CAVE-IN AT THE PARK AVENUE RAPID TRANSIT TUNNEL.

When we consider the great extent of the Rapid Transit Subway, and the different varieties of rock formation which have been encountered throughout the 21 miles of excavation, it is certainly surprising that there have been so few accidents due to caving in of excavations and tunnels. As a matter of fact, there have only been three that were at all serious, one occurring in the deep tunnel that is being driven beneath Washington Heights, another at Union Square, and the latest the cave-in on Park Avenue which forms the subject of the accompanying illustrations.

It will be remembered that the Subway beneath Fourth Avenue divides into two two-track tunnels in the neighborhood of Thirty-third Street, and that these two tunnels are being driven beneath the old Park Avenue tunnel and respectively somewhat to the east and west of it, the side walls of the old tunnel being approximately over the crown of the roofs of the Rapid Transit tunnels. These latter are being driven entirely through rock, and, apparently, judging from the nature of the material encountered, the rock has been of a good, solid quality in the neighborhood of the tunnels and presumably for some distance back of them. The general dip of the strata is at an angle of 45 degrees from east to west. At about the center of the easterly tunnel, between 37th and 38th Streets, the rock is seamed with thin layers of disintegrated material which ordinarily has sufficient binding effect to keep the adjoining rock from sliding during excavation, but which, should they become saturated, as happened in the recent instance, turn to a greasy consistency, and render the rock liable to slide when the surrounding or supporting material is cut away. As a matter of fact, this is what happened a few days ago for a distance of between 30 and 40 feet, on the easterly wall of the easterly tunnel, when the rock commenced to force its way in, and had filled the tunnel for about one-third of its width before the sliding was stopped by shoring the wall heavily with timber. After the movement of the rock had been stopped, it was not anticipated by the engineers that there would be any further trouble, as there were no indications on the surface of the ground, which at this point is 60 feet above the floor of the tunnel, that the movement of the rock had extended to the surface. Between 8 and 9 o'clock on Friday morning last, however, there was a sudden subsidence immediately below the front area of one of the houses in the center of the block. The cavity was large enough to take in nearly the whole of the front steps and the heavy stone balustrade, and it extended under the front of the house, with the result that a considerable portion of the front foundation wall was carried down. At 1.30 on the same day, the front foundation wall of the adjoining houses gave way, and the whole of the steps, landings and areas, with the brownstone facing of the first story, fell into the crater, which by this time had become greatly enlarged. The building department now gave orders for all families living in the houses facing Park Avenue between 37th and 38th Streets, to vacate their homes.

It is not anticipated that the movement of the rock will extend any further, as the overlying material has probably settled down solidly against the displaced tunnel wall, which is prevented from further movement by the heavy shoring within the tunnel.

