

No. 674,483.

Patented May 21, 1901.

C. STEFFEN.
DIFFUSION PROCESS.

(Application filed Nov. 28, 1899.)

(No Model.)

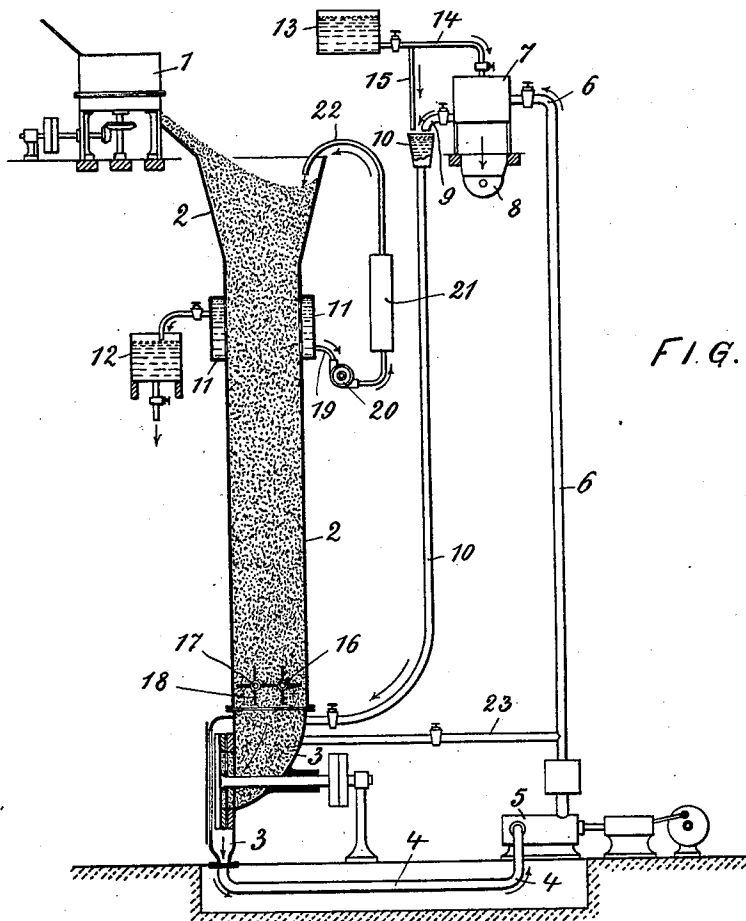


FIG. 1.

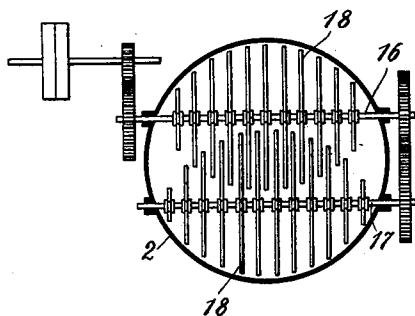


FIG. 2.

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CARL STEFFEN, OF VIENNA, AUSTRIA-HUNGARY.

DIFFUSION PROCESS.

SPECIFICATION forming part of Letters Patent No. 674,483, dated May 21, 1901.

Application filed November 23, 1899. Serial No. 738,063. (No specimens.)

To all whom it may concern:

Be it known that I, CARL STEFFEN, engineer, a subject of the Emperor of Austria-Hungary, and a resident of No. 40 Heugasse, Vienna, in the Empire of Austria-Hungary, have invented a certain new and useful Diffusion Process, of which the following is an exact, full, and clear description.

This invention relates to a process of extracting from beet-roots, sugar-cane, and other plants containing sugar as concentrated and pure a juice as possible.

This process is a diffusion process which is based on the following fact: If beet-root slices are subjected to the diffusion process, with the corresponding concentrations of the diffusion liquid at the high temperatures usually observed for the diffusion process, an extraordinarily rapid diffusion takes place from the commencement of the diffusion process up to the extraction of about two per cent. of the sugar contents of the slices, while the further diffusion from thence up to the lower limits of the usual diffusion requires a very much longer period if correspondingly concentrated diffusion juices are to be extracted. It therefore follows that with the diffusion process in the usual batteries the whole extracting process must on account of the lower limits endure a long time and that this loss of time must necessarily have a detrimental effect on the juices extracted. Since the diffusion is carried out in the lower limits at low temperature of the diffusion liquid and since sugar solutions are easily spoiled at mean or low temperatures, the method of diffusion as heretofore adopted can be termed defective. According to the known diffusion process a large quantity of wet residues is obtained, which impede a perfect utilization of the process and which are very inconvenient, especially in large factories.

The present process has for its object to remove these disadvantages. It enables the extraction of purer and more concentrated diffusion juices and at same time avoids the large quantity of wet residues. It also enables the extraction of the alimentary substances of the residues, which are practically lost according to the usual diffusion process.

The new process likewise removes the troublesome or inconvenient waste water of the usual diffusion process.

