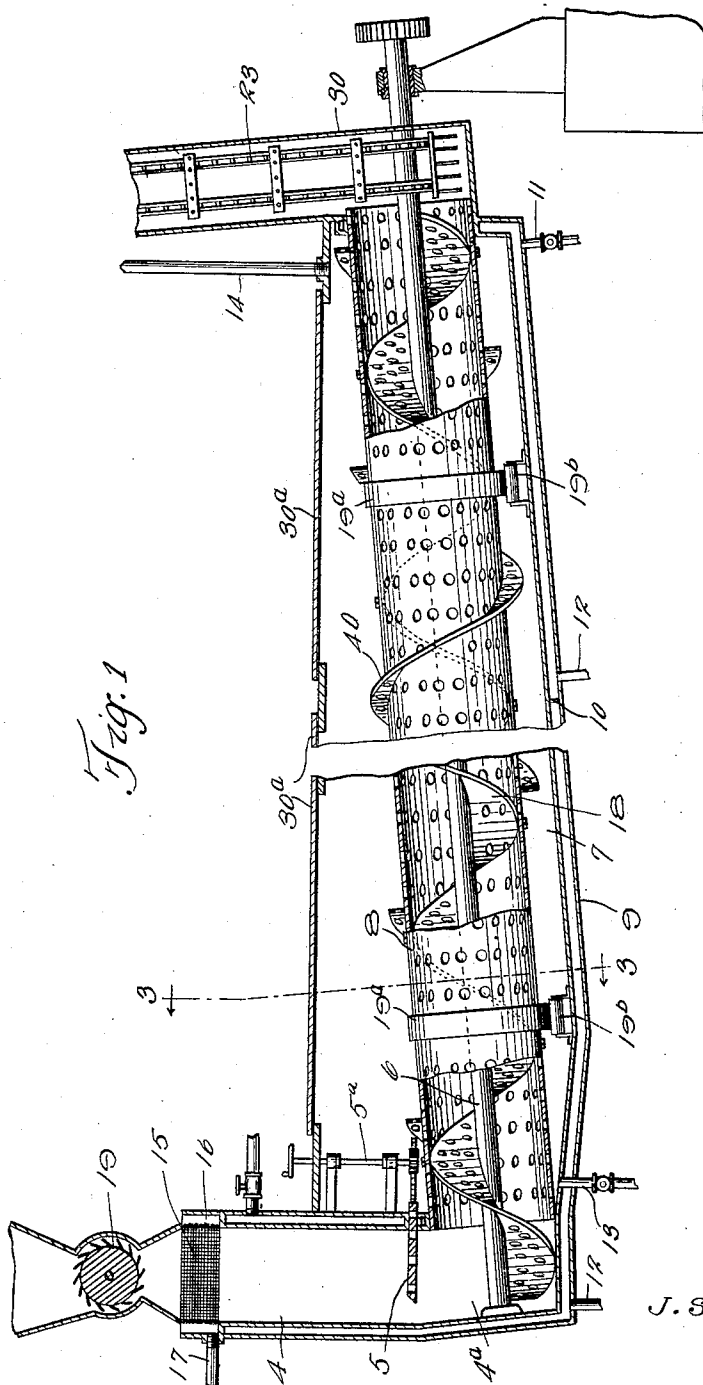


1,189,502.

J. STEWART.  
DIFFUSION APPARATUS.  
APPLICATION FILED JAN. 20, 1916.

Patented July 4, 1916.

2 SHEETS—SHEET 1.



**1,189,502.**

2 SHEETS—SHEET 2.



Fig. 3.

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# UNITED STATES PATENT OFFICE.

JOHN STEWART, OF LOGAN, UTAH.

## DIFFUSION APPARATUS.

1,189,502.

Specification of Letters Patent.

Patented July 4, 1916.

Application filed January 20, 1916. Serial No. 73,129.

*To all whom it may concern:*

Be it known that I, JOHN STEWART, a citizen of the United States, residing at Logan, in the county of Cache and State of Utah, have invented certain new and useful Improvements in Diffusion Apparatus, of which the following is a specification.

This invention relates to a diffusion apparatus for extracting sugar from beets or other material, the object being to provide an improved apparatus in which the diffusion may proceed continuously.

