

THE BEET SUGAR INDUSTRY IN NEW YORK STATE.

BY S. L. SHELDON.

At Binghamton, Broome County, N. Y., is located a factory which manufactures each day during the working season from twelve to sixteen tons of pure granulated sugar. The popular notion usually associates sugar with sugar cane and with tropical climates. But this popular notion must change, for the sugar supply of the world will soon be manufactured from the beet. Two factories are now in operation in New York State, one at Binghamton and one at Rome. A large sugar factory is also located at Bay City, Mich. Other factories are being planned in New York and Michigan, and it will be but a short time before this industry of the manufacture of sugar from beets will come into wide prominence. So important is the industry likely to become that a description of the Binghamton factory and the methods of extracting the sugar from the beets will prove of interest.

The factory is located some three miles from the city of Binghamton on the Delaware, Lackawanna & Western Railroad. The main building is a substantial brick structure, and the storage room for the beets is partially provided for by four mammoth sheds, each 460 feet long, 16 feet wide, and 12 feet high. It was thought that these sheds would furnish sufficient storage room for the beets, but, from the photograph, it will be seen that many carloads have been dumped upon the ground; indeed, there are apparently more upon the ground than in the sheds, and they are being received from the farmers at the rate of 100 carloads each day. In the spring of 1898 some 2,000 acres of beets were contracted for; the farmers agreeing to raise the beets and the company agreeing to pay \$5 per ton for the same.

Upon arrival at the factory the beets are unloaded from the cars into the sheds or upon the ground in the yard. Underneath each shed, and running its entire length, is a sluiceway through which runs water which has been heated to the boiling point in the factory. The beets are rolled into this sluiceway and the current is sufficient to carry them to the factory. The warm water so soaks and loosens the dirt that it is easily removed when the beets get to the washing machine. When the beets are unloaded into the sheds the hand work upon them is completed, and from that time they are carried forward by water or by machinery. As they near the end of the sluiceway they are seized by a screw elevator and raised to the factory, where the first operation is the washing. They are dumped into large tanks where revolving arms attached to a horizontal axis thoroughly churn them around and constantly work them forward toward the clean water. They pass from the first washing tank into a second one, and here the process is repeated and the beets are thoroughly cleaned. From the washing tanks they go to the bucket elevators and are carried to the top of the building. The next operation (pulping the beets) is done by a system of knives or scoops fastened to a horizontal wheel. The knives have scalloped edges and are situated at the bottom of a large hopper. As the beets come down upon these rapidly revolving knives they are literally cut into shreds or pulp. This pulp is put

into what is called the "diffusion battery." This battery is really a system of great tanks so connected that the water can pass from one to the other. The water is put in upon the beet pulp and the sugar is soaked out, the water being passed from one tank to another until it has become saturated, when it is drawn off. The fresh water is always put in upon the pulp, which is most nearly exhausted of its sugar content. The waste pulp is carted out of the building and is almost

entirely a waste product. It is relished by stock, and no doubt will soon be prized as stock food. The juice is drawn from the battery and a measured quantity is passed on to the lime tanks. Here it comes in contact with the milk of lime, which removes certain impurities. Carbon dioxide, which has been stored from the burning limestone, is forced into the mixture of milk of lime and the juices from the diffusion battery, and the lime is precipitated with the impurities which it

sugar is slowly moved along, passing over heated steam pipes until finally it comes out of the other end of the cylinder as crystallized sugar.

The most troublesome product to handle is the molasses, which is separated from the sugar by the centrifugals. It is stored in large tanks in a room heated to a temperature of about 115° F. After remaining there for three weeks, it becomes partially crystallized and is then taken out and run through the mill again, and a portion of the sugar is extracted. It is believed that American inventive genius will devise machinery by which this molasses can all be treated at once without the necessity of storing, and the sugar all removed. Indeed, it is said that the factory at Bay City, Mich., is so equipped that all the sugar is extracted within twenty-four hours.