The invention is carried out in the following manner: The beet-roots, sugar-cane, or the like are cut in known cutting-machines into diffusion slices or strips and fed into the diffusion apparatus, which may consist of one or more vessels combined into a battery. The slices, together with the diffusing liquid of the apparatus, are subjected to only a partial diffusion process, whereby only a partial sugar extraction of the slices takes place. The partially-extracted slices, together with the surrounding diffusing liquid, are then subjected by means of suitable disintegrating apparatus to a wet disintegrating and triturating process, so that a homogeneous liquid pulp is produced from the said diffusing liquid and the partially-extracted slices. This pulp is conveyed by pumps or equivalently-acting means into suitable apparatus, (filters, presses, or the like,) in which a separation of the disintegrated diffusion residues from the liquid can be effected by means of hydraulic or mechanical pressure. The liquid discharged from the separating apparatus is fed to the diffusing apparatus at that part where the slices have the smallest sugar contents and increased by a quantity of water equivalent to about the weight of the residuum left behind in the separating apparatus. This quantity of water can either lixiviate the eliminated residuum or be fed directly to the diffusing apparatus. During this feeding back of the separated diffusing liquid and the additional quantity of water fresh beet-root or sugar-cane slices are introduced at the end of the diffusing apparatus where the slices are richest in sugar and at the same end concentrated diffusion-juice is drawn off or flows away. The quantity of this drawn-off juice corresponds to the quantity of the introduced fresh slices, increased by the fresh or additional water fed with the separated liquid at the other end of the diffusing apparatus and decreased by the quantity of the eliminated residues. By the triturating process and the subsequent pressing off in the separating apparatus there results about twenty-five per

cent. of residuum. The loss of sugar always amounts to less than one-half per cent. of sugar.

The temperatures to be maintained during the process may be those usually adopted in the known diffusion process—*i. e.*, at the end of the diffusing apparatus, where the slices are rich in sugar, high temperatures can be used, while at the other end of the apparatus, where the slices have become poor in sugar, preferably lower temperatures are used. The process, however, has also an advantageous issue if high temperatures are used at all parts of the diffusing apparatus.

The accompanying drawings show in Figure 1, partly in elevation and partly in section, an apparatus for carrying out the above-described process. Fig. 2 is a horizontal section through the lower part of the diffusing vessel drawn on a larger scale.

The beet-roots, sugar-cane, or the like, from which sugar is to be extracted are disintegrated in a cutting-machine 1 of known construction into slices, as used with the known diffusion process. These slices pass into the upper end of a tubular or otherwise-shaped diffusing receptacle or vessel 2 and fill same in form of a pillar or column, the level of the diffusing liquid being indicated by the dotted line. The lower end of the vessel 2 communicates with the casing 3 of a suitable disintegrating apparatus, which, according to the drawings, consists of a known mill having a fixed and a rotating grinding ring or rings of chilled casting. Between these rings the partially-diffused slices, with surrounding liquid, are ground to a homogeneous pulp. The lower end of the mill-casing communicates with a pipe 4, through which the pulp is drawn off by means of a suitable double-acting pump 5 or the like, in order to be fed through the pressure-pipe 6 to an apparatus 7 for separating the liquid from the solid residues—as, for instance, to a filter press or other suitable apparatus. The solid pressed-off residues are emptied into a suitable vessel 8, while the liquid portions of the pulp passing from the separating apparatus through the outlet 9 are fed through a pipe 10 at the lower end of the diffusing vessel 2 or into the casing 3 of the disintegrating apparatus in order that they may here again be made accessible to the diffusion.

In the height of the water-level of the diffusing liquid in the receptacle 2 is arranged a ring 11, forming an annular chamber, whose inner wall, formed by the vessel 2, is provided with holes or slots, so that only liquid or concentrated juice passes out of the vessel 2, such liquid being passed off into a measuring vessel 12, provided with an outlet. A receptacle 13 for water communicates with the separating apparatus 7 through a pipe 14, provided with a cock or valve, and also allows of the delivery of water through a pipe

15 for diluting the liquid of the apparatus 7 discharged into the return-pipe 10. The regulated delivery of the slices after their partial diffusion in the disintegrating apparatus is secured by radial arms 18 of two driven shafts 16 17, Fig. 2, such arms preventing both the falling down of the slices into the disintegrating apparatus and a clinging of the column of material in the vessel 2.

Above the level of the diffusing liquid a column of material not penetrated by diffusing liquid rests upon the column of the slices, the former column causing the uniform displacement of the column in the vessel 2.

The annular chamber receiving or containing the overflowed liquid and formed by the ring 11 communicates with a pipe 19, with which a pump 20 or other conveying apparatus is in connection, in whose pressure-pipe is inserted a suitable heating apparatus 21—for instance, a tube-heating apparatus. The liquid is sucked off by the pump 20, pressed through the heating apparatus 21, and returned through a pipe 22 above into the diffusing vessel, so that the fresh supplied slices come in contact with the hot liquid.

In order to secure a uniform operation of the disintegrating apparatus, it is recommended to form or establish a communication between the pressure-pipe 6 of the pump 5 and the casing 3 through a pipe 23. After opening the valve in this pipe 23 liquid is fed under pressure to the disintegrating apparatus and in this manner a clogging of the grinding-bodies is prevented. The water from the receptacle 13 may be heated by indirect or direct steam. The discharged liquid of the separating apparatus 7 fed back or returned into the diffusing apparatus through the pipe 10 can also be heated in the pipe 10 itself or at any other part by steam admitted in a direct or indirect manner.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim, and wish to secure by Letters Patent, is—

The herein-described process for extracting juice from beet-roots or sugar-cane or the like consisting in slicing the material, subjecting the slices to a diffusion action, interrupting the same after a partial extraction of sugar, disintegrating the partially-diffused material until it forms with the diffusing liquid a pulp, separating the material from the liquid, and refeeding this liquid and a quantity of liquid equal to the separated solid matter to the slices poorest in sugar, substantially as described.

In witness whereof I have hereunto set my hand in presence of two witnesses.

CARL STEFFEN.

Witnesses:

ALVESTO S. HOGUE,
AUGUST FUGGER.