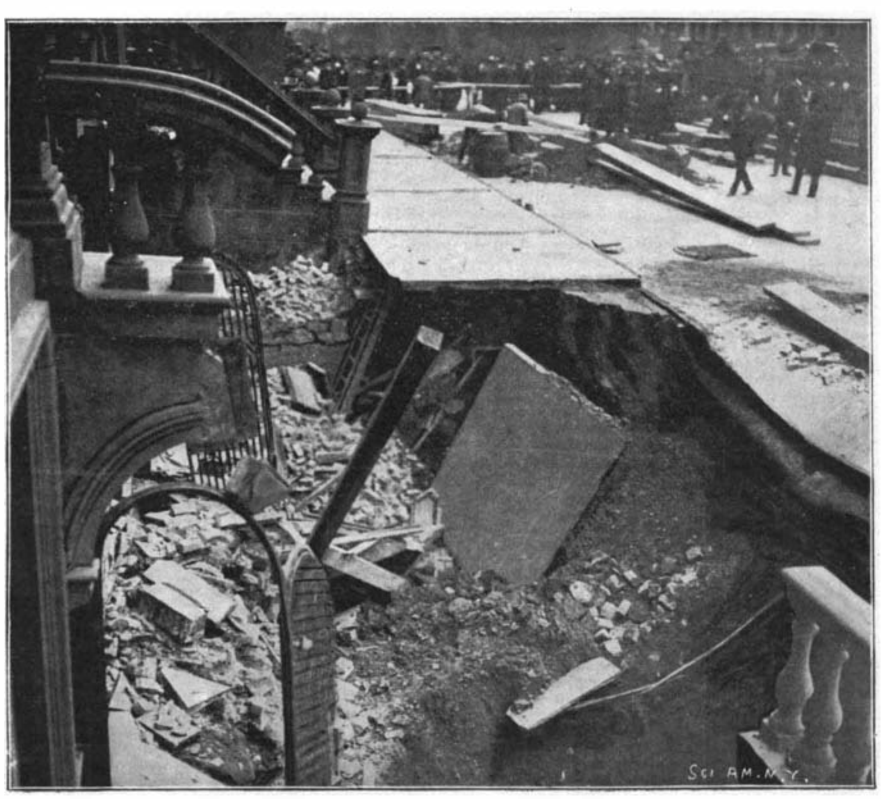
The engineers are meeting the difficulty by making an open cut above the cave-in. The shifting rock will be removed; a concrete arch turned over the tunnel; and the material filled in, restoring the normal surface of the ground. This accident should not cause any fears as to the stability of the completed tunnel, for the reason that the whole interior will be lined with a heavy wall of concrete, which will have sufficient strength in itself to resist any crushing-in effect of the kind we have just described. By the courtesy of the New York Herald we are enabled to present the three accompanying photographs, which show very clearly the extent and nature of the damage.


Front View of the Wrecked Houses.

The Measurement of Osmotic Pressure.

If a solution of ordinary salt or sugar be brought into contact with water, the salt or sugar will pass from the solution into the water until both become of the same concentration. Ordinarily this phenomenon is called diffusion. Obviously the particles of the dissolved substance are driven from their solution into the pure solvent by some force; and this force is known as osmotic pressure. Qualitatively, it is a simple matter to demonstrate the existence of osmotic pressure; but the measurement of the magnitude of this pressure is an experimental problem so difficult that few physicists have ever attempted its solution. To be sure, the well-known German botanist Pfeffer in 1877 succeeding in making some direct measurements; but the principal method which he employed never permitted him to measure pressures greater than that exerted by a sixty per cent solution of a substance, such as cane sugar. Meager as these results have been, they form the basis for the important labors of Van't Hoff. In 1887 this brilliant Dutch chemist showed that the osmotic pressure of solutions obeys the laws of gases. Ever since this generalization was reached scientists felt that the time had come to measure great osmotic pressures directly, and to ascertain the truth of Van't Hoff's law. But the many experiments made during the last decade have failed miserably. Finally Prof. Morse, of the Mechanical Department of Johns Hopkins University, devised a method which is brilliant as well as simple. For some years Prof. Morse has been engaged in important electrolytic work. It occurred to him that instead of allowing the two solutions to diffuse from the two sides of a cell into a porous wall, they might be forced in by means of the electric current. In carrying out the idea he poured a solution of potassium ferrocyanide into the cell; immersed the cell in a solution of copper sulphate; inserted an electrode into each solution; and passed a current from the outer solution through the walls of the cell into the inner solution. The positively charged copper ion moved with the electric current into the wall from the outside; the negative ion of the potassium ferrocyanide moved against the current and passed into the wall of the porcelain cup from the inside. When the two ions met they combined and formed the desired precipitate into the walls of the cup. The precipitate offered far more resistance to pressure than that deposited by the method of Pfeffer.

After long and arduous labor Prof. Morse succeeded in securing junctions in the apparatus that would withstand high pressures, and has solved other difficult problems that have arisen in the course of his work. So successful is the method devised by Prof. Morse that pressures as great as twenty-three atmospheres have been measured. Last June Van't Hoff visited Johns Hopkins University. Unhesitatingly he pronounced the work that Prof. Morse had then merely begun the most important in modern physical chemistry. Coming from one of the greatest living chemical physicists, this is high praise indeed.


Looking into the Crater from Steps of Adjoining House.


Snapshot Taken as the Front Walls Collapsed.

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