Not all the sugar contained in the beets can be extracted. From a ton of beets analyzing 15 per cent sugar, about 250 pounds of sugar can be secured. The importance of high grade beets is very great, and the difference between beets containing 12 per cent sugar and beets containing 15 per cent sugar may mean the difference between profit and loss. To illustrate this point, the Binghamton factory has a capacity of 300 tons of beets per day, and the working season consists of about 100 days. If the 30,000 tons of beets used contain 15 per cent sugar, the output will be about 7,500,000 pounds of sugar. If the beets contain only 12 per cent sugar, the product will be only some

5,400,000 pounds. This difference of 2,100,000 pounds of sugar is an important consideration and accounts for the desire of factories to secure high grade beets.

The new industry promises much for those States which are favored with proper climatic conditions. It makes a new cash crop for the farmers, who are able to net from \$25 to \$50 per acre. It opens a new channel for capital and the investment under proper management is a safe one. The important problem now is to secure men trained in the business who are capable of managing American labor. It is found that foreigners, while they may have been successful in their home country, are not entirely adapted to the conditions which prevail here.

To American youths who will prepare themselves for the work of managers of factories there is promise of lucrative employment. Several of our large universities are considering the organization of "sugar" courses. Cornell University will, no doubt, have such a course in operation in the near future. The chemical work at a sugar factory also requires expert management, and the success of the factory depends to a large degree upon the fidelity of the chemist in charge of what is called the "control" work. The limestone is analyzed for impurities which would possibly be injurious to the crystallization of the sugar; the fuel is analyzed to determine the per cent of carbon; the juices are analyzed and tested at various stages to ascertain if the proper degree of acidity or alkalinity is present, for the slightest deviation means loss of sugar. The waste pulp is analyzed, and, indeed, the watchful eye of the chemist must be upon every operation.

There has been no industry introduced in recent years which has offered greater inducements for young men, or for the

American farmer, or for the investment of capital, than the beet sugar industry.

THE expedition which was sent out by the Swedish government in search of Andree, the Arctic explorer who attempted to reach the North Pole in a balloon, has returned from Northern Siberia, where months were spent in fruitless efforts to learn the fate of Andree and his two fellow voyagers.



SHEDS FOR STORING BEETS, AND METHOD OF HANDLING.

has absorbed. After passing through various mixing tanks, the juice passes to the filter presses. Here the juice is forced through cloth and comes out almost as clear as water. After passing through two sets of these filter presses, the juice goes to the bleaching process. This is done by means of fumes of sulphur. The juice is made to drip slowly over a board filled with holes, and the sulphur dioxide is brought into intimate contact with every drop. All of these processes are preliminary to the "boiling down." After bleaching, the juice goes to what is called the "triple effect vacuum pans." These pans are simply large upright boilers which have had the air partially exhausted by means of pumps. The liquid boils violently in them at a temperature of 70° F., and the "boiling down" is greatly hastened. From the first boiling the juice goes to the sulphuration tanks, where it is again bleached. After passing again through the filter presses, all traces of sulphur and other impurities are removed. The "boil-

ing down" is then completed in vacuum pans. The next operation is performed by the centrifugals. In these rapidly revolving cylinders the molasses is thrown off from the particles of sugar. The principle is the same as in the common milk separator, where the cream is thrown out from the milk. The sugar is very damp after being separated from the molasses, and is dried by being passed through a long, slowly revolving cylinder. This cylinder is raised at one end and the



CHEMICAL LABORATORY FOR TESTING THE BEETS, ETC.

ing down" is then completed in vacuum pans. The next operation is performed by the centrifugals. In these rapidly revolving cylinders the molasses is thrown off from the particles of sugar. The principle is the same as in the common milk separator, where the cream is thrown out from the milk. The sugar is very damp after being separated from the molasses, and is dried by being passed through a long, slowly revolving cylinder. This cylinder is raised at one end and the

SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyright, 1899, by Munn & Co.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