In my U. S. Patent, No. 962725 there is disclosed an apparatus for the treatment of pulp or the like, in which the pulp is caused to flow through a chamber in one direction, in which chamber the water for extracting the sugar is caused to flow in the opposite direction, the chamber being heated to different degrees at different points along its length, by means of steam jackets.

The present apparatus is an improvement of the apparatus shown in said patent. Instead of flowing the pulp through a stationary chamber, by means of a screw conveyer therein, the pulp is passed through a rotary barrel or cylinder containing a spiral conveyer, which cylinder rotates in a trough through which the water is flowed, said conveyer acting to tumble or roll the material over and over as it passes through the same, whereby in consequence of the agitation of the material in the liquid a better and more complete extraction is obtained. The cylinder is made of perforated metal, as well as the screw therein, so as to permit or produce an intimate mixture or association of the water and pulp as they flow therethrough. This trough is heated by means of a steam jacket, to different degrees at different points, similarly to the prior apparatus.

The present construction is such that shorter vertical and inclined legs may be employed, and a denser solution obtained. Means are also provided to regulate the amount of pulp introduced into the apparatus, the preferable plan being to only partly fill the cylinder, whereby clogging is prevented, and the pulp is thoroughly agitated during its flow, producing a more complete and satisfactory extraction of the sugar content.

Improvements will also appear in various other details of the apparatus from the following description and the accompanying drawings.

In the drawings, Figure 1 is a vertical sectional view of the apparatus. Fig. 2 is a horizontal sectional view, the covers on the steam jackets being open to show the interior parts. Fig. 3 is a vertical section on the line 3—3 of Fig. 1.

Referring specifically to the drawings, 4 indicates a vertical leg into the top of which the pulp or material is introduced from any suitable shredding or disintegrating machine indicated at 19. This leg is provided at the top with a strainer or section of reticulated metal 15, opening into a surrounding chamber 16 having an outlet 17 for the juice. Within its lower end the leg 4 is provided with a gate valve 5, of perforated metal to permit the rise of juice therethrough, which controls the flow of pulp from the leg to the rotary cylinder. The valve may be operated by any suitable device as indicated at 5<sup>a</sup>. Below the valve, the leg has a lateral circular opening or bearing for the end of an elongated perforated cylinder 8 in which is a central shaft 6 and a screw conveyer 18 of perforated metal, the edges of the screw being fixed to the shaft and the cylinder, so that all rotate together. The lower end of the screw projects beyond the end of the cylinder, into a semi-circular chamber 4<sup>a</sup> at the foot of the leg 4, the extension of the screw thus acting to convey the pulp from the leg into the cylinder 8, and the screw acting to carry the pulp upwardly or outwardly through the cylinder to the point of discharge, where it is conveniently delivered into a casing 30 in which may be provided a belt conveyer 23 for lifting and discharging the spent material. The shaft and its connected parts are rotated by power applied to the outer extended end thereof.

The cylinder is mounted in an inclined trough 7, upon rollers 19<sup>b</sup> journaled in said trough, the cylinder having rims 19<sup>a</sup> resting upon said rollers, and through this trough water is flowed from an inlet 14, the trough being full of water which rises in the vertical leg 4 to the outlet strainer 15 and pipe 17, the trough having a tight joint with the jacket on the vertical leg. The water supplied by the pipe 14 will be cold, or of relatively low temperature, and in addition to this water inlet I also provide graduated hot water inlets 13 one of which opens through the bottom of the trough near the lower end of the vertical leg and others at different points along the trough. It will be

seen that the direction of the flow of pulp is opposite to that of the water, in both the inclined and the vertical legs, and the perforations in the cylinder 8 and the flights 18 permit the circulation of the water through the pulp in the cylinder, the rotation of the latter causing a tumbling or agitation of the pulp which is highly conducive to complete extraction of the sugar.

The trough is surrounded by a steam jacket 9 which is divided by partitions 10 into several sections, and each section has a steam inlet 11 and an outlet 12 for condensation. The vertical leg 4 is also similarly jacketed, and the sections are heated to different temperatures, the highest temperature being around the vertical leg, and the lowest at the discharging end.

