No. 755,546. PATENTED MAR. 22, 1904.

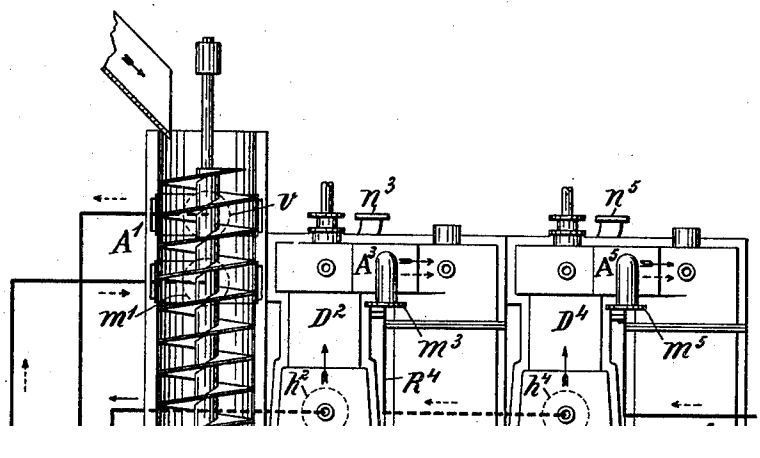
A. RAK.

DIFFUSION BATTERY.

APPLICATION FILED AUG. 1, 1903.

NO MODEL.

Fig. 1.



No. 755,546. Patented March 22, 1904.

UNITED STATES PATENT OFFICE.

ALOIS RAK, OF CESKÝ BROD, AUSTRIA-HUNGARY.

DIFFUSION-BATTERY.

SPECIFICATION forming part of Letters Patent No. 755,546, dated March 22, 1904.

Application filed August 1, 1903. Serial No. 167,857. (No model.)

To all whom it may concern:

Be it known that I, ALOIS RAK, a subject of the Emperor of Austria-Hungary, residing in Cesky Brod, Kingdom of Bohemia, Austria-Hungary, have invented certain new and useful Improvements in Continuous Batteries for the Diffusing Process in Sugar-Mills and the Like, of which the following is a specification.

My invention relates to improvements in diffusion-batteries in which a series of conical or partly-conical and partly-cylindrical compressing-worms revolve in fitting cases operating on the so-called "diffusion" of the beet-root or cane slices or the like which are mixed with the diffusing liquid, water, or juices, these devices being combined into a continuous battery, where each diffuser acts by diffusion and compression, the working being graduated in continuance through the whole series of said diffusers; and the objects of my improvements are, first, to obtain a continual diffusion in combination with a higher extracting power, because of the poorer juice of the rear diffusers acting upon slices from which the richer sugar-juice has been pressed out and taken away, and consequently, second, shortening of the duration of the processes with less diffusers and less water; third, economy of fuel, the juices being heavier than usual; fourth, in consequence of the continuity of work and overcoming the necessity of different devices—as, for instance, slice-presses, &c.—also an economy in the number of workmen; fifth, to obtain more sugar and to lose less nutrients of the slices, there being no waste water in my process. Other juices than those from the beet-root can be obtained by the same process and means from other sources; but I construct these diffusing-batteries principally for the manufacture of sugar from beet-root. I attain these objects by the improved mechanism and general arrangement illustrated by the accompanying drawings, in which—

Figure 1 is a vertical view and partly an axial section of the battery; and Fig. 2 is a horizontal section of the battery, taken upon the line X X in Fig. 1.

I do not limit myself to the number of diffusers, and the drawings show an example which can be variated in its details.

I II II IV V are diffusers which are consecutively connected by perpendicular channels A^2 A^3 A^4 A^5 into a continuously-working battery. Each of these diffusers is composed of the known transporting and compressing worm, which is fitted and revolves in its casing B' B^2 B^3 B^4 B^5. The axes of all the revolving worms are parallel to each other, and they are situated in one and the same plane. All the casings of said diffusers are divided into two equal halves along a plane passing through the axes of the worms, these two halves being firmly and tightly screwed together for the purpose of making their inside easily accessible.

The apparatus contains also a measure-cistern P or several such vessels, a regulating-reservoir F, with such engines as a pumping-engine L, a juice-warmer H. All of these vessels and reservoirs, &c., are connected together by different conduits, as will be shown farther on, and they are indicated in the drawings as simply as possible for the sake of making the whole plan clearer, such parts being well known. The worms are cylindrical in their broad part, conical in their middle part, and again cylindrical at their smaller ends. The casing of each diffuser is widened before the narrow end, so as to leave place for an inside sieve or perforated continuation of its inside wall at C—*i. e.*, at C' C^2 C^3 C^4, &c.—round about through which the juice can flow out, while the slices are retained by said sieve. The juice flows from C by the opening or outlet *h*—*i. e.*, h' h^2 h^3 h^4, &c.—as well as from respective conduits, as will be explained farther on. The worm stops in D and its shaft is prolonged through the cylindrical part of the connecting chamber or channel A—*i. e.*, A' A^2 A^3 A^4, &c.—and is provided with a paddle or shovel M, which is fixed upon it instead of the worm and is fitted into this cylindrical part of said chamber, which communicates with the wide end of the next following diffuser and worm. Another shovel N is mounted in the middle of this straight channel, so as to swivel on a pin *p*, which is situated near the rear wall of the channel A midway between the two worms. The drawings show the auxiliary shovel N in its two extreme positions when it closes either the way between the shaft and *p* or the way through the channel. The long

