Correspondence.

Cement Drain Tiles Wanted.

To the Editor of the SCIENTIFIC AMERICAN:

I see by an advertisement in your paper that it is now possible to make good building blocks of sand and cement at a cost of six cents each—blocks worth eighteen cents each for use in building a house wall. This leads me to suggest that some one of the makers of machines for this purpose might do well for himself and others by inventing a machine for turning out tiles for farm drainage.

Good burnt-clay tiles three inches in diameter cost from ten to twelve dollars per thousand at the factory, but by the time they reach the back-country farmer the cost runs up to twenty-five dollars and often much more. I should suppose that a farmer who has sand at home could make cement tiles at a cost far below that, provided he had the right apparatus.

Of course, such a machine must be, first of all, simple, and to this end I venture to suggest that a tile with the cross section of the letter U might be easier to make than the tube tile. In fact, I have seen the Indians in Central America making roof tiles of that shape by laying the clay half way round a tree trunk of the right size. Better still, I think, might be flat tiles having one edge notched, so that when laid together like the sides of an A roof, they would dovetail together. If well designed, such a line of tiles would never get out of place, and it would drain the land in half the time required by the tube tiles.

JOHN R. SPEARS.

Northwood, N. Y., January 16, 1906.

The Heat of the Subway.

To the Editor of the SCIENTIFIC AMERICAN:

I would judge from the different articles that I have read that the excessive heat of the Subway is somewhat of a mystery, and in your last issue of the SCIENTIFIC AMERICAN you state that a large amount of it is probably due to the powerful action of the Westinghouse brakes. This I will admit is true as far as that goes; however, I will ask this question:

Is it not true that all of the electrical energy fed into the Subway is finally converted into heat in one way or another? I claim that it makes no difference whether the electrical energy is all used in heaters or in motors, the heat units of the current in both cases are exactly the same. If we use this electrical force through electric heaters, the conversion into heat is direct; if we use it to run motors, about 15 per cent goes into heat direct by losses in the motors, and the other 85 per cent goes into mechanical energy or power, which is again converted into heat by the friction of bearings, the brakes, and the wind resistance of the trains. There is no way to fool this natural law, and to make the motors act as generators will give the same amount of heat as the brake shoes for stopping the trains, unless such generators could be used for charging storage batteries, which afterward could be discharged outside of the Subway. Ventilation or cold storage pipes is the only remedy.

E. A. BARBER,

Superintendent Black River Traction Company.

Watertown, N. Y., December 30, 1905.

The Consequences of Water Diversion from the Croton Valley.

To the Editor of the SCIENTIFIC AMERICAN:

The processes of water gathering and sanitary protection of streams in the Croton valley have been going on since 1842, when the first gravity supply was introduced into New York. If these processes have any effect upon the development of a drainage area, whether beneficial or otherwise, this period of sixty years is long enough to afford trustworthy results of what takes place. Such results are not only interesting in pointing out the destiny of this particular valley, but are of importance as an indication of what will take place in other regions under similar conditions.

The Croton watershed of 360 square miles is wholly within the counties of Westchester, Putnam, and Dutchess. The townships which include the watershed are thirteen in number and are 413 square miles in area, so that the area affected by the water gathering constitutes 87 per cent of the area of the townships. The following table shows the population of all the townships in ten-year periods from 1850 to 1900, according to the census returns:

Year.	Population.
1850	24,323
1860	26,068
1870	26,408
1880	27,406
1890	26,405
1900	23,576

The gain in these townships for the ten years ended 1860 was 18 per cent; for the twenty years to 1870, 14 per cent; for the thirty years to 1880, 12 per cent; for the forty years to 1890, 7 per cent; for the fifty years to 1900, the loss was 3 per cent. During this same period of fifty years the State has increased in population 125 per cent; the county of New York, 300 per cent; the three combined counties in which the Croton basin is located, 113 per cent. The density of population of the townships comprising the Croton basin was 59 to the square mile in 1850, and 57 in 1900. In the combined counties of Westchester, Putnam, and Dutchess the density was 84 in 1850 and 179 in 1900.

