

line sugar is obtained than by the application of pressure; the expense of pressing-cloths, and the cleaning and renewing them, are done entirely away with; the expense for motive power and machinery is considerably reduced, and the expense of manual labor is much less, requiring but one-fourth the number of laborers necessary for the pressing process.

Within a short time Mr. Robert has introduced a modification of his original apparatus. In this modification the series of vessels is abandoned, and one single chamber is employed instead. In the centre of the chamber is a feeding cylinder containing a feeding screw, driven by gearing from above. The sliced beet root is passed through a hopper to the bottom of the feeding chamber, whence it passes out through openings into the outer cylinder of the diffuser, and gradually rising to the top, is carried off by a regulating rake, driven by independent gearing. From the top of the diffuser, water is regularly supplied through small pipes, meeting in its descent the most exhausted slices as they rise to the discharge level, and passing through to the richer material as it becomes more and more saturated. At the bottom, it issues through perforations or outlet pipes, and is carried off to a cistern, where it is heated, and then returned upon the beet by the central feeding tube, by which the beet is supplied to the diffusing chamber. This apparatus, which has answered well at beet sugar and spirit works, has also been applied to cane sugar factories, where it promises good results.

The heat of the liquor or water supplied must be sufficient to *kill* the vegetable life in the root, as the diffusion process does not take place, or affect the skin of the sugar cells, until the *vegetable life* is destroyed. The heat required in the mass is at least 140° Fahrenheit, and from that up to nearly boiling.

The shape into which the roots are sliced is such that they will not lie close together, but allow the water of diffusion readily to percolate to every part. Long finger-like pieces, cut into a triangular shape, are considered the best, although some cut the roots up into small square masses, and others into fine oblong square pieces. That process is best which keeps the mass most open, and the pieces of root from packing together.

This process does not, however, do away with the necessary defecation with lime—less lime may be necessary, and the scums and curdlings will be less in amount and easier to get rid of, but the lime process must be used until the juice is properly defecated and cleared from impurities.

The carbonatation, as already described, must also be applied to the juice, and the entire process, with the exception of grating or rasping and pressing, must go on as before given.

The spent slices, when not wanted to be fed at once, may have all the waste water taken out of them by being centrifugally,

and the water so obtained will save so much of the sugar, and can be used in the diffusion vessel instead of fresh water. Cattle do as well on the spent slices as on the pressed cake.

#### PURIFICATION OF THE SYRUP.

The great object in the purification of beet root sugar, is the getting rid of the potash and salt, and other saline matters. In the first instance this was done by repeated strainings through bone charcoal, but that being very troublesome, and expensive, several other plans have been tried, and are generally now adopted.

The first of these plans is the "Osmose" process, which is founded on the fact that certain substances and mediums allow readily the passage of salt through them, while the medium prevents the passage of the sugar, except in a very small degree. The principle is an extended one, and is known under the name of "dialysis," but as we only want to show how the process is used in the manufacture of beet sugar, we shall not go into the general question.

The usual machinery adopted for the Osmose process is the "Osmogene," and is thus described by Crookes, in his admirable work on beet sugar:—

"The apparatus consists of about fifty cells, separated by sheets of parchment paper, laid flat, and connected at the edges all round, the space between each pair of sheets being fully half an inch. Each sheet is supported by a cross piece of wood, and a network of twine. The whole arrangement is about four feet long, and three feet high. By a peculiar arrangement of connection the syrup admitted from below passes through every second division, while water admitted from above so passes through every second space, and at last flows off from below, at a strength from 1° to 2° B, or say 1° to 2½° Twaddle (this strength is caused by the salts taken out of the sugar). Owing to the high diffusive power of the salts, as compared with that of sugar, the former readily pass through, together with only a comparatively small portion of the sugar, which may be saved as before, by fermentation—whilst the potash, and salts are saved by evaporation, and burning. This will no doubt appear to many too delicate a process to work on a large scale, but experience proves that it works well, and that six such machines are sufficient for a manufactory working daily about 250 tons of beets."

#### MODIFICATION OF THE OSMOSE PROCESS.

The following modification of the Osmose arrangement originates with the author, and has been highly approved of by one of the best sugar engineers in France, who says he shall adopt it in his works in future, as it admits of being cleaned, and renewed better than the ordinary system. It takes more room, but that is a small matter