THE UNDERGROUND RAILWAY, NEW YORK CITY.

NUMBER V.

Continued from page 371.

In our last issue, page 371, we gave drawings of the peculiar masonry tunnels of this great work, especially of those portions which occupy the subsurface of the street directly in front of the large edifice known as the Normal College, on Fourth avenue, at its junction with 69th street. The excavation for the underground railway began directly on the sidewalk in front of the main stairway entrance of the College, shown in our engraving. The cutting extended down to a depth of 33 feet below the ground surface, and 21 feet below the foundation of the tower of the College. But the angle of repose of the soil was not disturbed, and the stability of the College building was therefore at no time endangered, although, at the time, it appeared otherwise to the unexperienced eye. The work was executed last July. The successful carrying along the front of the College of so great a work as this underground railway, the outer walls of which at this point occupy a space of 78 feet in width, while the foundations are 33 feet below the street surface, is an example of the facility with which such works may be prosecuted in New York city without danger to adjoining buildings. In the case of the College building, no special excavations were required, not even the use of sheet piling at the side of the excavations. Our main streets are in general so broad and straight that underground railways may be constructed under their surfaces without difficulty or injury to adjoining property. Fear has been expressed in some quarters that the building of the Underground Railway under our great thoroughfare of Broadway, which, it will be remembered, was finally authorized by the Legislature in May last, might interfere with some of the adjacent buildings: but all such objections are idle, in view of the successful completion of the present great underground railway on Fourth avenue, where the works are much wider and often deeper than will be required on the Broadway line. The width of the Broadway Underground Railway will not exceed 32 feet, whereas 78 feet is the width of the work on Fourth avenue in front of the College. In our next article, we shall give drawings and descriptions of the great single arch masonry tunnel north of the Normal College. The arch of this section of the underground railway is 68 feet in diameter, and is a remarkable work.

THE NORMAL COLLEGE, NEW YORK CITY.

The Normal College of New York city, Fourth avenue and 69th street, is one of the most enduring and splendid monuments of the public school system of this country. Its proportions are large, the building covering an entire block. It possesses great architectural beauty, and is fitted up and arranged in the most convenient and handsome manner; and eleven hundred female students daily assemble in the fine central hall, before proceeding to the rooms allotted to the different branches of study. It is a wise and foreseeing regulation of the New York Board of Education that all female teachers, appointed to the public schools, must be graduates of the Normal College. By this means, an unquestionably high standard of education and of personal character is assured among those on whom the welfare of our next generation primarily and chiefly depends. Admission to the Normal College can only be obtained by graduating from the public schools, in which, and also in the Normal College, the instruction is given *free of charge.*

The edifice was completed for occupancy on the 1st of September, 1873. The institution includes a training school to afford practice to teachers.

The course of study in the Normal College covers three years, and embraces many branches of instruction. President Hunter, in a recent address, made the following remarks concerning the *curriculum:*

"Geology, mineralogy, zoölogy, and physiology are taught in outline, and without requiring home study. The instruction is given in the form of lectures, and for the purpose of enabling the young ladies, when appointed to the primary schools, to become intelligent teachers. In order to impart instruction, particularly on natural objects, some acquaintance with the elements and outlines of the natural sciences is indispensable. Of course it would be absurd to expect profound scholarship in all of these, or indeed in any of them, in the short period of three years. It would take a whole life to make a scientific geologist. Nor can it be expected that we shall make profound Latin scholars; but we can impart such a knowledge of this completely inflected language as will make the graduates much better teachers of reading, spelling, and etymology. The study of Latin will increase their vocabulary, and strengthen their powers of thinking. We intend to make the young ladies so perfect in their German that they can pass from us to the regular staff of the grammar school. The English language, composition, rhetoric, literature, and history shall receive all the attention that their importance demands. Language is so interwoven with thought that the two are one and inseparable. They are almost synonymous. In cultivating language, apart from its intrinsic value, we are cultivating the highest faculties of mind—comparison and judgment. Perhaps we have a little more mathematics than may be necessary, and the Committee on Normal College may deem it proper to cut it down; and yet, young ladies, if you would have sound minds and habits of logical reasoning, you must study mathematics."

"The Normal College has more than fulfilled the expectations of its friends. By the testimony of experts and superintendents, it turns out the best scholars of any institution of the kind in this country. Besides the regular course of three years, a post-graduate course, occupying an additional year, is in contemplation. Every precaution is taken to insure the health of the students. Air, exercise, frequent change, and short recitations are among the means taken to promote this end. The college has an attendance of over 1,000 students, from all parts of the city, and of all creeds, classes and nationalities. The number of graduates this year," says *Harper's Weekly*, from which we select the engraving, "is 184—abou sufficient to supply the vacancies in our city schools."

Effect of Damp Air on Coal.

M. Varrenstrass finds by recently conducted experiments on this subject, that the loss in weight, due to a slow oxidation and to the disengagement of gases which form the richest part of the coal, may equal one third of the original weight. The heating power in such coal was lowered to 47 per cent of its former capacity. The same coal exposed to the air, but in a closed receptacle, did not lose more than 25 per cent of gas and 10 per cent of heating power. Bituminous coals alter most rapidly.

This shows the disadvantage of damp cellars ,and of leaving coal uncovered for long periods and subject to bad weather. Judging from the large loss incurred, it would seem much the better economy to provide suitable receptacles for the fuel, the saving in the latter being sufficient to compensate for the extra expense.

THE manufacturers of firearms in this country are as busy as bees in clover time. Large orders from foreign governments are now being executed. Turkey is having 600,000 of the Peabody-Martini rifles made, Prussia lots of needle guns, Russia 100,000 of Smith and Wesson's pistols, while Spain calls for all that can be made of the Winchester and other breech-loaders.

A NEW DREDGING PROCESS.—M. Bergeron suggests that deposits of sand and mud in harbors might be cleared away by forcing into them the perforated ends of large tubes, through which a powerful stream of water is forced. The numerous currents would, he thinks, act upon the deposit in the same manner as so many underground springs, washing it away so that the soil could be distributed by the flow of the tides.

IT is said in France that the quarries of lithographic stone in Bavaria are exhausted as regards the best kind, and that the only fine stones are now obtained by the Paris lithographers from Bruniquel, Tarn, and Garonne, in France. These stones are said to be well appreciated in the United States. There are quarries of the same stone at Vigan, France, but these are of an inferior description

Fig. 13.—THE UNDERGROUND RAILWAY IN NEW YORK.—THE NORMAL COLLEGE FRONTING THE WORK.