difficult and inconvenient. The erection of the cells in straight lines may cause some little complication in charging, but it allows the hot spent slices to be discharged upon a travelling band which takes them to an elevator, an arrangement simpler than any which is practicable when the cells are disposed in a circle. Recently, however, a well-known sugar maker in Germany has altered his battery in such manner that instead of having to open a large door below the cells in order to discharge them promptly, he opens a comparatively small valve and, applying compressed air at the top of the cell, blows the whole contents of spent slices up a pipe, to the drying apparatus, thus saving not only a great deal of time but also a great deal of labour of a kind which is both arduous and painful, especially during cold weather. The slices so blown up, or elevated, are passed through a mill which expels the surplus water, and are then pressed into cakes and dried until they hold about 12% of water and 88% of beet fibre. These cakes, sold as food for cattle, fetch as much as £4 per ton in Rumania, where four or five beetroot factories are now at work. A cell when filled with fresh slices becomes the head of the battery, and where skilled scientific control can be relied upon to regulate the process, the best and most economical way of heating the slices, previous to admitting thc hot liquor from the next cell, is by direct steam; but as the slightest inattention or carelessness in the admission of direct steam might have the effect of inverting sugar and thereby causing the loss of some portion of saccharine in the slices, water heaters are generally used, through which water is passed and heated up previous to admission to the freshly-filled cell. When once a cell is filled up and the slices are warmed through, the liquor from the adjoining cell, which hitherto has been running out of it to the saturators, is turned into the new cell, and beginning to displace the juice from the fresh slices, runs thence to the saturators. When the new cell comes into operation and becomes the head of the battery, the first or tail cell is thrown out, and number two be­comes the tail cell, and so the rounds are repeated; one cell is always being emptied and one filled or charged with slices and heated up, the latter becoming the head of the battery as soon as it is ready.

*Saturation.—*The juice, previously treated with lime in the diffusion battery, flows thence into a saturator. This is a closed vessel, into which carbonic acid gas (produced as described here­after) is forced, and combining with the lime in the juice forms carbonate of lime. The whole is then passed through filter presses, the clear juice being run off for further treatment, while the carbon­ate of lime is obtained in cakes which are taken to the fields as manure. The principal improvement made of recent years in this portion of the process has been the construction of pipes through which the carbonic acid gas is injected into the juice in such a manner that they can be easily withdrawn and a clean set substituted. The filter presses remain substantially unchanged, although many ingenious but slight alterations have been made in their details. The juice., which has now become comparatively clear, is again treated with lime, and again passed through a saturator and filter presses, and comes out still clearer than before. It is then treated with sulphurous acid gas, for the purpose of decolorization, again limed to neutralize the acid, and then passed through a third saturator wherein all traces of lime and sulphur are removed.

A process for purifying and decolorizing the juice expressed from beetroots by the addition of a small quantity of manganate of lime (20 to 50 grammes per hectolitre of juice), under the influence of an electric current, was worked with considerable success in a sugar factory in the department of Seine-et-Mame in the year 1900-1901. A saving of 40% is stated to be effected in lime. The use of sulphurous acid gas is entirely abandoned, and instead of three carbonatations with corresponding labour and plant only one is required. The coefficient of purity is increased and the viscosity of the juice diminished. The total saving effected is stated to be equivalent to 3 francs per ton of beetroot worked up. This system is also being tried on a small scale with sugar-cane juice in the West Indies. If by this process a more perfect defeca­tion and purification of the juice is obtained, it will no doubt be highly beneficial to the cane planter, though no great economy in lime can be effected, because but very little is used in a cane factory in comparison with the amount used in a beet factory.

*Evaporation and Crystallization.—*The clear juice thus obtained is evaporated in a multiple-effect evaporator and crystallized in a vacuum pan, and the sugar is purged in centrifugals. From the centrifugal the sugar is either turned out without washing as raw sugar, only fit for the refinery, or else it is well washed with a spray of water and air until white and dry, and it is then offered in the market as refined sugar, although it has never passed through animal charcoal (bone-black). The processes of evaporation and concentration are carried on as they are in a cane sugar factory, but with this advantage, that the beet solutions are freer from gum and glucose than those obtained from sugar-canes, and are therefore easier to cook.

