C. DEROSNE.

10 Sheets—Sheet 1.

Defecating Cane Juice.

No. 4,108.

Patented July 10, 1845.

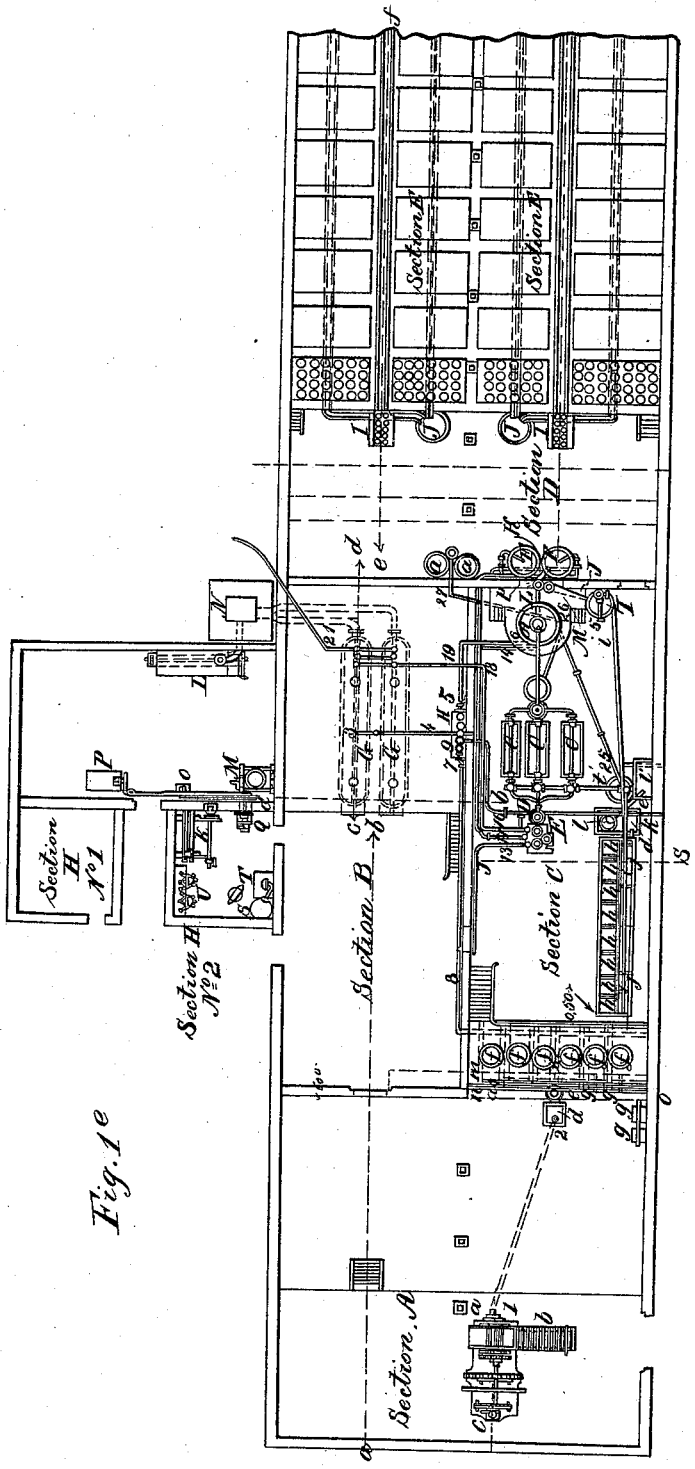

Fig. 1e

10 Sheets—Sheet 2.

