fresh bags, instead of only once as heretofore. In some refineries the travelling cranes are now run by electricity, which still further facilitates the work. Another method of enabling more work to be done in a given time in a given cistern is the use of a bag twice the ordinary length, open at both ends. This, being folded and placed in its sheath, is attached by both ends to the head, so that the melted liquor runs into both openings at the same time. The mud collects at the bottom of the U, and allows the upper part of the bag to filter for a longer time than would be the case if the bottom end were closed and if the bag hung straight like the letter l

The clear, bright syrup coming from the bag filters passes to the charcoal cisterns or filters. These are large cylindrical vessels from 20 to 50 ft. high, and of such diameter as to hold a given quantity of animal charcoal (also called “ bone-black ” and " char ”) in proportion to the contemplated output of the refinery. A very usual size of cistern forming a convenient unit is one that will hold 20 tons of char. Each cistern is fitted with a perforated false bottom, on which a blanket or specially woven cloth is placed, to receive the char which is poured in from the top, and packed as evenly as possible until the cistern is filled. The char is then “ settled " by water being slowly run on to it, in order to prevent the syrup making channels for itself and not permeating the whole mass evenly. The cistern being thus packed and settled is closed, and the syrup from the bag filters, heated up to nearly boiling point, is admitted at the top until the cistern is quite full. A small pipe entering below the false bottom allows the air in the cistern to escape as it is displaced by the water or syrup. In some refineries this pipe, which is carried up to a higher level than the top of the cistern, is fitted with a whistle which sounds as long as the air escapes. When the sound ceases the cistern is known to be full, and the entrance of further water or syrup is stopped. The syrup in the cistern is allowed to remain for about twelve hours, by which time the char will have absorbed all the colouring matter in it, as well as the lime. A cistern well packed with 20 tons of char will hold, in addition, about 10 tons of syrup, and after settling, this can be pressed out by allowing second quality syrup, also heated to nearly boiling point, to enter the cistern slowly from the top, or it may be pressed out by boiling water. By carefully watching the flow from the discharge cock of the cistern the change from the first liquor to the next is easily de­tected, and the discharge is diverted from the canal for the first liquor to the canal for the second liquor, and, when required, to the canals for the third and fourth liquors. Finally, boiling water is admitted and forces out all the last liquor, and then continues to run and wash out the sweets until only a trace remains. This weak solution, called “ sweet water,” is sometimes used for melt­ing the raw sugar, or it is evaporated in a multiple-effect apparatus to 27° Beaumé density, passed through the char filter, and cooked in the vacuum pan like the other liquors. After the sweets have come away, cold water is passed through the char until no trace of lime or sulphate of lime is found in it; then a large manhole at the bottom of the cistern is opened, and the washed and spent char is removed. In most modern refineries the cisterns are so arranged that the spent char falls on to a travelling band and is conducted to an elevator which carries it up to the drying floor of the charcoal kiln.

*Retorts for Reburning Char.*—The kilns are made with either fixed or revolving retorts. The former perhaps produce a little better char, but the latter, working almost automatically, require less labour and attention for an equal amount of work, and on the whole have proved very satisfactory. From the drying floor on which the spent char is heaped up it falls by gravitation into the retorts. These are set in a kiln or oven, and are kept at as even a tempera­ture as possible, corresponding to a dull cherry-red. Below each retort, and attached to it, is a cooler formed of thin sheet-iron, which receives the hot char as it passes from the retort, and at the bottom of the cooler is an arrangement of valves which permits a certain amount of char to drop out and no more. With the fixed retorts these valves are worked from time to time by the attendant, but with revolving retorts they are worked continuously and automatically and allow from sixteen to twenty-four ounces of char to escape per minute from each cooler, and so make room in the retort above for a corresponding quantity to enter from the drying floor. The reburnt and cooled char is collected and sent back to the char cisterns. In the best-appointed refineries the whole of the work in connexion with the char is performed mechani­cally, with the exception of packing the filter cisterns with fresh char and emptying the spent and washed char on to the carrying bands. In former days, when refining sugar or " sugar baking ” was supposed to be a mystery only understood by a few of the initiated, there was a place in the refinery called the “ secret room," and this name is still used in some refineries, where, how­ever, it applies not to any room, but to a small copper cistern, constructed with five or six or more divisions or small canals, into which all the charcoal cisterns discharge their liquors by pipes led up from them to the top of the cistern. Each pipe is fitted with a cock and swivel, in such a manner that the liquor from the cistern can be turned into the proper division according to its quality.

