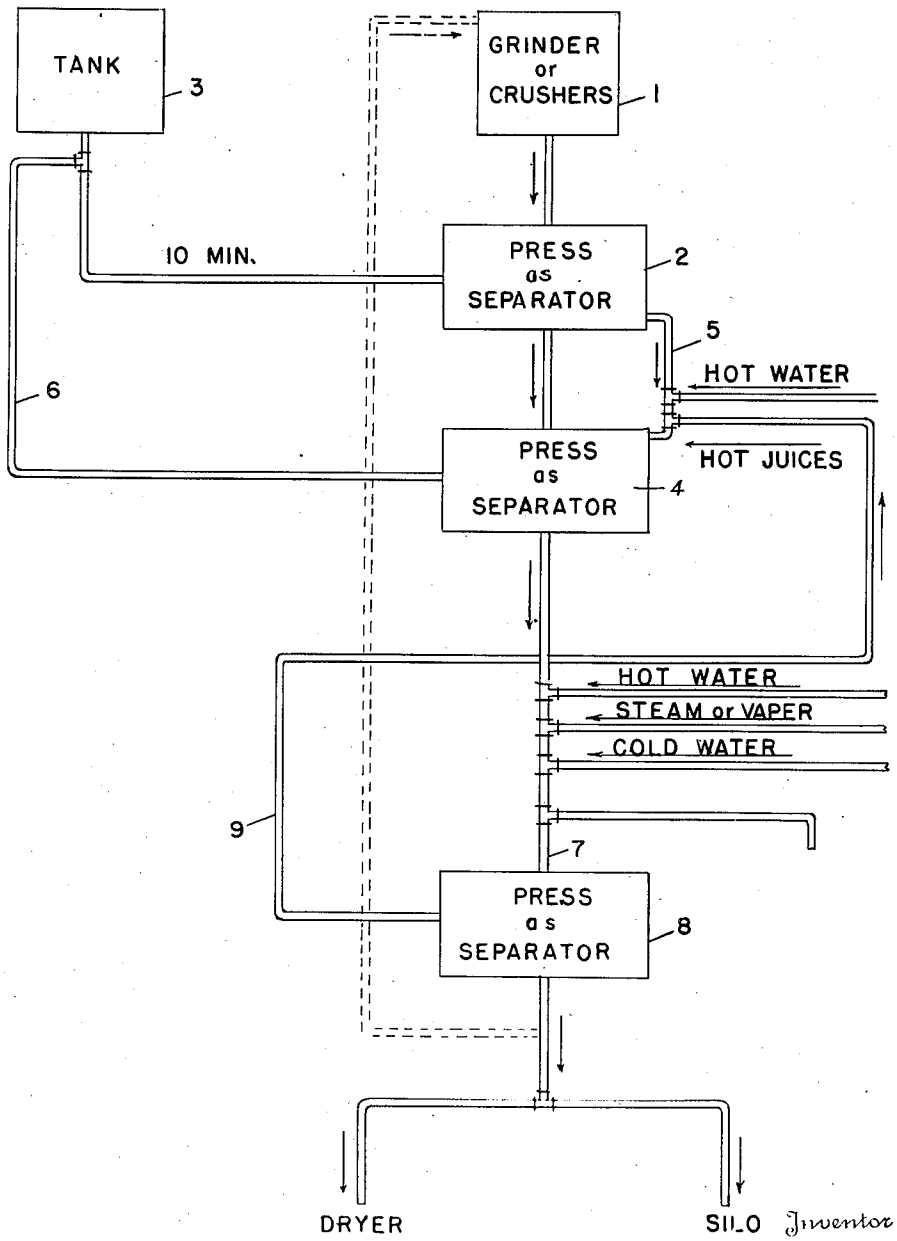
Oct. 19, 1943. T. R. CUTLER 2,332,062

METHOD OF EXTRACTING SUGAR FROM SUGAR BEETS

Filed Feb. 12, 1941



Inventor

Thomas R. Cutler

By Robert L. Dennison

Attorney

Patented Oct. 19, 1943

2,332,062

UNITED STATES PATENT OFFICE

2,332,062

METHOD OF EXTRACTING SUGAR FROM SUGAR BEETS

Thomas R. Cutler, Idaho Falls, Idaho

Application February 12, 1941, Serial No. 378,691

3 Claims. (Cl. 127—43)

My invention relates to a method of treating sugar beets for extracting the sugar therefrom.