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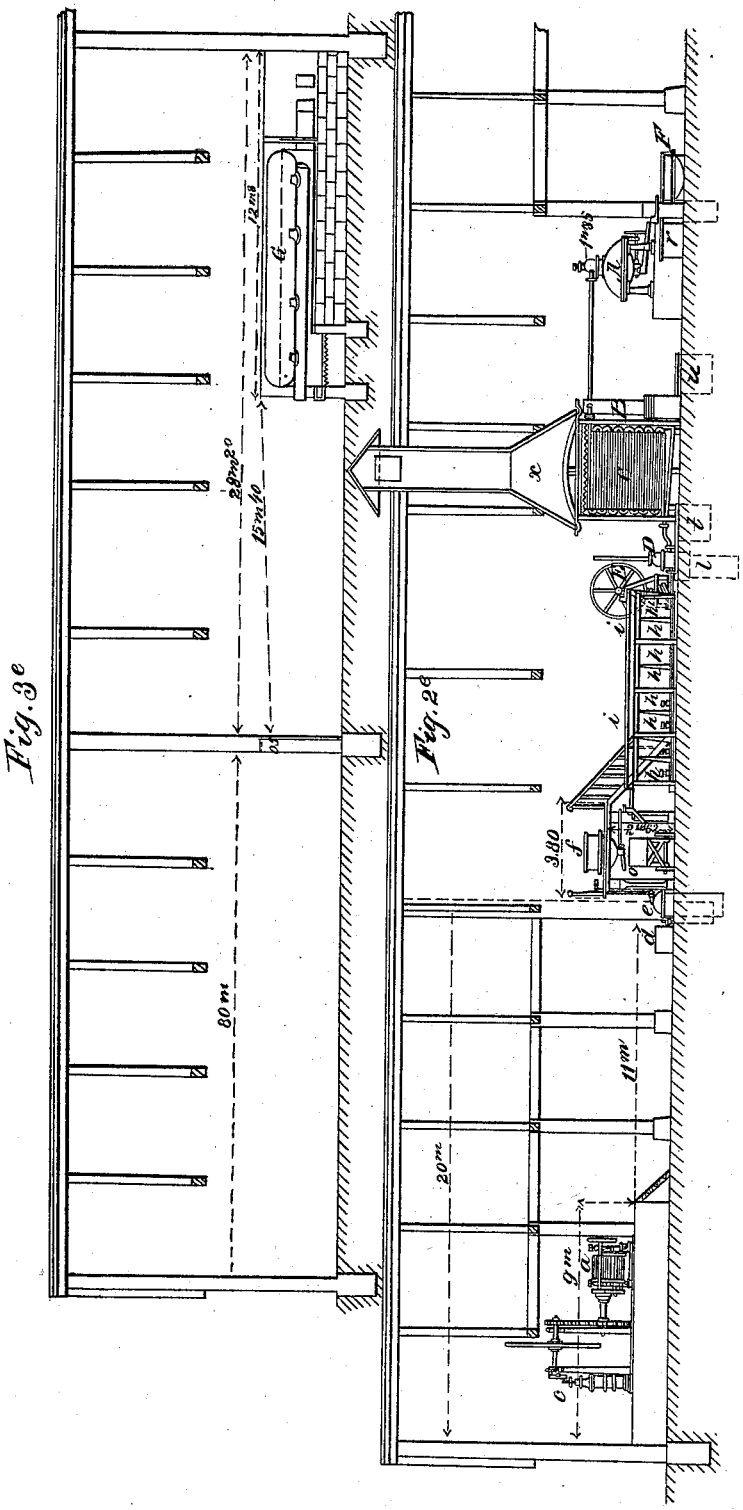

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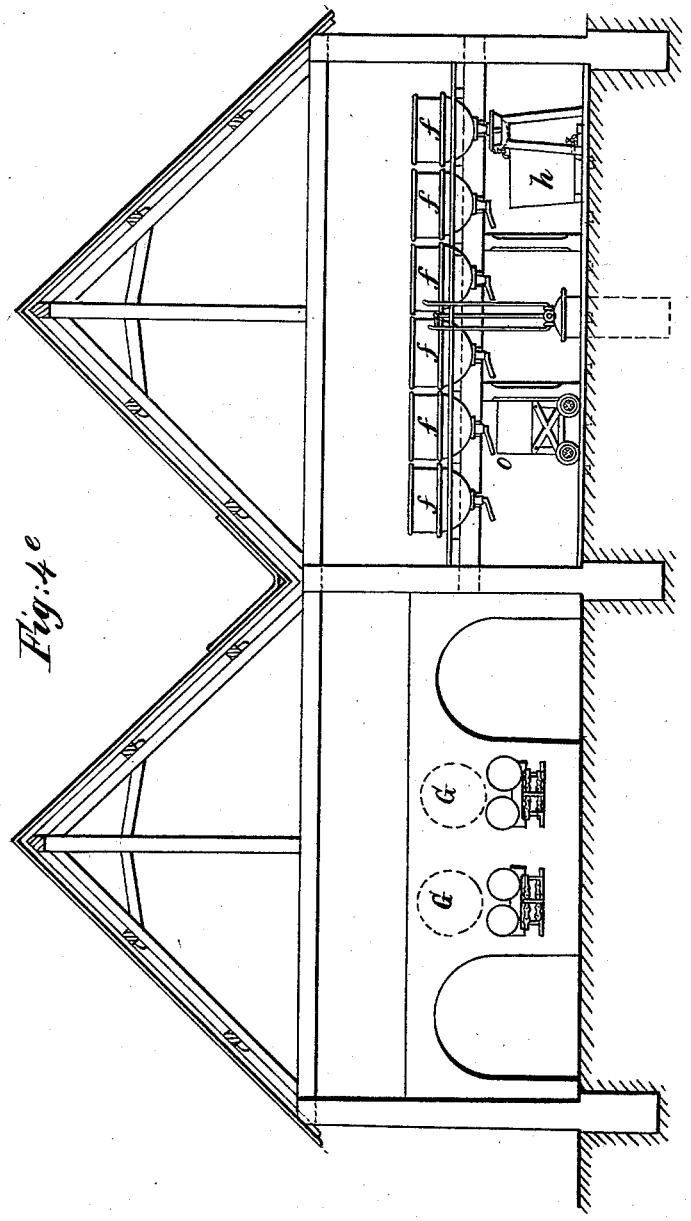

