

UNITED STATES PATENT OFFICE.

HENRI ARMAND JOSEPH MANOURY, OF PARIS, FRANCE.

SUGAR-BOILING.

SPECIFICATION forming part of Letters Patent No. 599,148, dated February 15, 1898.

Application filed November 26, 1895. Serial No. 570,207. (No specimens.) Patented in France November 24, 1894, No. 243,104; in Belgium December 21, 1894, No. 113,303; in Spain January 7, 1895, No. 16,828, and in Hungary March 6, 1895, No. 3,450.

To all whom it may concern:

Be it known that I, HENRI ARMAND JOSEPH MANOURY, a citizen of the Republic of France, residing at Paris, in the Republic of France, have invented certain new and useful Improvements in the Manufacture of Sugar, (for which I have received Letters Patent in France, dated November 24, 1894, No. 243,104; in Belgium, dated December 21, 1894, No. 113,303; in Spain, dated January 7, 1895, No. 16,828, and in Hungary, dated March 6, 1895, No. 3,450,) of which the following is a specification.

This invention has for its object to effect in a single operation the separation of the sugar and the final molasses contained in the syrups of sugar works and refineries without making use of chemical agents or costly apparatus.

It consists, on the one hand, of a system of rational regulation of the composition of the masses-cuites in such a way that the mother-liquor which surrounds the crystals consists solely of final molasses, and, on the other hand, in a method of treatment of these masses-cuites after removal from the boiling-pan with a view of insuring an easy separation of the crystals and the final molasses. These two phases of the process will now be successively described.

The principle of the invention consists in always obtaining masses-cuites of the first cast containing only sugar in crystals and final molasses.

It may first be just pointed out that what is called the "quotient of purity" is the relation between the weight of sugar contained in a liquid and the weight of dry substances (sugar and impurities) that it contains. For syrups derived from beet-root when this proportion is equal to or below 0.60 it is admitted that they are composed solely of final molasses. For cane sugar this quotient of purity may descend to 0.40. Take, for example, a masse-cuite derived from beet-root and containing—

Water	7
Sugar	83.70
Impurities.....	9.30
Total	100

At the melting temperature, however, the proportion of sugar dissolved is about three

to one of water which surrounds the crystals. Consequently for seven of water there will be $7 \times 3 = 21$ of sugar dissolved, and assuming that all the impurities are equally dissolved therein the quotient of purity of the mother-liquor of this masse-cuite will, as regards what has been hereinbefore stated, be as follows: $\frac{21}{21 + 9.30} = 0.69$, which shows that this liquid contains sugar capable of crystallization, seeing that the quotient of purity of the final molasses from beet-root may reach 0.60 at most. In order to reduce this purity without reducing the proportion of seven per cent. of water necessary for insuring the fluidity of the masse-cuite, a suitable proportion of final molasses arising from the centrifuging of the masses previously treated is introduced into the boiling-pan, and the concentration is then effected in such a way as to evaporate the excess of water contained in the molasses—that is to say, anything exceeding the seven per cent. which has been admitted to be necessary for the operations of running or flowing and centrifuging.

Admitting that the composition of the final molasses is as follows:

Water	25
Sugar	45
Non-sugar.....	30
	100

which corresponds to a quotient of purity of $\frac{45}{75} = 0.60$, and adding one of these final molasses to three of the masse-cuite we see that the quantity of impurities contained in this mass then becomes $\frac{30 + (9.30 \times 3)}{4}$, say about 14.50. The result of this is that the average composition of the mass becomes, after the concentration indicated,

Water	7
Sugar	78.50
Impurities.....	14.50
Total.....	100

and its quotient of purity is then $\frac{21}{21 + 14.5} = 0.591$ —that is to say, below the limit assigned

of 0.60—which proves that the mother-liquor of the masse-cuite is composed solely of final molasses.

It is thus seen that in the example given it is preferable to effect the boiling in the case of pure beet-root syrup by constantly inserting syrup into the pan during the operation of boiling in proportion as evaporation reduces the volume therein contained, in order that when the boiling is completed the pan may be well filled with masse-cuite. The filling of the pan is then completed by feeding with final molasses derived from a previous centrifuging and placed in a gaged tank with a graduated float, so that only the quantity calculated for reducing the purity of the mother-liquor below 0.60 is introduced. When this has been done, the evaporation is continued until only the seven per cent. of water necessary for the running and for the easy centrifuging is obtained. It is therefore evident that whatever may be the composition of the masse-cuite to be treated the exact proportion of final molasses which must be introduced in order to attain the desired result may be calculated in the manner hereinbefore described.

Experience has shown that it would be very difficult to operate the centrifuging of the masse-cuite, maintaining it exactly at the temperature which it had when flowing, and this is why it is preferable to operate on the mass suitably cooled. This cooling of the masse-cuite produces a supersaturation of the mother-liquor, which then no longer possesses the same dissolving power, and there must be added thereto the quantity of water necessary for dissolving the sugar and the impurities precipitated by the cooling. This addition may be made in the form of pure water, but it is preferable to have it assume the form of diluted final molasses. For this object the masse-cuite is cooled in an agitator provided with a false bottom, in which cold water circulates in such a way as to rapidly bring the temperature of the centrifugal chamber to, say, 20°, for instance; but at this temperature the water does not dissolve more than twice its weight of sugar in place of three times, which it dissolved at the melting temperature, and consequently for a masse-cuite containing seven per cent. of water seven per cent. of sugar will be precipitated, which will necessitate the introduction into the agitator of three and one-half per cent. of water to exactly dissolve the precipitated sugar and restore to the mother-liquor the necessary fluidity for the centrifuging. It is therefore easy to calculate for each case the quantity of diluted final molasses which

must be introduced into the agitator in order to provide the amount of water necessary for dissolving only the sugar and the impurities precipitated by the cooling, and in this manner it will be certain that the liquid separated by the centrifugals will be composed solely of final molasses. It is therefore evident that the use of an exactly-determined quantity of final molasses has the effect in the first phase of the process of imparting to the impoverished masse-cuite the necessary fluidity for the formation of the whole of the crystals of sugar which it can produce, whereas otherwise its pasty condition would prevent the last crystals from forming, and that in the second phase of the process the use of a given quantity of diluted final molasses has also the effect of increasing the fluidity of the cooled mass in order to permit of its being centrifuged under favorable conditions, while allowing only the sugar and the impurities precipitated by the cooling to be dissolved, in order to insure that the liquid separated by this centrifuging will be final molasses from which sugar can no longer be crystallized by concentration.

By the expression "final molasses" throughout the specification is meant a syrup or liquor derived from the centrifuging which is incapable of yielding further crystallization. This is to be distinguished from the product commonly termed "molasses," which differs from final molasses in the particulars that it does contain sugar capable of being crystallized.

I declare that what I claim is—

The method of treating masse-cuite in sugar making and refining, consisting in adding thereto toward the end of the boiling, a quantity of final molasses in proportion to the purity of the juices boiled, rapidly cooling the masse-cuite, then adding to the cooled mass a given quantity of diluted final molasses according to the difference in the solubility of the sugar in the water at the temperature of running, and at the temperature of the centrifuging, so that the quantity of free water contained in said final molasses dissolves only the sugar and the impurities precipitated by the cooling, in order to insure that the liquid separated out by the centrifuging shall be final molasses only, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

HENRI ARMAND JOSEPH MANOURY.

Witnesses:

EUGENE DUMAL,
JACQUES CONDOMY.