L. A. De Lime,

2. Sheets. Sheet. 1.

Making Extracts.

No. 97.059. Patented Nov. 23. 1869.

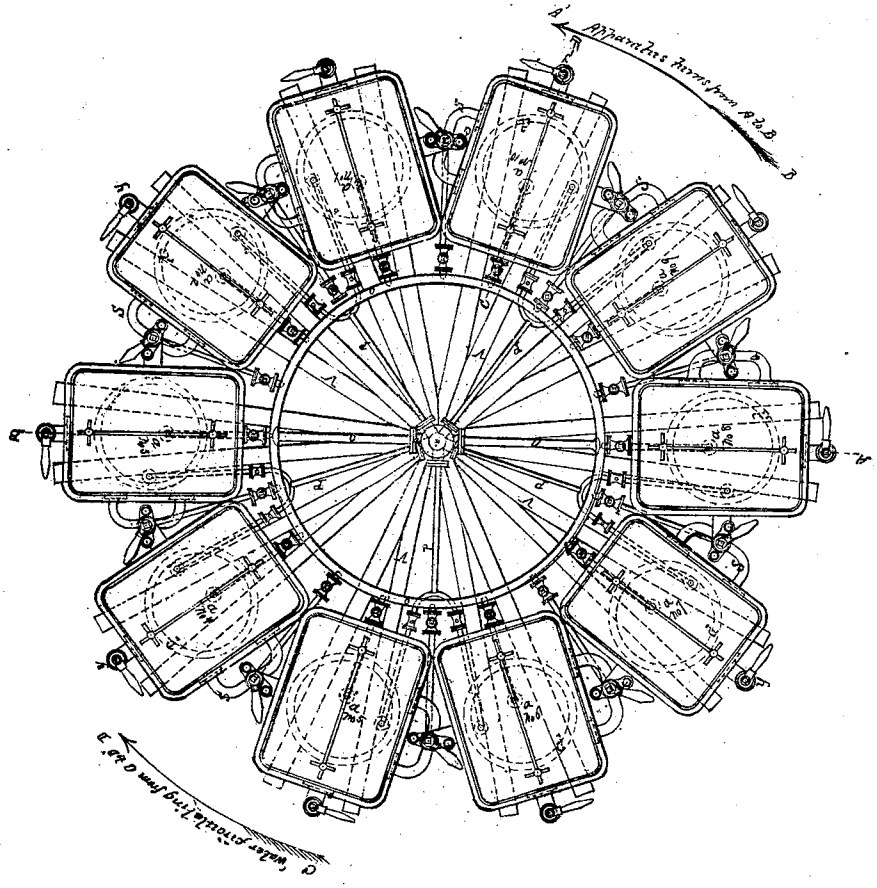


Fig. 1

Witnesses

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O. H. Phillips

Inventor

L. A. De Lime

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2 Sheets. Sheet 2.

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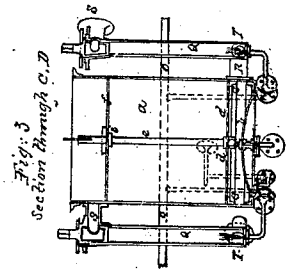


Fig: 3
Section through C. D

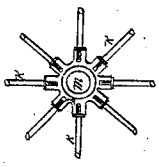


Fig: 4
Section through E. F

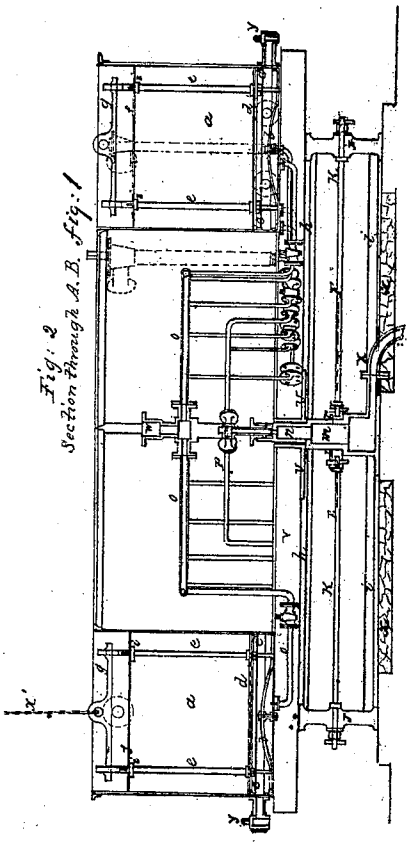


Fig: 2
Section through A. B. Fig: 1

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UNITED STATES PATENT OFFICE.