Fig: 4 e

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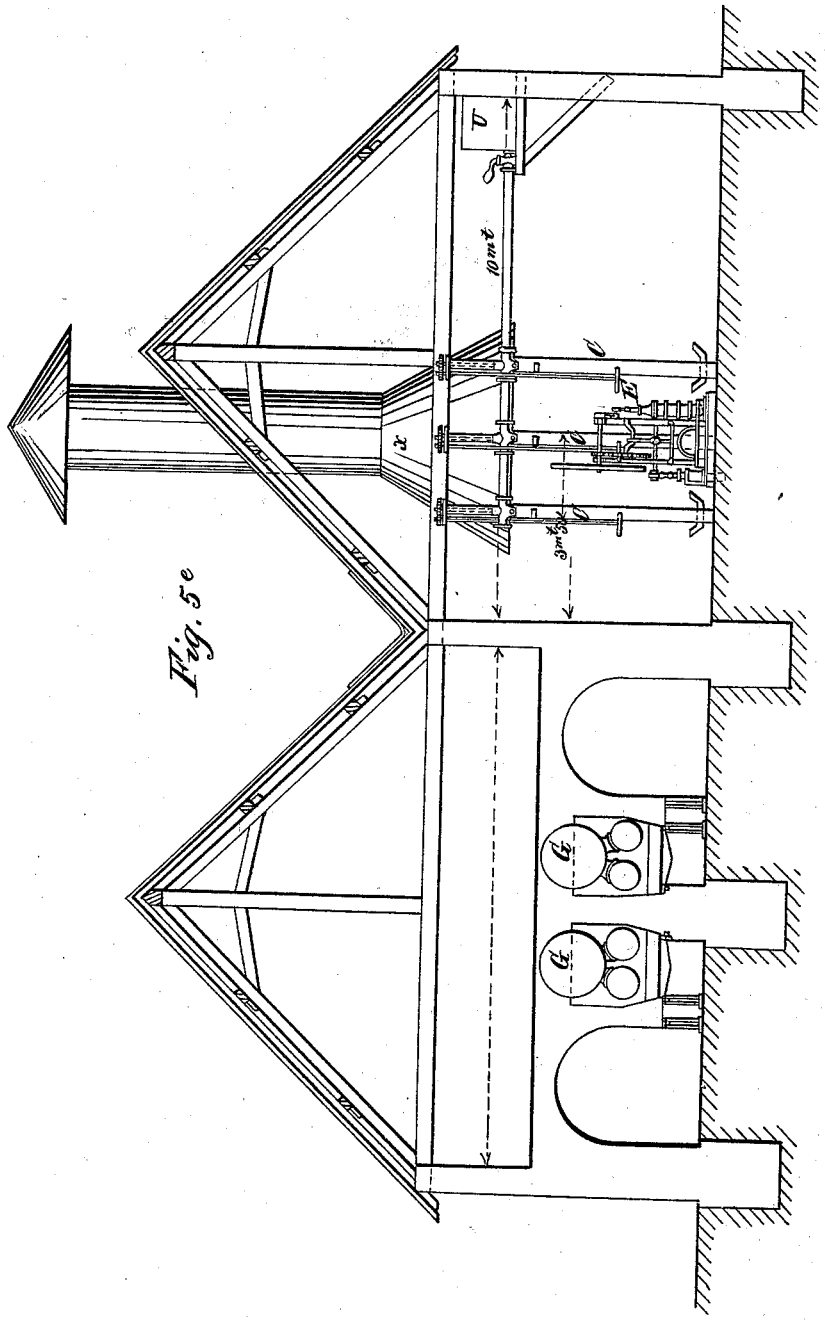