Important objects of the invention are to reduce the time in which the juice containing the sugar may be extracted from the beet, from 30 to 45 minutes; to reduce the draft or quantity of water now employed from 30% to 60%; to increase the capacity of the factory by reducing the quantity of water and increasing the quality of the juice; to reduce coal consumption; to reduce labor costs; to maintain higher purities in the extracted juices; to increase efficiency by having a better control of the density of the juice; to eliminate entirely the chance of loss in sugar which is the constant danger with diffusion batteries; to reduce the quantity of steam or vapors, by not heating all the pulp or mash; to reduce the quantity of water as compared with that necessary for operating diffusion batteries.

Other objects and advantages of the invention will be apparent during the course of the following description.

In the accompanying drawing, the figure is a diagrammatic view of apparatus employed in the practice of the method.

The first step in the process is to convert the beets into a fine even mash. The beets are first washed to remove the dirt or like foreign matter, and are then sliced. The amount of water which might adhere to the washed beets before slicing is slight and is not taken into account. The sliced beets are then comminuted or finely divided, and for this purpose they are passed through apparatus 1, which may be a grinder or crusher. This grinding or crushing action disrupts the sugar cells of the beets and produces a fine even pulp. The grinding or crushing action is a cold process and is carried out at room temperature, without added water.

The next step in the method is to subject the fine even mash to pressure for the purpose of separating out the juices containing the sugar, and the pressing step should follow immediately after the grinding step. The fine even mash is introduced into a hydraulic press 2 and the juices squeezed from the mash. The pressing step is a cold process as it is carried out at room temperature without added water. The juices extracted by the pressing step must be free from fine particles of pulp, and may be strained or filtered for this purpose. The extracted juices containing the sugar, immediately after the pressing step, are heated to a temperature of at least 85° C. and these juices are maintained at at least 85° C. throughout the process, the quickness of the process serving to retard any tendency of the sugar content becoming inverted. The extracted juices from the press 2 are conveyed to a tank 3, and the temperature of the juices within this tank is maintained at at least 85° C. to 90° C. The juices are extracted by pressure from the fine even mash having the sugar cells of the beets disrupted, immediately after the grinding operation, and without any added water, and this has been found to prevent certain impurities from being contained within the juices. The maximum amount of juices will thus be separated out from the beet mash, and the amount of juices will vary to some extent, but the juices extracted should amount to from 30% to 40% by weight with respect to the weight of the beets. The extracted juices will show the total amount of sugar per cent and also the purity of the beets being worked. The invention is not restricted to the use of hydraulic presses, as I may use a screen conveyor with a series of rolls or other appliances for extracting or pressing the juices from the pulp.

The beet pulp having its cells disrupted and the major portion of its water content removed, is now removed from the press 2 and is passed to the press 4, similar to press 2, through a conveyor 5. The several steps of the method should be substantially continuous, and as soon as the pulp has its pressing operation completed in press 2 it should be discharged into the conveyor 5. While passing through the conveyor 5 the beet pulp or mash is thoroughly agitated and has hot water or hot juices applied thereto, in the presence of agitation. The hot liquid applied to the mash or pulp in the conveyor may consist of hot water or hot juices or a mixture of the same, and this hot liquor should be added in from 40% to 60% by weight with respect to the weight of the mash, and the hot liquor should be maintained at a temperature of at least 85° C. The beet mash traveling in the conveyor is a spongy mass on account of the cells of the beets being disrupted and is highly absorbent and will practically instantaneously absorb the hot liquor applied thereto, while the mash is being agitated. The mash thus treated with the added hot liquor is immediately introduced into the second press 4, and therein immediately subjected to pressure, to separate out the juices containing the sugar. As stated, the mash is highly absorbent, and I have discovered that the best results are obtained by allowing the juice to remain with the mash only long enough for the mash to be saturated. Therefore as soon as the mash is satu-

rated it is immediately pressed to extract the juices. These juices discharge through a pipe 6 and are conducted to the tank 3, containing the previously extracted juices. The temperature of the juices passing through the pipe 6 should be maintained at at least 85° C.

