PROGRESS OF THE HUDSON RIVER TUNNEL.

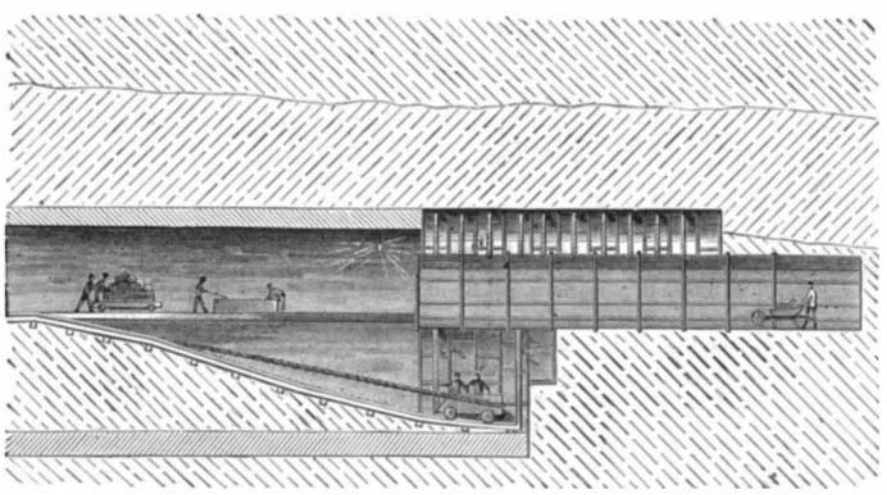
[*Continued from first page.*]

son near the foot of the ladder leading to the upper air lock. In the middle, between the tunnel openings, is shown the lower curved end of the chute for passing in bricks and other small materials, and which, in emergency, might serve as an additional way out for workmen. Fig. 4 represents the opposite side of the working chamber, with the telephone closet, compressed air pipes, electric lamp, windlass for operating the cable roads to the breast of the tunnel, etc. The tram cars laden with clay from the forward workings, are hauled to the shore end of the tunnel, where they are automatically dumped (as shown in Fig. 3) into the puddle underneath the floor of the working chamber. Here the clay is worked up with water to the consistency of cream and forced, by the air pressure in the tunnel (from 19 to 21 pounds according to the state of the tide) up through the blow-out pipe to the surface, where it is used for filling in low ground.

From the working chamber the visitor may enter either of the tunnels and follow the tramway to the breast, now between 450 and 500 feet distant, and advancing from 3½ to 4 feet a day. As he approaches the working end of the tunnel the roadway suddenly dips downward and the tunnel becomes a full cylinder. The guide explains the purpose of keeping the tunnel half full of clay to be two-fold—to partly relieve the strain upon the brickwork while the cement is hardening, and to furnish a broader passageway for men and materials. By this plan the full diameter of the tunnel is available for roadway.

The method of advancing the work can be described in few words when so much has been shown by the artist. The material to be removed is an extremely compact blue clay, which thus far has proved to be encouragingly free from softer streaks, seams, or other breaks, by which water can enter or compressed air escape in serious quantity. The advance is made cautiously, though, as already noted, with considerable rapidity.

First the quality and consistency of the material ahead are approximately determined by driving in slender rods of iron from the forward end of the pilot tunnel, which is 6½ feet in diameter. The breast of the pilot tunnel is kept from 15 to 20 feet in advance of the forward working of the tunnel proper. In this way any possible change in the character of the ground must be discovered before it can be a source of imminent peril to the main work. Besides, the pilot tunnel furnishes a substantial support for the braces which hold in place the advancing iron plates of the main tunnel until the successive rings are completed and the brickwork built up.



SECTION OF END OF TUNNEL AND PILOT TUNNEL.

The pilot tunnel is composed of ten segments or rings of stout iron plates, each 4 feet long, the whole securely bolted together and braced within by beams of wood (not shown in the engraving), to counteract the thrust of the exterior braces. This pilot tunnel is continually built up at the forward end as the clay is removed, the plates for the advancing segments being taken from the rear end, which has been passed by the advancing brickwork.

The main excavation follows the pilot in six or eight terraces or steps, and the iron shell of the tunnel is advanced section by section as the clay is removed, the construction of the rings going on from the top around the sides until each ring is completed. When four rings (or ten feet of the shell) have been completed and securely joined, the circle is bricked up and finished with a coating of Portland cement.

