PURITY OF CATSKILL WATER SUPPLY.

The special experts on the purification of water for the New York Board of Water Supply have been investigating local conditions at the Ashokan Reservoir, with a view to determine whether the surface soil and vegetation on the bottom and sides of the Ashokan Reservoir should be entirely stripped down to the clay and gravel, as was done in the larger reservoirs of the metropolitan water districts of Massachusetts, or whether some other treatment to obviate deterioration during storage was preferable. It was estimated that the stripping of the soil would cost about $5,000,-000. Messrs. Hazen and Fuller, the expert engineers, have decided that the stripping of the Ashokan Reservoir would not prevent tastes and odors in the water to a sufficient extent to warrant the great expenditure. They considered that aeration, at a small fraction of the cost of stripping the reservoir, would result in better water, and that perfectly satisfactory water can be obtained by both aeration and filtration, whether the reservoir is stripped or not. It was recommended that all the trees and bushes over the entire area be cut close to the ground and burned shortly before the area is flooded, and that all the stumps and roots be taken out, so that in case of low water they would not be unsightly. They also recommend that at the outlet of the reservoir a large fountain be built, where all the water drawn out will be thoroughly exposed to light and air.

THE NEW FOURTEEN-INCH ARMY AND NAVY GUNS.

Great interest attaches to the new 14-inch gun for the navy which has been delivered at the navy yard at Washington, where it will be rifled and the breech mechanism installed. On completion it will be shipped to the naval proving grounds at Indian Head, Maryland, for a test. The completed gun will weigh about 63 tons; its projectile will weigh about 1,400 pounds, and the latter will be propelled by a charge of 365 pounds of powder. The extreme range at maximum elevation will be more than twenty-five miles. As compared with the present navy 12-inch gun, this will be a far more powerful weapon. It will penetrate any armor afloat, at the most distant ranges at which accurate aiming is possible. The army has also a 14-inch gun of much lower velocity and power, which will soon be tested at the Sandy Hook proving grounds. The lower muzzle velocity (about 2,000 feet per second) of the 14-inch gun will give it additional life over the 12-inch gun. After some eighty discharges the rifling of the present 12-inch gun of 2,500 foot-seconds velocity becomes so badly worn as to destroy the accuracy. In the case of the 14-inch gun, the erosion is much less, and the gun will be serviceable for about 300 discharges.

THE NEW BRITISH AND GERMAN "DREADNOUGHTS."

The biggest "Dreadnought" of Great Britain and the most powerful German vessel of the same type were put into the water on the same day. The "Neptune," the English vessel, has a displacement of 20,250 tons, will carry ten 12-inch guns and twenty 4-inch guns, and her total broadside will weigh 9,120 pounds. The German "Dreadnought" "Ostfriesland" has a displacement of 19,000 tons; will carry twelve 12-inch guns, twelve 6.7-inch guns, and twenty-two 4-inch guns, and she will deliver 14,204 pounds in a single discharge of all her guns. The most remarkable feature of the "Neptune" will be the extraordinary power of concentrating the gunfire. The ten 12-inch guns will be mounted in pairs in five barbettes. One barbette will be placed in the forecastle on a high level. The two broadside barbettes will be *en echélon*, that on the port side being more forward than the barbette on the starboard side By a novel arrangement the superstructure is bridged over these two barbettes, both pairs of guns being fired on either side at once if required. Of the two barbettes astern, one will be raised above the other, so that all four guns can be fired direct astern simultaneously. The broadside fire of the "Neptune" will thus be ten guns, the stern fire eight guns, and the direct-ahead fire six guns. The "Ostfriesland," on the other hand, has four of her twelve guns masked by the superstructure, and can fire only eight 12-inch guns on either broadside. Her end-on fire will be six guns ahead and astern.

ACCELERATION OF LONG-DISTANCE EXPRESS SERVICE.

Hitherto the trip from New York to St. Louis has been a rather trying one. Now, however, conditions are ameliorated by two through trains which make a schedule run from New York to St. Louis in twenty-four hours. The New York Central train leaves at 2:45 in the afternoon, and the Pennsylvania train at 6:25 P. M. The Central's train is a duplicate of the "Twentieth Century Limited," and the Pennsylvania's is a duplicate of its eighteen-hour "Chicago Flier." The Central train is due to arrive in St. Louis at 1:45 P. M., which allowing for the difference in time makes a run of just twenty-four hours. The time saved is about five hours, and both of the trains are luxurious in the extreme. There are now seventeen trains daily each way on the New York Central and Pennsylvania systems.

THE LIMIT OF RAPID TRANSIT.

If all mechanical difficulties could be overcome and sufficient horse-power could be developed, what would be the minimum time in which passengers could be transported say from New York to Philadelphia? At first glance, one is apt to overlook the fact that the freight to be transported is not mechanical, but human, and this is a very important factor in the problem, because the safety and comfort of the passengers must be considered. It is really a question of starting and stopping that imposes a limit on the reduction of time consumed in transit. A very interesting discussion of the question has been received from one of the readers of the SCIENTIFIC AMERICAN. He points to the fact that the quickest way to get from one place to another without shock or jar is to travel faster and faster until half the distance is covered, and then to slow down until the destination is reached. When the rate of acceleration is just such as can be borne with comfort, the limit is attained. The effect on the passengers would be a continuous pressure against the back of the seat, of the sort experienced when a car is started suddenly, for the first half of the journey, and then in order to prevent them from pitching out of their seats, the chairs would have to be turned in the opposite direction for the rest of the journey, during which the same sensation would be felt. If an attempt were made to make the same time by any other method involving uniform speed throughout the greater part of the journey, an unpleasant jar or pressure would be experienced in starting and stopping. The highest speed attainable would therefore be proportional to the distance traversed.