The mash is now immediately removed from the press 4 and passed through a conveyor 7 toward a third press 8. While passing through the conveyor 7 the mass is constantly agitated and is subjected to the action of hot water applied thereto. The water is preferably supplied at a temperature of 98° C. to 100° C. I preferably add from 40% to 60% by weight of water with respect to the weight of mash. The mash from the press 4 will rapidly absorb the added water, and as soon as this mash is saturated it is pressed to extract the juices. The pulp containing the added water now therefore passes into the third press 8, as soon as it is saturated, and the juices are immediately pressed from the pulp as the best results are obtained by allowing the juice to remain with the mash only long enough for the mash to be saturated, and these juices pass through a pipe 9, which leads to the conveyor 5, and this is the source of the hot juices for the conveyor 5. These hot juices contain some sugar. The temperature of the juices discharging through the pipe 9 is maintained at a temperature of at least 85° C. The third juice from this press 8 will contain a small amount of sugar, and the solid matter in degree Brix will be 4% to 6% of the degree Brix in the first juice. The hot water in the conveyor 7 may be obtained by added steam or vapor and cold water.

The pulp is now discharged from the press 8 and contains very little, if any, sugar and contains 80% to 85% of moisture and can be conveyed to a silo or dryer, as is well known in the art. All steps of the process from the time that the beets are introduced into the grinder 1 up to and through the time that the pulp is discharged from the press 8, are continuous and these steps may be completed within ten minutes.

The juices from the first press 2 which is 30% to 40% of the weight of the beets contain from 16% to 20% solid matter or degree Brix. The juices from the press 4 consist of the added hot water or hot juices which will absorb additional sugar from the mash after the first extraction, and these juices from the press 4 will contain from 8% to 12% solid matter or degree Brix. The juices from the third press 8 comprising the added hot water will absorb a small amount of sugar from the mash and will contain about 4% of solid matter or degree Brix.

The total amount of juices extracted from the three presses will be from 80% to 100% of the weight of the beets. The total weight of the juices being reduced, with respect to the prior art method, it will contain a higher per cent of solid matter or degree Brix. Sugar technologists in the beet sugar business have maintained that the breaking of the sugar cells of the beet would allow the impurities free access to pass out with the juice. This is believed to be true with the diffusion or osmatic action, because of the long period in which the cossetts or beet mash is held in the diffusion battery, where the whole mash is heated and the per cent of water entering is such that in many cases the per cent of juice drawn from the diffusion will run to 160% of the weight of the beets worked, in order to reduce the amount of sugar remaining in the pulp. With the diffusion or osmatic action, for many years, the amount of sugar remaining in the pulp and pulp water would be .35% to .40% but in recent years this has been reduced from .20% to .25%. In accordance with my method it is possible to obtain a total of .05% without imparting detrimental impurities to the juice.

While I have described the juices as being separated from the pulp by a pressing action, this separation may be effected by other means.

The juices containing the sugar and held within the tank 3, are subjected to clarification, evaporation, and crystallization, to recover the sugar content in the solid form, as is well known. The juices are maintained at a temperature of at least 85° C. until the sugar is recovered in the solid form.

Having thus described my invention, what I claim is:

1. The method of extracting sugar from sugar beets, comprising finely dividing the sugar beets for producing a cold mash having the sugar cells of the beets disrupted, separating the juices from the cold mash, adding hot juices derived from a subsequent separation to the mash obtained from the first separation so that the mash is saturated, immediately separating the hot juices from the mash as soon as possible after the completion of the saturation of the mash, combining the second juices with the first juices, immediately subjecting the mash from the second separation to the action of hot water so that the mash is again saturated, and separating the juices from the mash as soon as possible after the saturation, the last mentioned juices being supplied to the mash resulting from the first separation.

2. The method of extracting sugar from sugar beets comprising slicing and grinding cold beets to form a cold mash, straining juice from the mash, pressing out cold juice from the mash, heating the juice, saturating the mash and immediately pressing out juice therefrom, the last mentioned juice being mixed with the heated juice, again saturating the mash and immediately pressing juice therefrom, the last mentioned juice being heated and employed for saturating the mash prior to the second pressing.

3. The method of extracting sugar from sugar beets comprising reducing raw beets to a cold mash, subjecting the cold mash to a press to extract cold juice, said juice being delivered to a container, conveying the pressed mash to a second press and while in transit saturating the pulp with juice obtained during a subsequent pressing operation, juice from the second press being delivered into the container and mixed with the first juice, conveying the mash from the second press to a third press and during transfer to the third press saturating the mash with steam or hot water, and subjecting the saturated mash to action of the third press, hot juice from the third press being sprayed upon the mash in transit between the first press and the second press for saturating the same.

THOMAS R. CUTLER.