*Curing.—*There are. various systems of purging refined, or so- called refined, sugar in centrifugals, all designed with a view of obtaining the sugar in lumps or tablets, so as to appear as if it had been turned out from moulds and not from centrifugals, and great ingenuity and large sums of money have been spent in perfecting these different systems, with more or less happy results. But the great achievement of recent manufacture is the production, without the use of animal charcoal, of a cheaper, but good and wholesome article, in appearance equal to refined sugar for all intents and purposes, except for making preserves of fruits in the old-fashioned way. The wholesale jam manufacturers of the present day use this sugar; they boil the jam *in vacuo* and secure a product that will last a long time without deteriorating, but it lacks the delicacy and distinctive flavour of fruit preserved by a careful housekeeper, who boils it in an open pan with cane sugar to a less density, though exposed for a short time to a greater heat..

*Carbonatation.*—The carbonic acid gas injected into the highly limed juice in the saturators is made by the calcination of limestone in a kiln provided with three cleaning doors, so arranged as to allow the lime to be removed simultaneously from them every six hours. The gas generated in the kiln is taken off at the top by a pipe to a gas-washer. In this it passes through four sheets of water, by which it is not only freed from any dust and dirt that may have come over with it from the kiln, but is also cooled to a temperature which permits an air-pump to withdraw the gas from tne kiln, through the gas-washer, and force it into the saturators, without overheating. In some factories for refining sugar made from beet or canes this system of carbonatation is used, and en­ables the refiner to work with syrups distinctly alkaline and to economize a notable amount of animal charcoal.

*Refining.—*Briefly, sugar-refining consists of melting raw or unrefined sugar with water into a syrup of 27° to 28° Beaumé, or 1230 specific gravity, passing it through filtering cloth to remove the sand and other matters in mechanical suspension, and then through animal charcoal to remove all traces of colour­ing matter and lime, thus producing a perfectly clear white syrup, which, cooked in the vacuum pan and crystallized, becomes the refined sugar of commerce.

*Melting Pans.—*The melting pans are generally circular vessels> fitted with a perforated false bottom, on which the sugar to be melted is dumped. The pans are provided with steam worms to keep the mass hot as required, and with mechanical stirrers to keep it in movement and thoroughly mixed with the water and sweet water which are added to the sugar to obtain a solution of the specific gravity desired. Any sand or heavy matter in suspension is allowed to fall to the bottom of the pan into the " sandbox ” before the melted sugar is run off to the cloth filters. In a process employed with great success in some refineries the raw sugars are washed before being melted, and thus a purer article is obtained for subsequent treatment. In this process the raw sugar is mixed with a small amount of syrup so as to form a suitable magma, and is then run into a continuous centrifugal, where it is sufficiently washed, and from which it runs out, com­paratively clean, into the melting pans described above.

*Filters.—*Taylor bag filters are generally used for clearing the melted liquor of its mechanical impurities. They were introduced years ago by the man whose name they still retain, but they are very different in construction to-day from what they were when first employed. They consist of tanks or cisterns fitted with “ heads ” from which a number of bags of specially woven cloth are suspended in a suitable manner, and into which the melted sugar or liquor to be filtered flows from the melting pans. The bags, though 60 in. or more in circumference, are folded up in such a way that a sheath about 15 in. in circumference can be passed over them. Thus a maximum of filtering surface with a minimum of liquor in each bag is obtained, and a far greater number, of bags are got into a given area that would otherwise be possible, while the danger of bursting the bags by leaving them unsupported is avoided. As the liquor goes on filtering through the bags they gradually get filled up with slime and sludge, and the clear liquor ceases to run. Steam is then turned on to the outside of the bags and sheaths, and hot water is run through them, to wash out all the sweets they contain. Large doors at the side of the cistern are then opened, and as soon as the bags are cool enough they are removed at the expense of very exacting labour and considerable time, and fresh bags and sheaths are fixed in their places ready for filtering fresh liquor. The dirty bags and sheaths are. then washed, mangled and dried, and made ready for use again. In a refinery in Nova Scotia a system has been introduced by which a travelling crane above the bag filters lifts up any head bodily with all its bags attached, and runs it to the mud and washing tanks at the end of the battery, while another similar crane drops, another head, fitted with fresh bags, into the place of the one just, removed. The whole operation of thus changing a filter occupies about ten minutes, and there is no need for anyone to enter the hot cistern to detach the bags, which are removed in the open air above the mud tank. By this arrangement the work of a refinery can be carried on with about one-half the cisterns otherwise required, because, although it does not reduce the number of bags required per day for a given amount of work, it enables the refiner to use one cistern twice a day with