end of shovel N reaches over the boss of M, and the opposite end of the shovel N is provided with an undercut nose q, into which the turning shovel M butts, as will be explained farther on with the working of the whole device.

All the diffusers of the battery are alike in size and shape, with the exception that the first one is provided on its wide side and top with a device for filling in the fresh slices and with outlets m v and the last diffuser at its end with a conical stopper G, which is regulated so as to open more or less the outlet for the completely pressed-out slices.

R′ is a conduit for the final juice, which flows from h' into the measuring-cistern P, and it is provided with a valve S.

R^2 is a conduit by which from the diffuser II at h^2 the juice runs into the regulating-reservoir F, and it has a valve Q and a branch conduit which joins R^2 between F and valve Q and which leads to the opening v in the upper end of diffuser I, as shown in Fig. 1. As may be seen from the drawings, where all these conduits are indicated by simple lines, diffuser III is connected with channel A^2 by the conduit R^3, which leads from h^3 to m^2. Diffuser IV is connected with channel A^3 by the conduit R^4, which leads from h^4 to m^3. Diffuser V is connected with channel A^4 by the conduit R^5, which leads from h^5 to m^4. Opening m^5 serves for the introduction of the diffusing liquid—in this case warm water—which is introduced under pressure. The worms are revolved in any convenient known way, and this is done in such a direction that the slices which are mixed with the extracting liquid (diffusing liquid) and which fill them may be thus transported by the worms from their wide end to their narrow end, they being at the same time mixed through and compressed by this action. The direction in which the slices advance is indicated in Fig. 1 by full arrows, while the direction of the flow of the diffusing or extracting liquid is indicated by dotted arrows.

The fresh slices are filled into the broad end of diffuser I, where they are mixed with the warmed juice which arrives at m' from the warming device H and are mixed and transported downward by the revolving worm of the diffuser I. On their way the slices are under the treatment of combined diffusion and extraction till they arrive at C′, where the juice flows off through the perforated inside wall and the opening h' through pipe R′ into the measure-cistern P. The slices are retained by the perforated wall in C′ and are forced into the narrow part D′ of the diffuser I and through this part are transported into the cylindrical part of the channel A^2. From here they are transported by the rotating shovel M through the straight part of the channel A^2, while the auxiliary swivel-shovel N opens this communication and shuts up the opening between the shaft of diffuser I and pin p through engaging the boss of shovel M, as shown in Fig. 2. The shovel N shuts the channel gradually as it is pushed by the revolving shovel M till it arrives into the position shutting up channel A^4, as shown in Fig. 2. In this position the shovel M butts the undercut nose q of shovel N and turns it in this way into its former position (shown in Fig. 2) by the open channel A^2. In the part D′ the slices divide the contents of the consecutive diffusers I and II, which work each under a different pressure, so that the juice or liquid from the diffuser II cannot flow through the closing part D′ into the diffuser I. This part D′ must be long enough so that no liquid will pass through its compressed and advancing mass. Though in II the pressure is notably higher, still the two liquids in I and II are completely divided from each other and the slices in D′ act as a stopper, of which the mass is continually renewed. From one end into the same ratio as at the other end it falls out and is being transported regularly into the wide end of diffuser II, where the worm transports it again in a similar way as has been done by diffuser I, but changing the direction. At the same time it receives the diffusing liquid—in this case sugar juice—and the effect or head of the diffusion remains still as high as needed. The stopper of slices in D′ replaces exactly the bottom covers of the so-called "Robert" diffusers, which are at present generally used in sugar-mills. Channel A^2 forms the beginning of the diffuser II. Here the slices are pushed forward by the shovel M into the diffuser II and meet a diffusing liquid which contains less sugar than the juice in m', this liquid flowing from C^3 out of the diffuser III through conduit R^3, there being a higher pressure in III than in II and in II higher than in I. The worm in II acts in a similar way to that in I upon the mixture of slices and juice which by said worm is transported and compressed on its way through the diffuser to its narrow end till at C^2 the juice, enriched thus by extraction of a further portion of sugar from the slices upon which it acted, escapes by flowing through the perforated wall at C^2 and through the opening h^2, flowing through the conduit R^2 into the regulating-reservoir F. The extraction or rather diffusion of sugar from the slices is thus continued in a similar way as the slices pass consecutively through the diffusers I II III, &c., and the same transporting, mixing, compressing, dividing, and diffusing of juice and passing through the channels A—*i. e.*, A^2 A^3 A^4, &c.—and turning by ninety degrees, being repeated continually from diffuser to diffuser throughout the whole battery. Just as the slices advance in the direction of the full-line arrows—*i. e.*, from the wide to the narrow end of each diffuser—the diffusing liquid flows