The trough is closed at the top by hinged lids 30<sup>a</sup> making water tight joints therewith, the lids being clamped tight by screws 24 which swing into notches 25 in the lids.

The inclination of the trough and height of the casing 30 is such that the point of pulp discharge is higher than the outlet 17, so that discharge of the juice is effected by overflow thereof through said outlet.

In the operation of the apparatus, the disintegrated pulp falls through the vertical leg 4 into the trough, whence it is conveyed by the screw through the rotary cylinder to the point of discharge, flowing upwardly through said cylinder, and the gate 5 is preferably so adjusted that the cylinder will be only partly filled with the material, which will be in the state of partial suspension in the water in the trough. The flow of water through the trough is in the contrary direction, down the inclined leg and up the vertical leg, to the outlet, thereby circulating through the pulp and extracting the sugar therefrom.

In order to prevent a too rapid flow of water, the exterior of the cylinder 8 may be provided with a screw blade 40, thus furnishing an obstruction to the flow of the liquid outside the perforated cylinder and tending to force the same into the interior thereof, and at the same time conveying small solid particles, which may pass through the perforations of the cylinder, to the outlet end for the pulp.

My former patent also discloses a stirring device 20 in the vertical leg, and this may be used in the present apparatus if desired.

The invention is not limited to the particular mechanism shown, but various changes may be made within the scope thereof.

What I claim is:

1. In a diffusion apparatus, the combination of an elongated vessel having a water inlet at one end and an outlet for juice at the other end, a rotary perforated cylinder in the vessel, means for feeding material

to the cylinder, and means for conveying said material through the cylinder in a direction contrary to the direction of flow of water in the vessel.

2. In a diffusion apparatus, the combination of a trough having a water inlet at one end and an outlet for juice at the other end, a rotary perforated cylinder in the trough, said cylinder having an inlet at one end and an outlet at the other, a screw conveyer in said cylinder, and a vertical leg communicating with the inlet end of the cylinder for feeding material thereto, said leg being located at the outlet end of the trough, the outlet end of the cylinder being at the inlet end of the trough.

3. In a diffusion apparatus, the combination of a trough having a water inlet at one end and a juice outlet at the other, a rotary perforated cylinder extending lengthwise in the trough and provided with a perforated screw conveyer therein, the cylinder having an outlet at one end for spent material at the inlet end of the trough, and means to feed material into the opposite end of the cylinder.

4. In a diffusion apparatus, the combination of a trough for water and juice, having inlet and outlet at opposite ends, a perforated cylinder rotating in said trough, said cylinder having means therein to cause a flow of material through the same in a direction contrary to the flow of water through the trough, said cylinder having means on the outside thereof to obstruct the flow of water along the same, and means to feed material to the inlet end of said cylinder.

5. In a diffusion apparatus, the combination of a trough having a water inlet at one end and a juice outlet at the opposite end, a perforated cylinder rotating in said trough and having therein a perforated screw conveyer for conveying material through the cylinder, said cylinder having a waste material outlet at the inlet end of the trough, a spiral blade on the outside of the cylinder, and means to feed material into the inlet end of the cylinder.

6. In a diffusion apparatus, the combination of an elongated chamber comprising a trough having an upright leg at one end thereof and a water inlet at the opposite end, said leg having a juice outlet at the top, a perforated cylinder extending in said trough and communicating at one end with the lower end of said leg, and a rotary perforated screw conveyer in said cylinder, adapted to convey material through the same.

7. In a diffusion apparatus, the combination of an elongated chamber comprising a trough having an upright leg at one end thereof and a water inlet at the opposite end, said leg having a juice outlet at the top, a perforated cylinder extending in said

trough and communicating at one end with the lower end of said leg, and a rotary perforated screw conveyer in said cylinder adapted to convey material through the same, and a valve in said leg, controlling the feed of material through the same to said cylinder. 15

8. In a diffusion apparatus, the combination of an elongated chamber through which water is flowed in one direction, a container for material, located in said chamber, said

container being movable to agitate the material therein, and means to convey material through said container in the opposite direction while it is being agitated.

In testimony whereof, I affix my signature in presence of two witnesses.

JOHN STEWART.

Witnesses:

F. O. NELSON,  
PERCY SHELLEY.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."