L. A. DE LIME, OF ST. LOUIS, MISSOURI.

IMPROVED APPARATUS FOR OBTAINING EXTRACTIVE MATTERS FROM SUGAR-CANE AND OTHER MATERIALS.

Specification forming part of Letters Patent No. **97,059**, dated November 23, 1869.

To all whom it may concern:

Be it known that I, LOUIS A. DE LIME, of the city of St. Louis, in the county of St. Louis and State of Missouri, have invented a new and useful Apparatus for Obtaining Extractive Matter from Sugar-Cane and other Substances; and I do hereby declare that the following is a full and exact description of the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, in which—

Figure 1 is a plan or top view of the macerating apparatus; Fig. 2, vertical section on line A B of Fig. 1; Fig. 3, vertical section through C D of a macerating-tub. It indicates the construction of the pipes of transmission of the liquids from one tub to another, as well as the disposition of the steam-pipes and of condensation. Fig. 4, horizontal section, following the line E F (see section, Fig. 2) of the circle receiving the supports, and maintaining them the same distance from the center of the apparatus.

The nature of my invention consists in a new and improved method for obtaining extractive matters from sugar-cane, sorghum, beets, malt, barks, wood-ashes, earth, and other materials; and to enable others skilled in the art to make and use my invention, I will proceed to describe its construction and operation.

a a are rectangular sheet-iron tubs, lined at the top with an iron cornice; *b*, double bottom riveted to the bottom of the tub *a*. It is between these two bottoms that steam is injected and used to maintain the liquid contained in the tub *a* to a temperature above that in which fermentation can be developed. *c*, iron cornice riveted to the bottom of the tub to receive the lower diaphragm *d*, perforated with holes. This diaphragm receives the matter to be macerated. *e*, pieces of iron fixed to the diaphragms *d* and *f*; *f*, the upper diaphragm, resting on the two iron pieces *e e*. It is maintained on these by two wedges, *i i*. *g*, pieces of iron attached to the hook of the chain *x'* of the derrick, taking at once the matter contained between the two diaphragms of each tub; *h*, cast-iron circle resting on solid cast-iron wheels J. It is on this circle that every piece of wood is solidly bolted. *i*, second cast-iron circle fixed on a solid foundation, *x*, of stone or brick, resting on the soil. It is on this second circle that the cast-iron wheels J operate their movements in rotation. J are the cast-iron wheels rolling between the two circles *h* and *i*; K, pieces of iron reaching to the circle L. This circle surrounds the pivot M. These pieces maintain the wheels J at equal distance from the center of the apparatus. All these pieces and their external parts are fixed to an iron circle, *o*, which ties them all together. This circle maintains each wheel to the distance assigned to itself. L, rotating cast-iron circle, receiving rods K; *m*, hollow pivot, solidly fixed on the foundation resting on the soil. It is from the center of this pivot that all the condensations produced by the steam of the double bottom of each tub are discharged. *n*, piece of cast-iron resting on the fixed pivot *m*, turning on it in a stuffing-box with the whole macerating apparatus. This same piece, which is hollow, receives the steam produced by the water, which from this point is forced into the double bottoms of the tubs, and through the pipes of transmission of the liquids from one tub to another. *o*, several steam-pipes provided with cocks, connected with the double bottoms *b*, and with the vertical pipes of transmission Q; P, pipes taking back to pivot *m* the condensation produced in the double bottoms *b*; Q, pipe of transmission of the liquids from one tub to another, each pipe at its upper part having a vertical cock, which is used to establish or suspend the circulation. The liquids come out of the tub in R, rise in the pipe Q, and run in the next tub through that portion of same pipe marked S. At T the injection of the steam is made, designed to heat the liquids and accelerate the progress of their action. U, a rotating platform turning on the pivot *m*. It is on this platform that is bolted each piece of wood V. V, pieces of oak wood, bolted on the upper circle and on the platform U. The whole is a movable platform. It is on these pieces of wood that rest the ten marcerating-tubs. W, the pipes in which the steam from the steam-generator enters the stuffing-boxes *m* and *n*, and from the rotating box *n* is distributed at pleasure to the