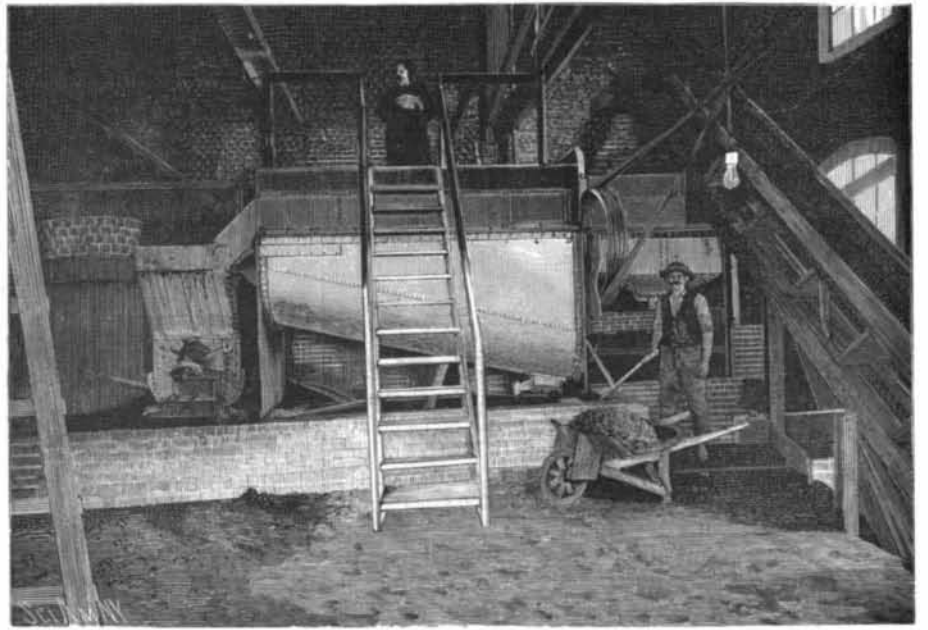
Vol. LXXX.—No. 3.
ESTABLISHED 1845.

NEW YORK, JANUARY 21, 1899.

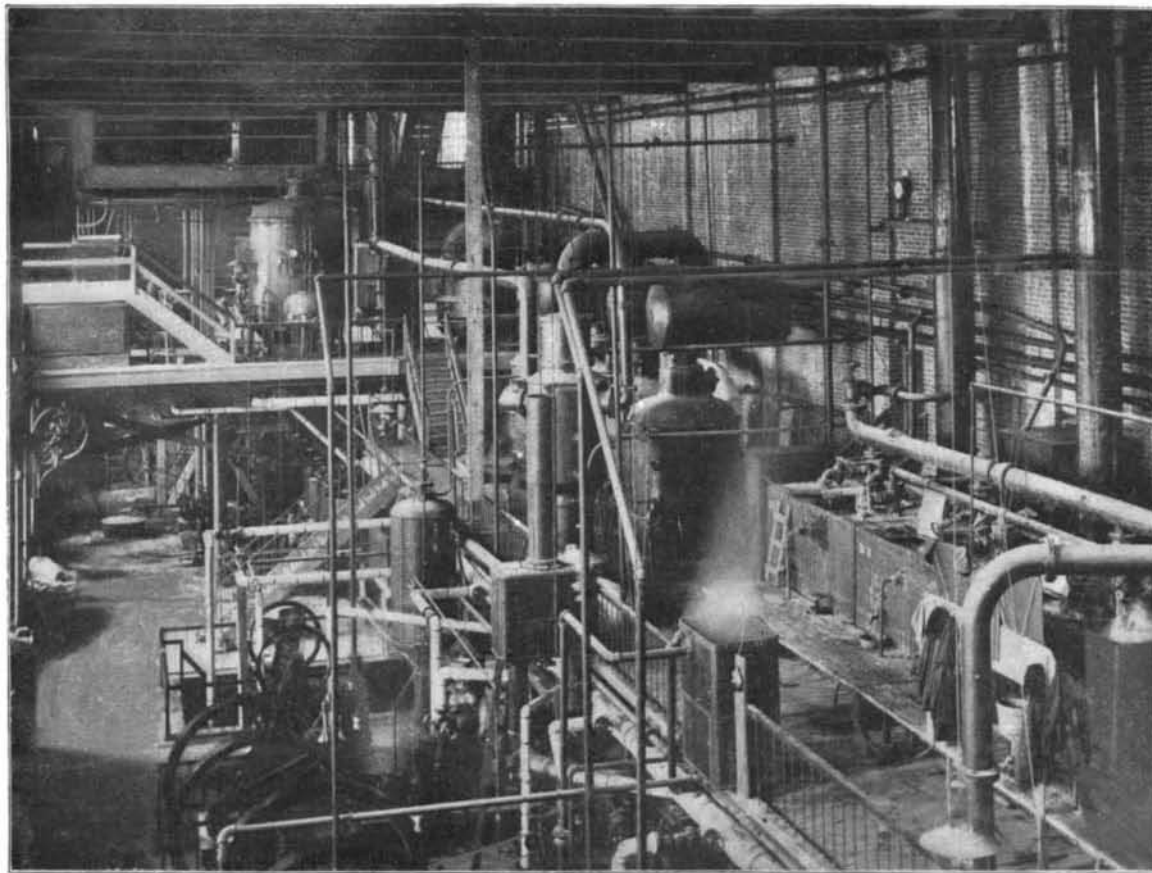
[\$3.00 A YEAR.
WEEKLY.]