in the direction of the dotted arrows; but the transmission of the liquid from one diffuser into the other is done in the opposite direction. The slices advance in the order as follows: $A' B' C' D'$, $A^2 B^2 C^2 D^2$, $A^3 B^3 C^3 D^3$, $A^4 B^4 C^4 D^4$, $A^5 B^5 C^5 D^5$, while the liquid flows in the order $A^5 B^5 C^5$, $A^4 B^4 C^4$, $A^3 B^3 C^3$, $A^2 B^2 C^2$, $A' A' A'$.

The extracting and diffusing liquid enters into the channel A^5 under pressure at the beginning of the last diffuser at the opening m^5, which is protected by a sieve, and flows, together with the slices, to C^5, from where it flows through the sieve and h^5 and through the conduit R^5 into the channel A^4 of the diffuser IV. In the following diffusers III II the transmission of the liquid is quite analogous. For this reason there is a higher head of pressure in diffuser V than in IV and in this latter one higher than in III, &c.

For the purpose of assuring the pressure in the last diffuser—*i. e.*, for maintaining the closing of the last diffuser by the juiceless slices in D^5—there is a conical stopper G arranged in the outlet of the last diffuser. By opening this stopper more or less the degree of pressure of the slices is also regulated.

The warming of the juice is done in diffuser I only. For this purpose the juice from the dividing part C^2 of the diffuser II does not flow in the mixing part A′ of diffuser I, but flows, as mentioned before, through conduit R^2, which is provided with a regulating-valve Q, into the reservoir F, from where it is pumped and forced by a convenient pumping-engine L through the warmer H into the upper part A′ of diffuser I at an inlet m', which conveniently is protected by a sieve, all these arrangements and engines being otherwise well known. Arriving in A′ the highly-warmed juice meets fresh slices and flows, together with them, in the way described before into the dividing part C′, as described, from where the finished juice flows into the measure-cistern P. The overflow of the warming-juice falls through the inlet V, which is protected by a sieve, back into the reservoir F.

It will be understood that the diffusers need not be vertical, but that they can be arranged in a slanting position or horizontally as well as vertically.

My new battery works under a considerable head of pressure and so that the liquid is transferred from one diffuser into the other by the difference of pressures only and flows through separate conduits or channels and not through the slices, no auxiliary devices, as pumping-engines, exhausters, and the like, being needed for it, and the quantity of the drawing off of the liquid can be regulated simply by a valve, so that it is proportionate to the quantity and quality of the worked material. The diffusion takes place in each diffuser completely separately, the liquid in each diffuser being stopped by the part D. The somewhat similar stopping parts used by Dr. Nitthack never produced the effect of my present invention, because he never worked with differences of pressures in the diffusers, and therefore the transferring of liquid from diffuser to diffuser in his battery was done by pumping-engines. By the peculiar combination of the shovel device M N, I further combine the diffusers into a continual battery. The division of this battery into two equal halves creates an easier accessibility to the interior of the apparatus.

I am aware that processes of rotating worms have been repeatedly patented and tried in the manufacture of raw-sugar juice from beet-root, but never with a practical success. Up to now the use of Robert's intermittently-working diffuser is exclusive in this industry. The peculiar combination of the compressing-worms and of their battery working continuously according to the rules of the known Robert's process, but with more effect and economy, is new and my own invention. I therefore do not claim such a combination broadly; but

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination in a continuous battery for the manufacture of sugar from beet-roots, cane or the like, of a series of rotary worm-presses, each terminating in a narrow juice-stopper D′, dividing parts C′ interposed before said stoppers, each press being provided with an outlet having a sieve therein, through which the juice flows off, a conduit R from the channel A′, a measuring-cistern P into which said conduit leads, a conical stopper G in the last diffuser of said battery adapted to maintain a pressure in said diffuser, the arrangement being such that the diffusing liquid passes from one diffuser to another without the necessity of auxiliary means.

2. The combination in a continuous battery for the manufacture of sugar from beet-roots, cane or the like, of a series of rotary worm-presses each terminated by the narrow juice-stopper D′, a dividing part C′ for driving off the juice, communicating channels A′ between the worm-casings leading from the exit of the closing part D′ to the widened part of the next worm, rotating shovels M in said channels secured to the shafts of the worms, and auxiliary shovels N in the center of said channels, said parts being adapted for transporting the slices perpendicularly to the direction of the worms and means for regulating the discharge from the last diffuser whereby the pressure in the battery may be regulated.

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

ALOIS RAK.

Witnesses:
ADOLPH FISCHER,
LADISLAV VOJAILL.