tubs; X, escape-pipe of the condensations of the pivot *m; y*, cock used to turn the liquids out of each tub.

The construction of the macerating apparatus, though simple, needs the greatest care. It is indispensable that the circles *h* and *i* be dressed and turned, likewise the eight cast-iron wheels, J, the fixed pivot *m*, and the two stuffing-boxes. The platform U must be turned, and it is necessary to leave a little space in the turning part on the pivot, for the slightest displacement of the normal part of the apparatus would break the platform or the pivot.

The rivets inside of the iron tubs must be perfectly smooth and even with the iron.

The cocks can be made of cast-iron or bronze, and must be perfectly tight.

Construction of the displacing apparatus.—The apparatus is composed of ten rectangular tubs placed circularly on a wood-work, which is fixed permanently to a cast-iron circle, from which circle each piece of wood converges to, and is bolted to, a cast-iron platform forming the center of the apparatus, which reposes on a hollow pivot solidly fixed to the soil.

A second cast-iron circle, like the first described, rests on a stone or brick foundation, and is fixed to it by solid bolts. Between the two circles there are eight cast-iron wheels, maintained by iron pieces, converging to a movable circle surrounding the pivot. The result of it is that the whole system of tubs, placed circularly, rests on the rotating platform, which can turn to the right or to the left.

The tubs are connected between them by cast-iron pipes used to transmit the liquid from one tub to another. On the upper part of each of these pipes is a cock, which is used to stop the transition of the liquids from one tub to another. This transmission begins on the bottom of a tub to the top of the next. At the lower part of each pipe of transmission is a little pipe with a cock, which cock is destined to inject vertically the steam into the interior of said pipe. This injected steam in the liquid, when the apparatus is in motion, fulfills two important objects: first, to carry the liquids and make them pass rapidly from one tub to another; the second is to heat the liquids and keep them always to a temperature of about 70° Reaumur, this temperature being indispensable to avoid all beginning of fermentation in the saccharine liquids, and, consequently, avoid all transformation of crystallizable sugar. In uncrystallizable sugar, to reach the same object, each tub has a double bottom, hollow in its interior. One injection of steam is directed into the interior of these double bottoms to heat the liquids contained in each tub.

It is very probable that the double bottom is not indispensable to maintain the liquids to a temperature of 70° Reaumur, and that the only injection of steam made to the interior of each tub would be sufficient. Each tub has, at its lower part, a discharge-cock. To the interior of each tub is a cork bored with holes. It rests on an iron cornice, which sets it apart a few inches from the bottom of the tub. Each diaphragm bears two iron pieces, solidly bolted.

A second diaphragm, alike the first, rests on the two pieces at their upper part, and is maintained on these pieces by means of two keys passed through the said pieces. It is between the two diaphragms of each tub that the matters to be macerated are placed. Outside of the macerating apparatus, and placed higher, is a reservoir full of water, maintained to the temperature of 70° Reaumur by an injecting steam-pipe. Generally this reservoir is kept filled up by warm water coming from condensations, &c.

