No. 706,669. Patented Aug. 12, 1902.

F. KESSLER.

PROCESS OF CONTINUOUS DIFFUSION.

(Application filed May 11, 1901.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

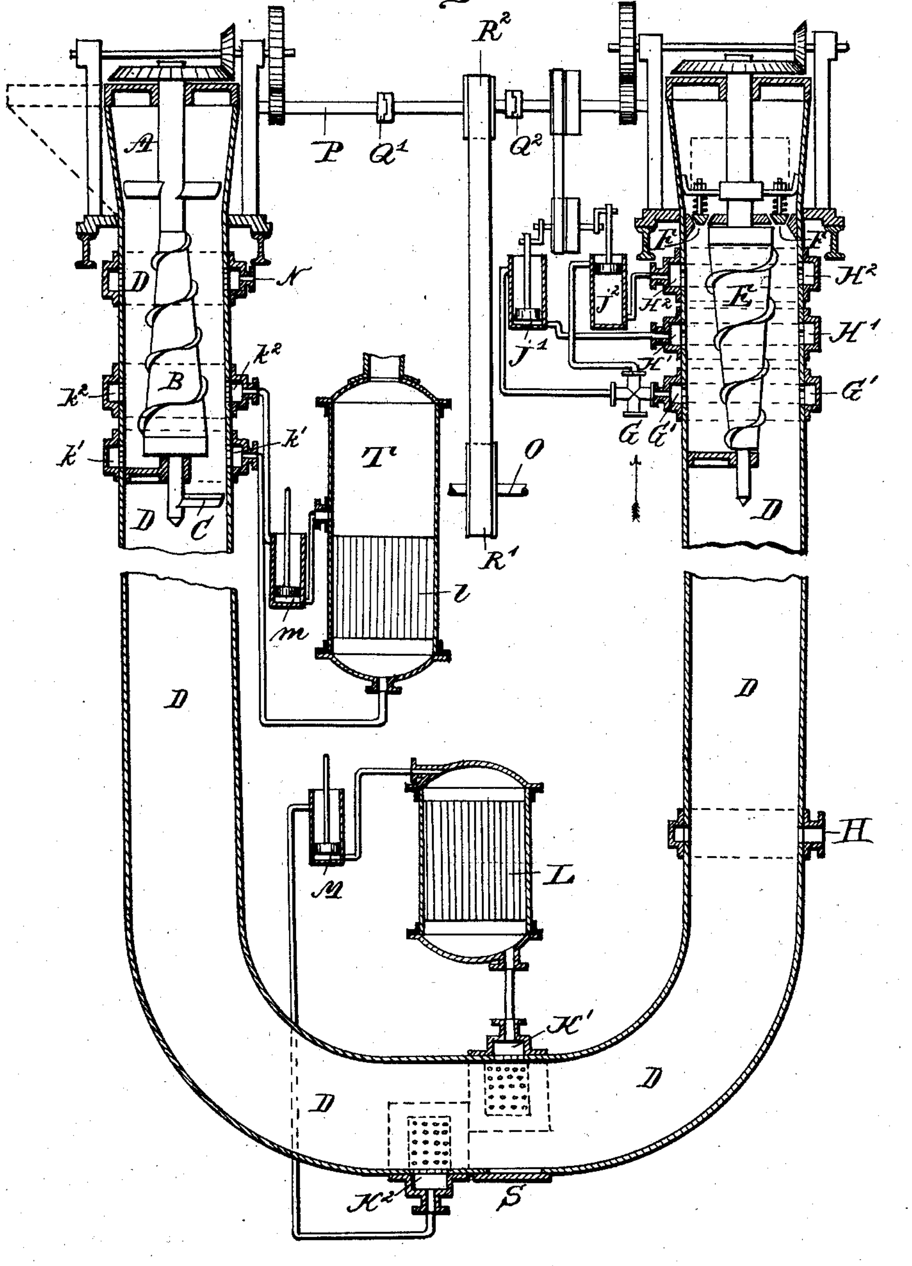

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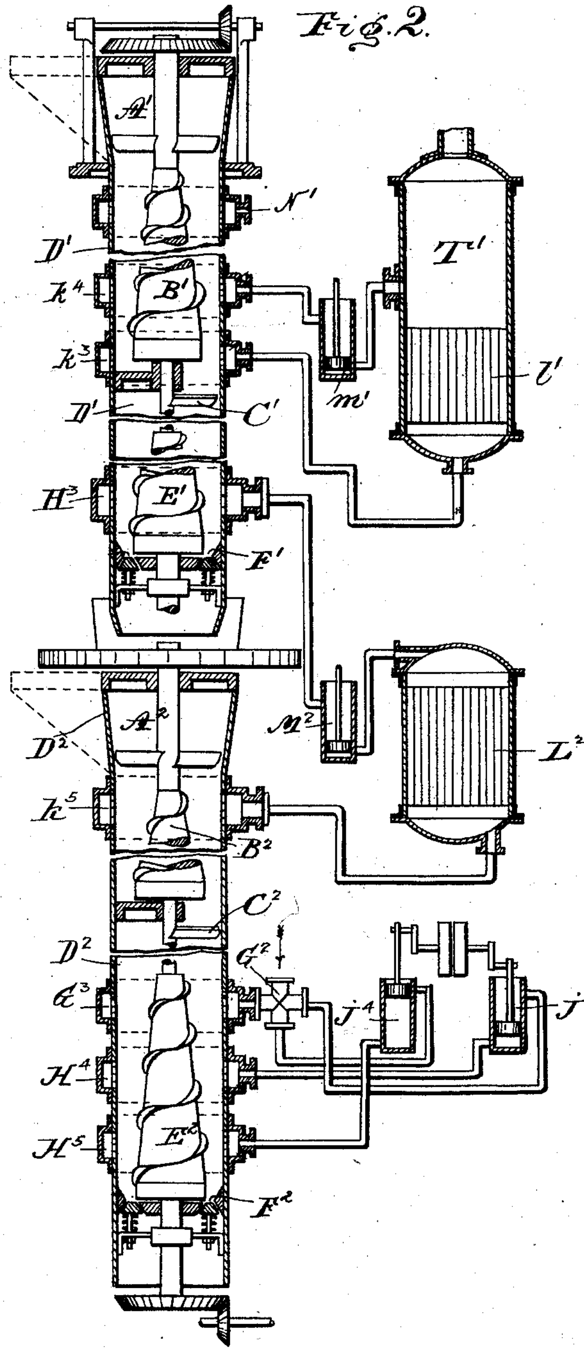
Fig. 2.



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UNITED STATES PATENT OFFICE.

FERNANDO KESSLER, OF ROSARIO, ARGENTINA.

PROCESS OF CONTINUOUS DIFFUSION.

SPECIFICATION forming part of Letters Patent No. 706,669, dated August 12, 1902.

Application filed May 11, 1901. Serial No. 59,745. (No specimens.)

To all whom it may concern:

Be it known that I, FERNANDO KESSLER, engineer, residing at Rosario, Argentina, have invented new and useful Improvements in Processes of Continuous Diffusion, (for which Letters Patent have been applied for in Germany, application K. 20,318, IV/89^c, dated November 8, 1900,) of which the following is a specification.

My invention relates to a process of continuous diffusion and is applicable for extracting sugar-cane juice, as well as for other purposes, such as the leaching of bagasse, dyewoods, tanning materials, and wool. Most of the processes used heretofore have been intermittent, and while attempts at continuous diffusion have been made they have been more in the nature of unsuccessful experiments than of commercial processes.

The object of my invention is to overcome the defects which have so far rendered continuous-diffusion processes objectionable. For this purpose I proceed as follows:

The process is carried out in a single vessel having no compartments, unless different liquids are employed. The mass which is to be subjected to the process is compressed and is caused to move from the inlet toward the outlet as a substantially continuous body without any agitation. The liquid is forced through the material by exerting a suction at the entrance end of the apparatus, and as this alone would not be sufficient on account of the compressed condition of the material pressure is applied at the end at which the material is delivered to more effectually force the liquid through the mass. The liquid is heated, and the material is heated through the medium of the liquid, thus avoiding all danger of overheating of the material, which would exist if the heat were applied directly through the walls of the vessel. The material, which proceeds in a compact mass, is finally thrown out of the apparatus at the periphery thereof, a pressure being exerted which is sufficient to prevent the diffusion liquid introduced near the outlet from traveling in the wrong direction.