The influence for retardation exhibited in the above census figures is remarkable for its persistence, inasmuch as the area affected possessed many features favorable for a normal growth. It contained thirty-one natural lakes and much beauty of scenery to attract residents. As early as 1852 the Harlem Railroad brought the entire length of the watershed into close connection with New York city. Without the presence of the water gatherer it stood in a good position to sympathize in development with the city, which has always had a record of doubling every seventeen years.

That there has been a positive influence against the progress of the townships comprising the Croton watershed is now made manifest and it may be recorded as an indisputable fact that the sanitary control and partial appropriation of land by the city for the purpose of diverting the maximum yield of water has in this instance resulted in retardation.

The question now to be answered by those interested in the welfare of the State is this: Will these same consequences follow the diversion of 500,000,000 gallons daily from the streams in the Catskill region? and, if so, whether or not the devotion in perpetuity of 900 square miles of drainage area is justifiable in the face of the fact that an equivalent supply may be obtained without resorting to the process of diversion at all, namely, by conserving the rainfall at the sources of the Hudson River for the twofold purpose of flood protection and the generation of electric power, the latter to be transmitted by wire to a station near Poughkeepsie and there utilized to pump the river water through an aqueduct to New York. Under this project the expenditure by the city does not injure the inhabitants of any extent of country, but on the contrary equalizes the flow of streams and aids in industrial development.

The estimated cost of the Catskill gravity project is $161,000,000, and the estimated cost of the Hudson River pumping project is $108,000,000, showing a difference of 30 per cent in favor of the latter. This wide difference is due to the fact that the required storage in the Catskill region will cost over $50,000,000, while the required storage on the upper Hudson will not cost $3,000,000. It would be utterly impossible to spend $50,000,000 in providing storage for a daily supply of 500,000,000 gallons anywhere in the State except in the Catskill Mountains. The topography of the country explains that fact fully, but the following quotation from the report of Mr. G. W. Rafter, C. E., to the Water Storage Commission points out how favorable in comparison is the topography of some other watersheds for storage. "These several reservoir systems (Hudson, Genesee, Salmon, and Black rivers) have a total capacity of 139,000 million cubic feet, an amount of water sufficient, if uniformly distributed, to produce continuously, under the existing conditions of fall on the various streams, about 400,000 horse-power, worth at $12 per year per horse-power, $4,800,000. But $4,800,000 is the interest on $120,000,000; hence this amount of money could be actually invested in combined flood protection and water storage for power purposes before the project would become commercially impracticable. As a matter of fact, the storage system here outlined will not exceed in cost $17,000,000." The average cost for storage for each horse-power in these four river systems is accordingly $42.50, and at this rate the 55,000 horse-power necessary to pump 500,000,000 gallons of water daily from the river to an elevation of 400 feet can be provided in the upper Hudson watershed by the expenditure of $2,237,500.

By the generation of electric power at the source of the Hudson and the utilization of this power down stream one hundred miles or more an economy will be brought about that will save the city more than forty million dollars and save the State from sacrificing to the water gatherer what properly belongs to the tax gatherer.

R. D. A. PARROTT.

100 East 17th Street, New York, January 22, 1906.

ORE-UNLOADING BY MACHINERY.

BY DAY ALLEN WILLEY.