Macerating apparatus.—Generally the sugar-cane contains water and different salts—

Potash	65	per	cent.
Ligneous part	17	"	"
Crystallizable sugar and others	18	"	"
Total	100	"	"

Plantations well organized obtained generally of the sugar-cane—

Extracted juice	55	per	cent.
Ligneous part	17	"	"
Juice left in the bagasse or ligneous parts	28	"	"
Total	100	"	"

The general results of a sugar-cane factory by ordinary process are—

Extraction of crystallized sugar	6	per	cent
Molasses and sirup	6	"	"
Loss of sugar left in the bagasse	3	"	"
Molasses or sirup left in the bagasse	3	"	"
Total	18	"	"

Risumi.—A plantation of sugar-cane which produces every year one million two hundred thousand pounds of sugar and six hundred thousand pounds of molasses or sirup would certainly, if it was in good condition for the extraction of the juice, produce, with the same quantity of sugar-cane, one million eight hundred thousand pounds of brown sugar and nine hundred and fifty thousand pounds of molasses and sirup. There is, then, a loss for the manufacturer of about six hundred thousand pounds of sugar and three hundred thousand pounds of molasses or sirup. The extraction of all the juice contained in the sugar-cane would be the greatest industrial progress realized in the important branch of this indispensable product. It is to realize this idea and purposes that the macerating apparatus for sugar-cane and bagasse has been constructed; and the following description of this new and important tool is bound to attract the greatest attention of all the manufacturers of sugar, molasses, sirups, and alcohol obtained by fermention of saccharine substance.

To understand very well the operation of the apparatus it is necessary that each tub be provided with a number from 1 to 10. All the tubs are in communication with one another by the pipe of the transmission of liquids. Consequently the cocks of these pipes are open from the tub No. 1 to the tub No. 10; but the cock of this last one is shut, and does not communicate with the tub No. 1, all the tubs being loaded with matter to be macerated, which is maintained between the two diaphragms of each tub, the warm water coming from the reservoir to fill up the tub No. 1, at the same time, by its natural level, raised from the bottom of the said tub in the pipe of transmission corresponding to the top of tub No. 2, and continuing without interruption to let the water run into the tub No. 1. This water passes to the tub No. 2, to go through from the top to the bottom, all the matter which is in the tub to come again on the top of the tub No. 3, and operate on this one in the same manner as that in the tub No. 2, and so on from tub to tub until it reaches tub No. 10.

It is easy to understand that the water falling on the tub No. 1 and passing through the matter from top to bottom has displaced and chased before it a great part of the saccharine liquid which was contained in it, to pass in the same manner from tub to tub, becoming richer and richer in its transmission, as the water meets matter richer and richer in sugar, arriving finally in the tub No. 10, and fills it up as the others. If one operator opens the discharge-cock of the tub No. 10 and examines the liquid, he will find it composed only of saccharine gravy, having, as near as possible, its same density and, consequently, the same saccharine richness that the natural juice has directly extracted from the matter itself. If, on the contrary, you open the discharging-cock of tub No. 1 and weigh the liquid you have taken out of it, you will find its density reduced, as at 0, to the areometer Baumé—that is to say, that the matter contained in this tub is completely extracted, and does not contain a particle of sugar.

It is easy to be convinced of this fact by taking some of the matter and pounding it in a mortar, pressing it strongly. Taking the juice and submitting it to the areometer, you will obtain for the liquid of the said tub No. 1, 0 to the areometer, for it would have been displaced and carried toward the tub No. 10.

It is easy to see, after what has been explained, that the principle of the apparatus is this: The liquids, in their progressive transmission, become richer and richer to the point of becoming natural juices, while the matter going in an opposite direction becomes so poor that they do not contain any particle of sugar.

It is when all the tubs have been filled up, as it has been explained, that the apparatus is in its continuing and manufacturing progress.

In fact, all the tubs rest on a movable platform resembling the turn-table of a railroad, and the tub No. 1, discharged of all saccharine or extractive-principle matter, will take the place of tub No. 10, to be recharged with richer matter. By this same movement of the platform the tub No. 2 has taken the place of No. 1, taking care to intercept, as it has been already said, the communication of the liquid between the new tub bearing the No. 1 and 10.