The visitor cannot but be favorably impressed by the excellent character of the work now being done, and by the increased care taken to reduce to the smallest the inevitable hazards of a work of this nature. Two new features in the prosecution of the work will command especial approbation. These are the introduction of solid bulkheads with double air locks near the working ends of the tunnels, and the construction of an air-tight diaphragm filling the upper half of each tunnel, at a point still closer to the men engaged in excavating, plate laying, and brick laying. By means of these precautions the danger to the workmen from any possible inrush of water will be materially reduced. Work upon the bulkhead for the south tunnel is now going on, and at the time of our visit (May 17) the air locks were being put together for testing. The bulkhead will be placed at a point near where Fig. 2 begins; and the intention is to have one of the air locks always open as a refuge for the workmen. The diaphragm will be placed near the rear end of the pilot tunnel. Its office will be to prevent the outflow of air from the upper half of the tunnel between the diaphragm and the bulkhead, should a break occur at the breast of the working, thus insuring the safe retreat of the workmen to the air lock in case of such an accident. The doors of the air locks are made uncommonly large and strong, both for the safety of the workmen and their convenience in passing through materials. By the use of these bulkheads, as will be readily perceived, the workmen in the other tunnel and at the shore ends of both tunnels are relieved of risk in case an accident occurs at the working end of either tunnel. These bulkheads and diaphragms will be carried forward from time to time as the work proceeds.

The direction and immediate supervision of this important enterprise has lately been undertaken by the favorably known engineers, Wm. Sooy Smith & Son. An early beginning on the New York end of the tunnel is anticipated.

Full particulars as to the location, purpose, magnitude, and history of this great work will be found in the volumes of the SCIENTIFIC AMERICAN for 1880. For the convenience of reader, who have not the back numbers at hand, the following facts may be recapitulated:

The tunnel is intended for railway use, to obviate the expense of transferring freight and passengers for New York arriving at Jersey City from the South and West, and also to escape the delays incident to fog and ice on the river. The Hudson at the point of crossing is one mile wide. The tunnel proper (under the river) from the foot of Fifteenth street, Jersey City, to the foot of Morton street, New York, will be 5,550 feet in length. The Jersey City approach will probably add about half a mile to the length of the excavation. On the New York side it is not decided what the course will be—whether to a terminus somewhere on Broadway or into a contemplated system of underground roads for rapid transit throughout the city.

The work comprises, as already stated, two parallel, almost cylindrical, tunnels, each 16 feet in horizontal and 18 feet vertical diameter inside. Outside the measurements are repectively about 4 feet more, the brick wall being 2 feet thick, and the outer shell of boiler iron, one-quarter inch thick. The plates of the shell are 2 feet 6 inches wide, with 2½ inch flanges on each side, through which the plates are bolted together. The brickwork is laid with carefully tested cement. The methods of constructing the shell and laying the brick have been noticed above. In its deepest part, about 1,000 feet from the New York shore, the river is 60 feet deep. The top of the tunnel will be kept about 30 feet below the surface of the river bed. Near the New York side some rock and sand will be encountered. The rest of the way the excavation will be through the stiff clay already described.

Noises in the Telephone.

Having remarked that telephones transmit along with speech sounds of an unknown origin, the author has undertaken experiments in order to find out if the causes of these sounds are not those which oppose telephonic communication at great distances. To eliminate all possible sources of error, the following arrangement was adopted. A line of twenty meters was laid on the floor of several rooms, all the doors of communication being closed. It was connected at one end to a pair of telephones by means of flexible conductors, designed to arrest sounds which might communicate themselves mechanically along the metal to the telephones. The circuit was completed between these conductors by another flexible wire, on the path of which was an interruption pedal, rendering it possible to cut the circuit without changing at all the nature of the communications between the line and the telephones, and to prove that the sounds heard had an electric origin. The operator acted at the other end of the line which was not connected, directly or by induction, with any electric generator. He observed that the current produced by the friction of two wires of the same kind or of different kinds and that produced by closing a pressure screw were heard in the telephones. It is easily understood that when suspended, telegraph wires serve for telephonic transmission; this cause may occasion much trouble, since these lines are formed of pieces of iron wire connected to each other and to the stretchers by ligatures, more or less perfect, which are in a state of constant agitation. But this cause of failure may be removed by soldering the wires instead of tying them. Unfortunately there is another cause: the currents due to the influence of the vibrations themselves. To verify this hypothesis, the author placed in the circuit, at the end opposite the telephones, a rod of iron 1·50 meters in length, and connected to the system by supple conductors. This rod was struck sometimes transversely and sometimes longitudinally with a hammer. The sounds occasioned by the blows were distinctly reproduced by the telephones with their peculiar characters. This experiment if repeated with copper or brass rods, gave merely negative results. It seems that the phenomenon is only produced as an effect of the vibrations occasioned in the wire. Future experiments must decide whether it is due to a molecular change which the metal undergoes or to a peculiar action. If, as it is probable, the vibrations caused by the wind act upon the lines of iron wires like the blows upon a rod, it appears difficult to correspond at great distances with the existing means of transmission, till a method has been found of causing the telephones to speak by the aid of electric action so powerful that the currents arising in the line itself cease to be an appreciable cause of disturbance.—*M. A. Gaiffe.*