*Vacuum Pans and Receivers.*—The filtered liquors, being collected in the various service tanks according to their qualities, are drawn up into the vacuum pans and boiled to crystals. These are then discharged into large receivers, which are generally fitted with stirrers, and from the receivers the cooked mass passes to the centrifugal machines. As in the beetroot factories, these machines work on different systems, but nearly all are arranged to turn out sugar in lumps or tablets presenting an appearance similar to that of loaf sugar made in moulds, as this kind of sugar meets with the greatest demand. Granulated sugar, so called, is made by passing the crystals, after leaving the centrifugals, through a large and slightly inclined revolving cylinder with a smaller one inside heated by steam. The sugar fed into the upper end of the cylinder gradually works its way down to the lower, showering itself upon the heated central cylinder. A fan blast enters the lower end, and, passing out at the upper end, carries off the vapour produced by the drying of the sugar, and at the same time assists the evapora­tion. The dry sugar then passes into a rotating screen fitted with two meshes, so that three grades of sugar are obtained, the coarsest being that which falls out at the lower end of the revolving screen.

*Recent Improvements.—*Systematic feeding for the vacuum pan and systematic washing of the massecuite have been recently introduced not only into refineries, but also into sugar houses or factories on plantations of both cane and beetroot, and great advantages have resulted from their employment. The first- mentioned process consists of charging and feeding the vacuum pan with the richest syrup, and then as the crystals form and this syrup becomes thereby less rich the pan is fed with syrup of lower richness, but still of a richness equal to that of the mother-liquor to which it is added, and so on until but little mother-liquor is left, and that of the poorest quality. The systematic washing of the massecuite is the reverse of this process. When the massecuite, well pugged and prepared for purging, is in the centrifugals, it is first washed with syrup of low density, to assist the separation of mother-liquor of similar quality, this washing being supple­mented by the injection of pure syrup of high density, or “ clairce,” when very white sugar is required. The manufacturers who have adopted this system assert that, as compared with other methods, not only do they obtain an increased yield of sugar of better quality, but that they do so at a less cost for running their machines and with a reduced expenditure in sugar and “ clairce.” " Clairce ” is the French term for syrup of 27° to 30° Beaumé specially prepared from the purest sugar.

Apart from modifications in the details of sugar refining which have come into use in late years, it should be mentioned that loaf sugar made in conical moulds, and sugars made otherwise, to re­semble loaf sugar, have practically disappeared from the trade, having been replaced by cube sugar, which is found to be more economical as subject to less waste by grocers and housekeepers, and also less troublesome to buy and sell. Its manufacture was introduced into England many years ago by Messrs Henry Tate & Sons, and they subsequently adopted and use now the improved process and apparatus patented in March 1890 by M Gustave Adant, a foreman sugar refiner of Brussels.

The following is a Brief description of the process and apparatus, as communicated by the courtesy of Messrs Henry Tate & Sons, Ltd. : Groups of cells or moulds are built within and against a cylindrical iron casing, by means of vertical plates inserted in grooves and set radially to the axis of the casing. Each cell is of suitable dimen­sions to turn out a slab of sugar about 14 in. long—this being about the height of the cell—and about 8 in. wide and about 1/2 in. to 5/8 in. thick. By means of a travelling crane the casing is placed within an iron drum, to which it is secured, and is then brought under an overhead vacuum pan, from which the cells are filled with massecuite. After cooling, the casing is lifted out of the drum by a crane, assisted by compressed air, and is then con­veyed by a travelling crane to a vertical centrifugal, inside of which it is made fast. Suitable provision is made for the egress of syrup from the massecuite in the cells when undergoing purging in the centrifugal ; and the washing of the crystals can be aided by the injection of refined syrup and completed by that of "clairce.” When this is done, the casing is hoisted out of the centrifugal and the vertical plates and the slabs of sugar are extracted. The slabs are sent by a conveyor to a drying stove, whence they issue to pass through a cutting machine, provided with knives so arranged that the cutting takes place both downwards and upwards, and here the slabs are cut into cubes. The cubes fall from the cutting machine on to a riddling machine, which separates those which are defective in size from the rest. These latter pass to automatic weighing machines, which drop them, in quantities of 1 cwt., into wooden boxes of uniform measurement, made to contain that weight; and the boxes are then conveyed to the storehouse, ready for sale.

*History and. Statistics.—*Strabo xv. i. 20, has an inaccurate notice from Nearchus of the Indian honey-bearing reed, and various classical writers of the first century of our era notice the sweet sap of the Indian reed or even the granulated salt-like product which was imported from India, or from Arabia