Again, you let run the warm water on the tub No. 1, which, by its natural level and by the ejection of steam in the pipes, displaces successively from one tub to another tub the liquids which are contained in them, arriving finally at the tub No. 10, where is received the juice which is extracted by the discharging-cock.

If the juice decrease in degree, and is inferior to the natural juice, you shut the discharge-cock of tub No. 10, and stop the water falling on the tub No. 1, and discharge this tub of its extractive principle, and put the apparatus in motion.

To reach a tenth of its revolution, you recharge the tub which has taken the place of the one bearing precedently the No. 10; you let run the water on the new tub No. 1, and so on, continuing the operation, which cannot be stopped but by want of matter to be macerated.

The matter taken off of the tub No. 1, as it has been said, each tub, by the movement of rotation of the apparatus, becoming, in its turn, tub No. 1, containing no more sugar and being perfectly worthless, the result is that the extraction of the sugar contained in the matter submitted to the apparatus is complete. The matter so operated upon is always taken off to the same point—that is to say, from the tub No. 1.

The taking off of this matter is made by the use of a little derrick, and at once, this matter being between the two diaphragms. The chain of the derrick is terminated with a hook, which can be attached to the iron piece, binding together the two iron pieces fixed to the diaphragms.

In the operation of the apparatus the removal of the worthless matter and the changing of the tub receiving the rich matter ought to be executed rapidly if you wish to macerate a notable quantity of matter in a given time.

The preparation of the sugar-cane before it is submitted to the maceration consists in a pair of cylinders, employed in the actual process to crush the cane between these two cylinders. This operation has for its object to break the bark and open its envelope. When it is then prepared and submitted to the maceration, you let run the hot water on the cellular part containing the saccharine liquids, which liquids are displaced by the water taking their place. It is not necessary that the sugar-cane be submitted to a great pressure.

It needs simply to be crushed. It is very probable that under a light pressure it will run very little juice. In all cases this juice can be mixed with those of the maceration. In the case where the bagasse, which has until the present time been completely abandoned, it would suffice to place this bagasse in the maceration-tub, when it runs off the cylinder and between the diaphragms of each maceration-tub. This bagasse, which has been considered as unproductive, would certainly give juices as rich as those coming directly from the cane.

In conclusion, by the maceration of the bagasse two thousand pounds of this matter contained—

In ligneous part.....	756 pounds
And in saccharine juice.....	1,244 "
Total.....	2,000 "

This number demonstrates in an evident manner all the importance of this new mode of application of the maceration of the sugar-cane and bagasse. The juice coming from the bagasse can be transformed by the ordinary process in sugar, or can be distilled after their alcoholic fermentation.

It is very important to notice that, by the action of the heat on the saccharine juices of sugar-cane, sorghum, and others, the vegetable albumen and the chlorophile are coagulated and filtered in passing from tub to tub through the ligneous matters contained between the two diaphragms of the macerating apparatus, and if the operation is well managed the juices must be perfectly bright, consequently ready for evaporation, then saving the defecation of liquids.

As for the other substances for which the macerating apparatus is employed with great success, they need only before to be put between the two diaphragms to be coarsely ground, avoiding as much as possible the fine powders, the malt to be crushed coarsely between two cylinders, the bark, as oak, &c., all the roots, woods, and plants, &c., coarsely ground.

Ashes and other saline substances dissoluble in hot or cold water will be ground in accordance with their cohesive properties.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The apparatus herein described for obtaining extracts, the same consisting in the combination of a series of extractors, to operate successively, as described.

2. The combination, with the tubs or vessels *a*, as described, of pipes for liquids and steam, so as to operate as described.

3. The process herein described of using steam and water of high temperature, so as to obtain extractive matters from solids, in the manner set forth.

4. The arrangement of pipes and cocks, so that the liquid is forced automatically from one vessel to another, as described.

5. The combination of a series of vessels with a revolving table, as described.

This specification signed and witnessed this 18th day of August, 1869.

L. A. DE LIME.

Witnesses:
T. C. CONNOLLY,
PETER F. WILSON.