A Curious Case of Partial Deafness.

Mr. Edwin Cowles, of the Cleveland (Ohio) *Leader*, gives the following account of an infirmity which curiously limits the range of his sense of hearing:

"My deafness is somewhat of the nature of color blindness. There are certain sounds I never hear. I have never heard the sound of the bird since I came into this world, and until I grew up to manhood I had always supposed the music of the bird was poetical fiction. You may fill this room with canary birds, and they may all sing at once, and I never would hear a note, but I would hear the fluttering of their wings. I never hear the hissing sound in the human voice, consequently, not knowing of the existence of that sound, I grew up to manhood without ever making it in my speech. A portion of the consonants I never hear, yet I can hear all the vowels. I never could distinguish the difference between the hard sound of the letter 's' and the soft sound, consequently I frequently mix these sounds in a sad manner. It is the same with the soft and hard sound of the letter 'g.' It was only by accident, after my marriage, that I discovered the existence of the hissing sound in the human voice. I was then taught arbitrarily how to make it, but I never hear it in my own voice, consequently I frequently miss making that sound in my speech without knowing it. Owing to its having become second nature to me to omit the sound of the letter 's,' when I do make it I labor in doing so, which in a great measure gives my pronunciation the peculiarity it has. There are words which I pronounce literally according to the spelling, which gives an additional peculiarity to my speech. For instance, I used to pronounce the word 'parochial' just as it was spelled until I was corrected, when I now pronounce it 'parokial.' I cannot hear the difference between the sounds 'ch' and 'k' when embodied in a word. All these examples will give an idea how it is that my peculiar deafness affects my speech. Before I was taught to make the hissing sound my pronunciation sounded the same to everybody as theirs did to me. About a quarter of the sounds in the human voice I never hear, and I have to watch the motion of the lips and be governed by the sense of the remarks in order to understand what is said to me. I have walked by the side of a policeman, going home at night, and seen him blow his whistle, and I never could hear it, although it could be heard by others half a mile away. I never hear the upper notes of a piano, violin, and other musical instruments, although I would hear all the lower notes. I can hear low conversation, but cannot as a general rule understand a public speaker in a hall. Now you will understand how it is that my impediment of speech is owing entirely to my extraordinary hearing. I have consulted the most eminent surgeons, physicians, and aurists in the country in regard to my hearing, and they all tell me there is not another case like it in the books."

ENGINEERING INVENTIONS.

Messrs. William H. Bomgardner and Henry Kerns, of Omaha, Neb., have patented a system of car braking by which the brakes are set instantaneously by diminishing the speed of the engine, and by which they can be released by increasing the speed of the engine, the object being further to set the brakes automatically whenever the moving or standing train receives a shock from either end, the system being so arranged as not to interfere with hand braking as commonly applied.

Mr. Frederick W. Hales, of Charlotte Town, Prince Edward Island, Canada, has patented a ditching machine designed especially for opening ditches through wet or swampy grounds, and which may also be used with advantage for other ditching.

An improved speed recorder and indicator has been patented by Mr. Marmont B. Edson, of Brooklyn, N. Y. The object of this invention is to obtain a constant indication and permanent record of the speed of machinery. For this purpose I combine with indicating and recording mechanism of usual character devices fitted for rotary motion by connections to the machinery, and provided with weights fitted for centrifugal motion, that are in connection with the actuating rod of the indicating mechanism, whereby the indicating hand and recording pencil are moved in unison with the centrifugal motion of the weights.

An improvement in time signals for railroads has been patented by Mr. Alma P. Burroughs, of Seneca Falls, N. Y. This invention is an improvement upon the time signal for which Letters Patent No. 230,738 were granted to the same inventor on the 3d day of August, 1880, and it consists in the application of compressed air, and in the mechanism therefor, whereby the clock hands are ungeared by passing trains.