An apparatus for the carrying out of my improved process is shown in the accompanying drawings, in which—

Figure 1 is a vertical section of such an apparatus; and Fig. 2 is a similar view of a double apparatus having two sections arranged tandemwise, so that one section feeds the other.

A is a hopper through which the material is introduced into the receiving end of the diffusion receptacle or vessel D, which, as shown in Fig. 1, is a U-shaped pipe. From this hopper the material, such as sliced cane, is fed forward by a conveyer B, which is slightly conical, being larger at its inner end than its outer end, so that it will exert a gradually-increasing pressure. At the outlet end of the diffusion vessel is located another conveyer or compressor E, having its larger end located outward adjacent to a closing device, such as a spring-pressed valve F, which controls the final egress of the material. Suitable means, as a shaft P, driven from a shaft O by means of a belt passing over pulleys R' R^2, are provided for imparting motion to the conveyers B and E, and clutches Q' Q^2 may be used for throwing the said conveyers into and out of gear. From the said shaft may also be driven pumps J' J^2, which are connected by pipes, as shown, with jackets G' H' H^2, located at different points adjacent to the conveyer E. The perforations leading from the jackets H' H^2 to the interior of the diffusion-chamber D are finer than the perforations communicating with the jacket G'. The operation of the pumps J' J^2 withdraws liquid, that is mainly water, which has been pressed out of the material from the jackets H' H^2, and this liquid may be returned to the jacket G' and the diffusion-chamber D through the union G and the delivery-pipes of the pumps J' J^2. The object of this arrangement is to free the compressed mass from water as far as possible before said mass is expelled through the annular outlet.

Adjacent to the conveyer B is located a distributer C for the purpose of aiding in forcing the mass forward, and at the inner larger end of the conveyer B the diffusion-chamber D is surrounded by jackets k' k^2, which communicate with the interior of the diffusion-chamber through perforations. The liquid extracted from the sliced material by the pressure of the conveyer B enters the said jackets and is caused to circulate by means of a pump m, which may be worked from the shaft O. This pump forces the liquid into a heater l and back into the diffusion-chamber D, the liquid passing from the jacket k' to the heater and thence through the pump to the jacket k^2. It will be obvious that this circulation will produce a diminished pressure at the jacket k' and will thus diminish the resistance to the progress of the material. To further reduce the pressure, I may combine with the heater l a receiver T, connected with an air-pump. To enable the operation to be performed continuously, even when the heater or receiver needs a cleaning, two heaters may be provided, with appropriate valves, so that one or the other may be put in operation. Under this diminished pressure there is a thorough exhaustion of the air from the material as it enters into the diffusion process, and the gases which are evolved during such process can readily escape to the receiver T and to the air-pump. By this arrangement the osmotic effect is greatly enhanced. It will be understood that the liquid which effects the diffusion or extraction enters into the diffusion-chamber D adjacent to the outlet of the material and travels in a direction opposite to that of the material itself. This liquid is subjected to a treatment whereby air is removed therefrom, as above described, and finally the diffusate or extract escapes into a jacket N, from which it is conducted to any suitable apparatus, as a refining apparatus.

The diffusion-chamber D is preferably wider at the end which is adjacent to the conveyer E than at that portion which is adjacent to the conveyer B. Sometimes it may be beneficial to warm or heat the diffusate between the outlet and the inlet of the diffusing-chamber. For this purpose I may provide a jacket K', communicating with the interior of the diffusing-chamber, said jacket being connected with a heater L, from which a pipe leads to a pump M, the pump discharging the heated liquid into a jacket K^2, from which it passes again into the diffusion-chamber D. Of course all the pumps and other moving parts of the apparatus will be driven from a common source of power, so that said parts will perform their work in proper relation to each other.

H is a jacket located between the jackets K' and G'. From this jacket H the diffusing medium may be withdrawn for the purpose of returning it to the diffusion-chamber in a purified condition. I consider it of advantage to effect an intermediate purification, for the reason that a weaker and less pure diffusate may be submitted to a more energetic and thorough purification than a stronger one can. At the lowest portion of the diffusion-chamber D is located a manhole-cover S, upon removing which the material will be forced out through the opening by the working of the conveyers B and E.

My improved process can be used for sliced sugar-cane, for sugar-beets, and for bagasse. The liquid used for diffusion and admitted at G is water or dilute sugar solution. Instead of admitting the extracting liquid continuously such liquid may be admitted alternately with water and low-pressure steam or compressed air, or in some cases all three may be admitted together.