A new unloading apparatus has recently been placed in operation on the Great Lakes for unloading cargoes of ore and coal. It differs radically from other apparatus for the reason that there is no cantilever and cable bucket system employed for unloading. It might be called a gigantic hull dredge, for in its operation it is quite similar to the modern dredge. The Hulett ore unloader, as it is termed, is undoubtedly one of the most perfect types of vessel unloader which has yet been designed, for it not only removes the material from the hold but literally cleans up the bottom of the ship, so that practically no hand labor is required. This is due to the design of what is termed the unloader leg. As the illustration shows, this is one of the most massive parts of the unloader, yet is so adjusted that it can be moved back and forth in the hold. The bucket itself, however, is so ingeniously constructed that, as already stated, it removes practically all of the ore, since it can be adjusted to the shape of the hold. The bucket, as generally constructed, is of ten gross tons capacity, and opened and closed by hydraulic power when steam is used, or by specially designed motors in case electricity is the source of power. The total spread of the bucket when wide open is over 18 feet, and by telescopic motion can be made to reach, when open, more than half-way from the center of one hatch to the center of the other. It also travels lengthways of the hatch to the sides of the boat; consequently the operator is able to reach almost the entire cargo. In an ordinary boat there is no difficulty in reaching 90 per cent of the cargo, and in some of the compartment boats the machines have actually unloaded 97 per cent without the help of shovelers.

The leg to which the shovel is attached is in turn connected to the beam, which answers to the beam of the ordinary steam shovel. It is pivoted, however, and mounted upon a massive truck. In operation, the walking beam, as it is called, is run out upon the truck until the unloader leg with its bucket is over the section of hold to be emptied. The beam is then lowered until the bucket has reached the material and the mechanism controlling the bucket set in motion. When it is filled the movements are of course reversed, the beam raised and moved inward until the bucket is in position to discharge its contents. The truck frame carrying the walking beam consists of two parallel girders mounted upon truck wheels, the girders being installed at right angles to the face of the dock. Between these girders are set hoppers into which the contents of the bucket are deposited. Where the unloaders are used for transferring ore from vessels, the material taken out may be carried some distance to the furnaces or to stock piles adjacent to the wharf. Where the ore is to be carried away by rail, the receiving hoppers are located above the railroad track so that as fast as cars are drawn along beneath, they can be filled by gravity. Where the ore is to be placed on the stock pile the cantilever conveyor is utilized, and is attached to the other end of the unloader, the hoppers being unloaded into the series of buckets which it carries. By means of the cable and trolley, the ore is distributed upon the stock pile as desired.

The unloaders can be operated either by steam or electric power. On the steam-operated machines the power is supplied by a boiler of heavy locomotive type and 175-horse-power capacity, which operates a steam pump capable of supplying the necessary amount of water at 1,000 pounds pressure per square inch. Hydraulic cylinders are used to open, close, and rotate the bucket, to move the trolley and to raise and lower the walking beam. An independent steam engine supplies the power for moving the machine along the docks and for the haulage of the bucket car. On the electrically-operated machines the power is supplied from motors which take their current through sliding contacts, from lines laid along the dock. The motors for operating the bucket are of 80 horse-power, those for hoisting the walking beam are 150 horse-power, for trolleying in and out 50 horse-power, and for operating the bucket car and moving the machine 260 horse-power. The controllers are of magnetic type especially built for heavy service.

In spite of its capacity the mechanism is so compact that only three operators are required to each unloader. The bucket operator, who rides into the hatch and out over the dock with his bucket, controls all motions of the machine, except travel from hatch to hatch and operation of the bucket car, his position in the bucket leg enabling him to watch the work to best advantage. Another operator is required for moving the machine from hatch to hatch and for controlling the bucket car. On the steam-operated machines a fireman is also necessary. On the electrically-operated machines an extra man is usually provided for oiling and adjustments.

The advantage of this mechanism in connection with large smelting plants has caused it to be installed at the works of the Lackawanna Steel Company at Buffalo—an industry which has possibly a greater variety of material conveyors than any other in the world. Here a single unloader will remove cargoes of ore at the rate of nearly 300 tons an hour, taking out 95 per cent of the cargo without the assistance of hand shovelers. Other apparatus installed at the Buffalo works includes a car dumper which is also notable for its design and capacity. It is utilized to carry coal intended for the coke ovens of the Lackawanna Company, and consists of a rotating cradle supported on a rectangular framework. When the car is pushed upon the platform of the dumper it is clamped into the cradle, raised to the proper elevation, and then inverted to such an angle that its contents fall into the dumping bin through a chute. From this receptacle the coal is carried by means of endless conveyors into the receiving bins. By this plan all of the fuel re-