On the bottom curves thus described the brick were laid; next ribs of T iron, bent to a radius slightly less than that of the brickwork, were set up and supported by radial braces from the pilot tube, while over the top of the arch and against the earth a curved shell plating or shield of iron, which covered from one-third to one-half the extrados of the upper arch, was placed and bolted together and was held in position by other radial braces from the pilot tube. The sections of the shell plating were twelve inches long in the direction of the axis of the tunnel.

Narrow lagging boards were laid upon the iron ribs and were carried up at one time far enough to allow the mason to conveniently lay brick behind them. When he had reached their top, more boards were put in place and more brick laid. In this way the brick tube was completed until a space of but two feet was left to be filled in by the key bricks. To support the brick in this place, short boards two feet long, passing between the last lagging boards, which were rabbeted to receive them, fitted like the sliding lid of a box. They were inserted by the mason, who, after putting one of them in place, laid in the key bricks to cover it, closing that much of the arch. He then would slide in a second board, lay the key brick corresponding to it, and thus would work, board by board, toward the face of the sewer. The iron plates were left in position; the false work of course was removed as the work progressed.

One of the interesting features of this work, which facilitated the rapid construction of the tunnel and at the same time protected the workmen against the caving in of the earth at the heading, was the use of the Beach system of tunneling needles, which is clearly illustrated in one of our engravings. This system was patented June 8, 1869, No. 91,071, by Alfred E. Beach, of the SCIENTIFIC AMERICAN, New York. It consists of a series of iron sheet bars or needles arranged to slide in juxtaposition upon the exterior of the front end of the constructed tunnel; each needle is moved forward independently from within the tunnel. The front end of each needle has a cutttng edge. In operation the needles are driven forward separately into the earth, which forms a support for their front ends, while their rear ends are supported on the exterior of the completed tunnel, thus forming a temporary protecting roof or shield, which permits the safe removal of a sufficient width of the earth of the heading to allow the insertion of a new section of the iron plates that compose the outer wall of the tunnel. This system, substantially, was successfully used the year before last (1890) in boring the large 25 foot tunnel, 1,560 feet long, for the new double-track railway line at King's Cross Station, London.

Our illustrations show also various interesting features of the work, the section of ground under which the tunnel passes, and its course near a church on the corner of Greene and Clermont Avenue, illustrating vividly the depth of the sewer and what the engineer has accomplished.

The connections with the existing sewers which lie far above its level is to be thus managed. Manholes are carried up from it to the street level. Sweeping side connections are made from these manholes to the sewers. Where the connection is made a flagstone is to be laid diagonally across the sewer on the lower side of the connection, so as to be approximately a tangent to the side connection. The bottom of this flagstone will be, as nearly as possible, at the level of the ordinary surface of water maintained by the sewer in actual service. On the occasion of a rain storm, any water rising above this level will be deflected into the side outlet and thence to the manholes of the intersecting sewer. This will give it a fall in some places of many feet, as will be evident by inspection of the sectional drawing of the course of the tunnel. Stone paving is accordingly placed over the invert beneath the receiving manholes, to prevent the fall of water from wearing away the bottom.

The work was in charge of Mr. L. Russell Clapp and Mr. David Brower, Assistant City Engineers, under charge of Mr. Robert Van Buren, City Engineer. The main tunnel was built by the firm of Hart, Anderson & Barr. The terminal portions of the sewer were built by Daniel J. Creem. As yet the existing sewers are not connected to it, but before long the entire work will be completed and ready for the spring and summer storms of the present year.

As regards the size of the sewer, it is believed to be the third largest of the working sewers of the world. The city of Washington has a sewer 20 feet in diameter, and the great sewer of the city of Paris is 18 feet high and 17 feet wide; the present structure forms a good third to these. The Cloaca Maxima, built by the Romans, contains three arches and occupies a total cross area of 30 by 15 feet.

Enlistment of Boys in the U. S. Naval Service.

The Secretary of the Navy has recently issued the following information:

Boys between the ages of fourteen and seventeen years may, with the consent of their parents or guardians, be enlisted to serve in the navy until they shall arrive at the age of twenty-one years.

No minor under the age of fourteen years, no insane or intoxicated person, and no deserter from the naval or military service of the United States can be enlisted.

Boys enlisted for the navel service must be of robust frame, intelligent, of perfectly sound and healthy constitution, free from any physical defects or malformation, and not subject to fits.

Their height and measure must be as follows:

Age.	Height not less than—	Weight not less than—	Chest measurement, breathing naturally, not less than—
Fourteen years.....	4 ft. 9 in.	70 pounds.	26 inches.
Fifteen years.....	4 " 11 "	80 "	27 "
Sixteen years.....	5 " 1 "	90 "	28 "

They must be able to read and write.

In special cases, where the boy shows a general intelligence and is otherwise qualified, he may be enlisted, notwithstanding his reading and writing are imperfect.