The sliced cane or other material enters at A and is fed forward by the conveyer B, which subjects it to a gradually-increasing pressure. The distributer C properly compresses the slices together, so that they form a practically continuous mass, which is forced forward until it reaches the conveyer E, which then takes hold of the slices and forces them with a gradually-increasing pressure toward the outlet F. The extracting or diffusing medium enters at the jacket G' under a pressure smaller than that obtaining at the outlet F. The diffusing medium therefore is caused to travel in the opposite direction to the material, and thus comes in contact with the cane slices and extracts the saccharine juice therefrom. The diffusing medium after it has traveled through about half of the diffusion-chamber D is passed through the heater L and pump M and returned to the diffusion-chamber at a higher temperature. It will be observed that the heating does not take place while the said medium is in contact with the material. As the diffusate gets to the jackets k' k^2 the air and gases contained in the diffusate are withdrawn by the action of the pump m and the air-pump connected with the receiver T, and the result is, as before explained, a much better extraction. The froth which may form in the receiver T is broken up in any suitable manner, and the froth forming at the top of the diffusate at the inlet A is broken up by the incoming slices.

In some cases I prefer to construct the apparatus in a plurality of sections, each constructed substantially like the one above described, except that the sections may be straight instead of U-shaped. Further, I prefer in this case to connect the jacket at the outlet of one section with the jacket at the inlet of the next section through the medium of a pump and a heater, and preferably while passing through this pump and heater on its way from one section of the apparatus to the other the diffusate is subjected to purification. This apparatus, as shown in Fig. 2, consists of an upper section or receptacle D' and a lower section or receptacle D^2. Each section has a hopper or inlet A' or A^2, respectively, adjacent to which is the conveyer B' or B^2, provided with the distributer C' or C^2. E' E^2 are the conveyers or compressors located at the outlets, and F' F^2 are the outlet-valves. On the upper section N' is the outlet for the diffusate, l' the heater connected by a suction-pipe with the jacket k^3, T' the exhausting-receiver, and m' the pump for returning the liquid from the heater l' to the jacket k^4. k^5

is a jacket near the inlet of the lower section, from which jacket the liquid is drawn by a pump M^2 through a heater L^2 to the jacket H^3 at the outlet of the upper section. Near the outlet of the lower section are located the jackets G^3 H^4 H^5, union G^2, and pumps j^3 j^4, these parts corresponding in construction and connection to the parts G' H' H^2 G j' j^2 in Fig. 1—that is, the pump j^3 is connected with the jacket H^4 and with the union G^2, and the pump j^4 is connected with said union and with the jacket H^5.

Now what I claim, and desire to secure by Letters Patent, is the following:

1. The herein-described diffusion process, which consists in forming the material to be treated, into a continuous mass or column, imparting a practically continuous movement to said mass or column and exerting a gradually-increasing pressure thereon at both ends, introducing at a point situated at a distance from the delivery end of the column, an extracting or diffusing medium under a pressure smaller than that obtaining at the said delivery end, and causing said medium to travel in the opposite direction to the material.

2. The herein-described diffusion process, which consists in forming the material to be treated, into a continuous mass or column, imparting a practically continuous movement to said mass or column and exerting a gradually-increasing pressure thereon at both ends, introducing at a point situated at a distance from the delivery end of the column, an extracting or diffusing medium under a pressure smaller than that obtaining at the said delivery end, causing said medium to travel in the opposite direction to the material, in contact therewith, heating said medium at an intermediate point, out of contact with the material, and returning the heated medium into contact with the material.

3. The herein-described diffusion process, which consists in forming the material to be treated, into a continuous mass or column, imparting a practically continuous movement to said mass or column and exerting a gradually-increasing pressure thereon at both ends, introducing at a point situated at a distance from the delivery end of the column, an extracting or diffusing medium under a pressure smaller than that obtaining at the said delivery end, causing said medium to travel in the opposite direction to the material and in contact therewith, and withdrawing the said medium by suction at a point situated at a distance from the inlet of the material, so as to reduce the pressure at said point.

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

FERNANDO KESSLER.

Witnesses:
RICARDO KÖNIG,
HERMANN C. VEANDER.