Our correspondent draws a fanciful picture of the railroad of the future, which would permit of such rapid transit. The trains would have to run in a vacuum, to prevent them from being heated to incandescence by the resistance of the air. They would also have to be held in suspension in the vacuum tube through which they travel, for the slightest contact with the sides of the tube would result in enormous friction. The cars might be held in suspension by the repulsion of opposing magnets on the cars and tube respectively. When thus isolated, they could be propelled only by the magic power of magnetism. Under such conditions, the energy consumed in propelling the car would be quite low. The running time on such a road between New York and Philadelphia or New York and Boston would be a matter of a few minutes. The time for each half of the distances could be calculated from the well-known formula, $S = \frac{1}{2} a\, t^2$, where S is the distance, here *half* the whole journey; a, the acceleration, or change of speed each second; and t, the time in seconds. Taking an acceleration of 11 feet per second each second, which would bring to rest, in 4 seconds, a train moving at 30 miles per hour (44 feet per second) we find that the time from New York to Philadelphia (85 miles) and from New York to Boston (190 miles) would be 6 minutes 44 seconds and 10 minutes 4 seconds respectively.

This may indeed be considered the absolute limit of rapid transit; for the passengers would be traveling each half of the distance one-third as fast as they could fall through the same space under the attraction of gravity.

THE OTHER HALF OF THE CULLINAN.

It is reported in African papers that the original stone, of which the Cullinan was a portion, has been found in the possession of the Kaffirs of the Magatos tribe in Zoutpansberg. The dimensions of this second Cullinan stone have been given as 4,323 karats.

This story has been denied by the Transvaal Department of Mines, and an official of the treasury in Pretoria states that the origin of the legend can undoubtedly be traced to the belief that enormous quantities of diamonds were buried by command of the celebrated chieftain's wife Majatje during the Boer war. These diamonds became the spoil of the Kaffirs when they returned to Kimberley. But these treasures are lost, for the Kaffirs who buried them are dead and search for them has been without result.

The possibility of finding still larger stones than the Cullinan in the soil of South Africa is, however, by no means remote. G. A. Molengraaff, professor of mineralogy in the Technical High School at Delft, recently stated that the Cullinan is only a portion of a much larger stone, the original form of which can only approximately be indicated. Four pieces must have been broken off from the original stone by natural crystal cleavage, which is evident from the cleavage planes. Each of these pieces must have been of considerable size. Accordingly, the natural end planes (called "nijf" in the language of the diamond workers) are only partially shown in the Cullinan. Most of the crystal planes are cleavage planes. The original portion of the surface shows only a single octahedral face; it also has an irregular curved front surface bearing some resemblance to the six faces of a dodecahedron, and a very irregularly formed cubical (hexahedral) surface, in which the quadrangular impressions can be recognized. These quadrangular impressions are characteristic of minerals such as diamonds, which occur in the octahedral form. The Cullinan consists of a single crystal; there are no traces either of a twin crystal or of twin lamellæ; it is completely transparent and colorless. Its transparency can be best compared with that of very pure ice, or with the complete clearness of the variety of opal known in the mineral kingdom as hyalite (principally consisting of silicic acid). It is true that the Cullinan contains a few impurities in the shape of inclosed grains, also some internal cleavages of fragmentary character, called "glessen" in the Dutch diamond trade, but their situation is such that they do not injure the value of the stone as a jewel. In any case the Cullinan is the purest of all large precious stones hitherto found.

The question now arises whether there is a possibility of finding the pieces broken off by crystal cleavage. That they can be found is certain, but it is impossible to predict whether they are now in diamond mines or elsewhere. The diamond is formed, as is known, at great depths by the decomposition of carbon, dissolved in the molten, basic, plutonic magma of the earth. (The so-called "blue-earth" is formed at a later period from this rock.) The carbon was then, under enormous pressure and at the very high temperature prevailing at these depths, deposited from the molten rock in the form of diamonds. During the volcanic discharges of the masses of rock the diamond was forced upward with tremendous force, and the very great friction to which the mass was exposed during its passage through the crater shaft caused the cleavage of the stone according to crystallographic laws to which we have referred. It is therefore not impossible that the broken-off fragments of the Cullinan are scattered over a wide space, and that they may one day be found on the surface of the earth, but it is just as possible that they are still reposing in the depths of the mines. Sir William Crookes has also lately expressed the opinion that the Cullinan is the smaller portion of an octahedron broken by crystal cleavage.

New applications of electricity are being discovered daily, but not every new application is of as much interest or importance as one recently developed for purifying the air of reading rooms, theaters, and other close places where large numbers congregate. The apparatus referred to is the ozone generator installed recently in the Chicago Public Library to purify or ozonize the 10,000 cubic feet of air per minute that is forced into the main reading room. After the installation of the ozonizing apparatus it was found that the main reading room was completely deodorized, the air being freed of that disagreeable and deleterious odor which for years had so thoroughly permeated all papers, books, furnishings, etc., in this large room. The fresh sterilized "mountain" air in the room reduced the humidity during the hot, oppressive days of summer, and greatly increased the comfort of the readers and employees. The installation renders the disinfecting of all books, periodicals, papers, etc., on the shelves, racks, tables, etc., an automatic process, keeping them constantly in a hygienic condition.