Harvesting the Beets.



The Machine that Completes the Washing of the Beets.



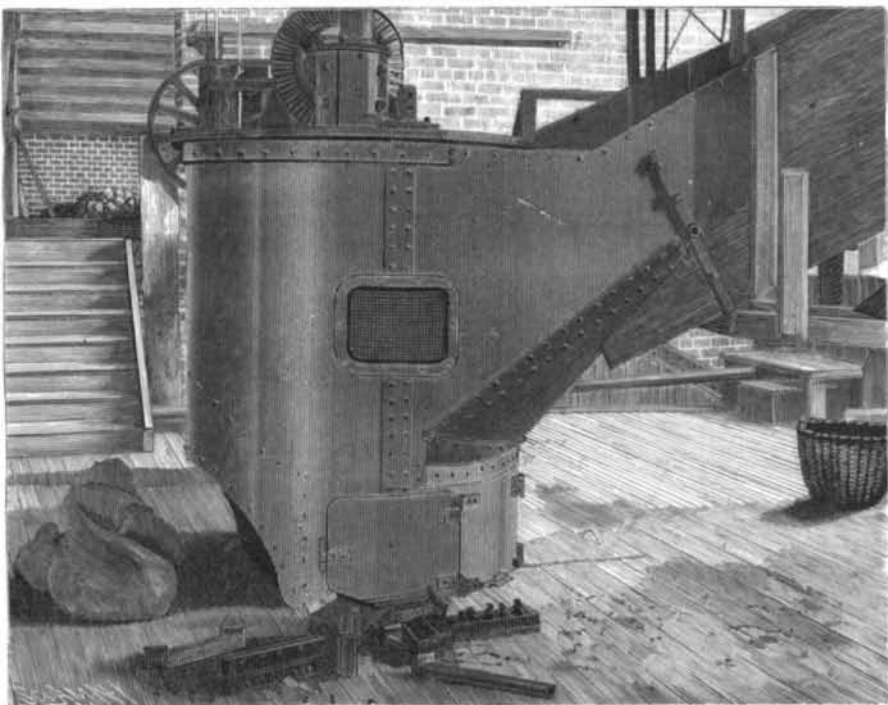
General View of Apparatus for Evaporating the Juice.



Putting the Beets into Sluice of Hot Water to Wash.



General View of the Exterior of the Building.



The Machine for Slicing the Beets.



The Diffusion Cells, where the Sugar is Soaked Out.

THE MANUFACTURE OF BEET SUGAR AS CONDUCTED IN NEW YORK STATE.—[See page 36.]