Each boy presenting himself for enlistment must be accompanied by his father, or by his mother in case the father be deceased, or by his legally appointed guardian in case he has neither father nor mother living, and the parent or guardian presenting the boy must sign the prescribed "consent, declaration, and oath" which forms part of the Shipping Articles.

In cases where parents or guardians may, by reason of distance, infirmity, or other causes, be unable to appear at the place of enlistment, they will, on written application to the Commanding Officer of either of the ships upon which enlistments are made, be furnished with the printed form of "consent, declaration, and oath," in duplicate, by executing which the enlistments will be perfected, should the boys be accepted by the Board of Examining Officers.

No allowance will be made for traveling expenses, whether accepted or not.

The Board of Examining Officers will consist of the Commanding Officer, a Line Officer, and the Senior Medical Officer of the vessel.

All boys enlisting as apprentices must voluntarily sign an agreement to serve in the navy until twenty-one years of age, which agreement must, before being signed, be carefully read and explained to each boy by the Recruiting Officer.

Boys who have been convicted of crime cannot be enlisted.

All boys enlisted will be rated 3d class apprentices, and receive $9 per month.

Deserving boys will be rated 2d class apprentices and receive $10 per month after having served six months in a cruising ship, and 1st class apprentices, at $11 per month, after having served one year in said ships.

Properly qualified apprentices will be rated seamen apprentices, 2d class, and receive $19 per month, after having served one year in cruising vessels of war; and seamen apprentices, 1st class, at $24 per month, after two years' service in said cruisers.

All apprentices receive one ration per day.

When first received on board of a training ship apprentices will be furnished, free of cost, with an outfit of clothing not exceeding in value the sum of forty-five dollars.

This outfit of clothing is furnished upon the supposition that the apprentice will serve during his minority, and therefore, if during his minority he is discharged at his own request, or at the request of his parents or friends, the value of this outfit of clothing must be refunded.

Boys enlisted to serve until twenty-one years of age will not be permitted to allot any part of their pay to parents or guardians until they shall have been transferred to general cruising ships.

Apprentices will be transferred to fill vacancies in seagoing vessels as they become proficient.

Upon the expiration of the enlistment of an apprentice, he will, if recommended, receive an honorable discharge, and upon re-enlistment within three months from the date of honorable discharge he will receive three months' extra pay of his rating when discharged, a continuous-service certificate, and an addition of one dollar per month to his pay.

Apprentices will be under the immediate supervision of the Bureau of Navigation, Navy Department, and applicants for enlistment may be made to the chief of that bureau, or to the Commanding Officer of either of the following named ships, viz.: U. S. S. Richmond, Coaster's Harbor Island, near Newport, R. I.; U. S. S. Minnesota, foot of West 50th Street, North River, New York City; U. S. S. Wabash, Navy Yard, Boston, Mass.; U. S. S. St. Louis, Navy Yard, League Island, Philadelphia, Pa.; U. S. S. Dale, Navy Yard, Washington, D. C.; U. S. S. Michigan, Erie, Pa., or during her cruise upon the lakes, and such other vessels as may from time to time be designated for this service.

Apprentices will be sent to the Training Station at Coaster's Harbor Island as soon after enlistment as practicable.

Fast Compound Locomotives.

On a recent run by a Baldwin compound on the Baltimore & Ohio, hauling a "Royal Blue" train from Philadelphia to Canton, on December 22, 1891, the time, including one stop at Wilmington and a slowdown at the Susquehanna bridge, requiring three minutes in crossing, was 101 minutes for 91·6 miles. A similar run was made on the 20th with six Pullman coaches. An observer on the train judged that the engine could have hauled two more cars with equal ease. The fact that the engine made at times a speed as great as 67 miles per hour goes to show that there is no serious defect in compounds at high speed. A record has been obtained from this engine in one instance of a speed of 77 miles per hour, but the details of the run were not gathered. In another case a ten-wheel passenger and freight engine, with 62 inch wheels and 26 inch stroke, made 72 miles per hour. The 10 wheeler made for the Master Mechanics' Association Committee, with 72 inch wheels, hauled a fast train on the Baltimore & Ohio, and made up time with 11 coaches, and traveled 8·6 miles in 9 minutes over a grade of 42·6 feet per mile.—*Railroad Gazette.*

Costs of Making Pig Iron.

The following statement concerning the cost of making pig iron in England and the United States is given by *The Engineer*, London.

	U. S.	England.
Coke used per ton pig.....	2,500 lb.	2,500 lb.
Cost of same at oven.....	2.25 dols.	4.00 dols.
Selling price pig No. 3.....	13.50 dols.	9.75 dols.
Percentage cost of coke to ton pig...	16⅔	41

Assuming 1¼ tons as the equivalent to the 22 cwt. of the English practice, 13.50 dols. as the price of pig iron at Pittsburg as against 39s. in England, Connellsville coke 1.75 dols. f.o.b. cars and Durham 14s., the figures stand as in the preceding table. These figures are of course an approximation.