Fig. 5e

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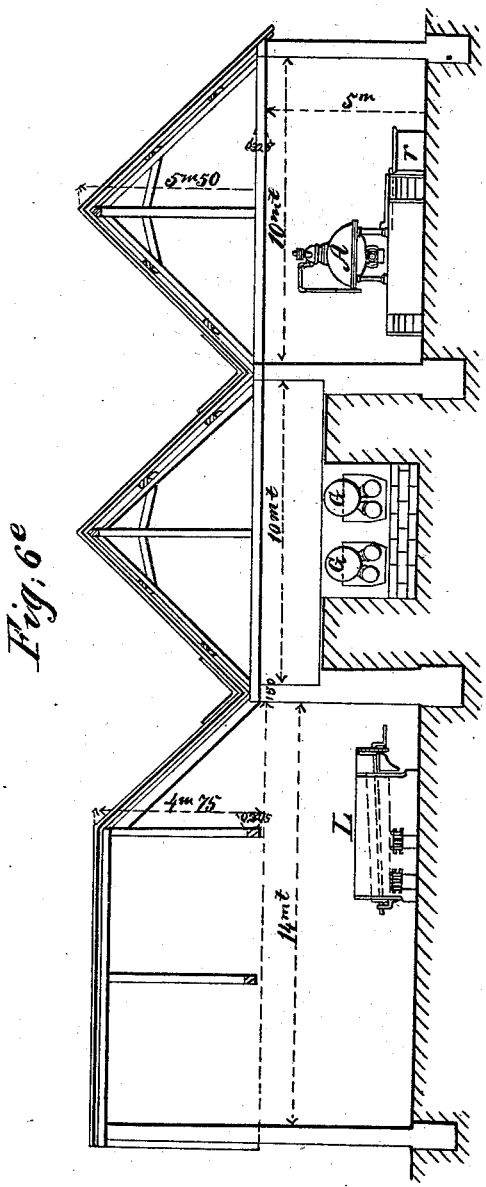

Fig. 6e

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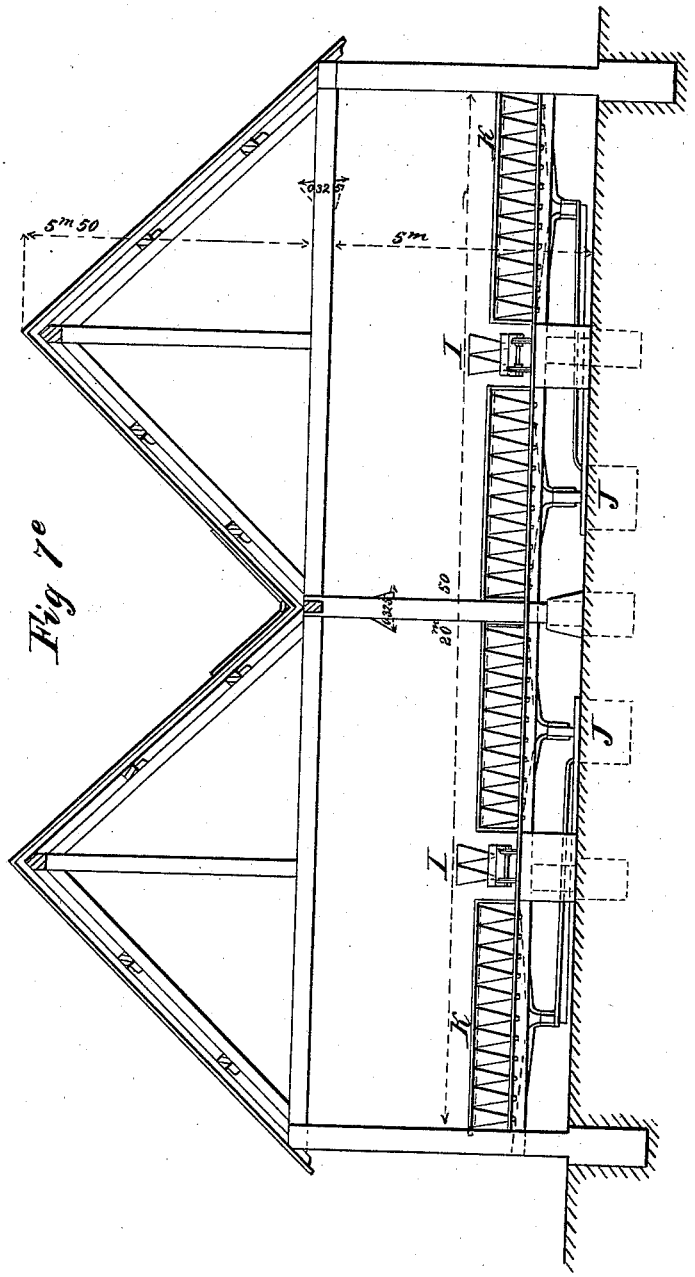

Fig 1e

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Defecating Cane Juice.

No. 4,108.

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Fig. 1.

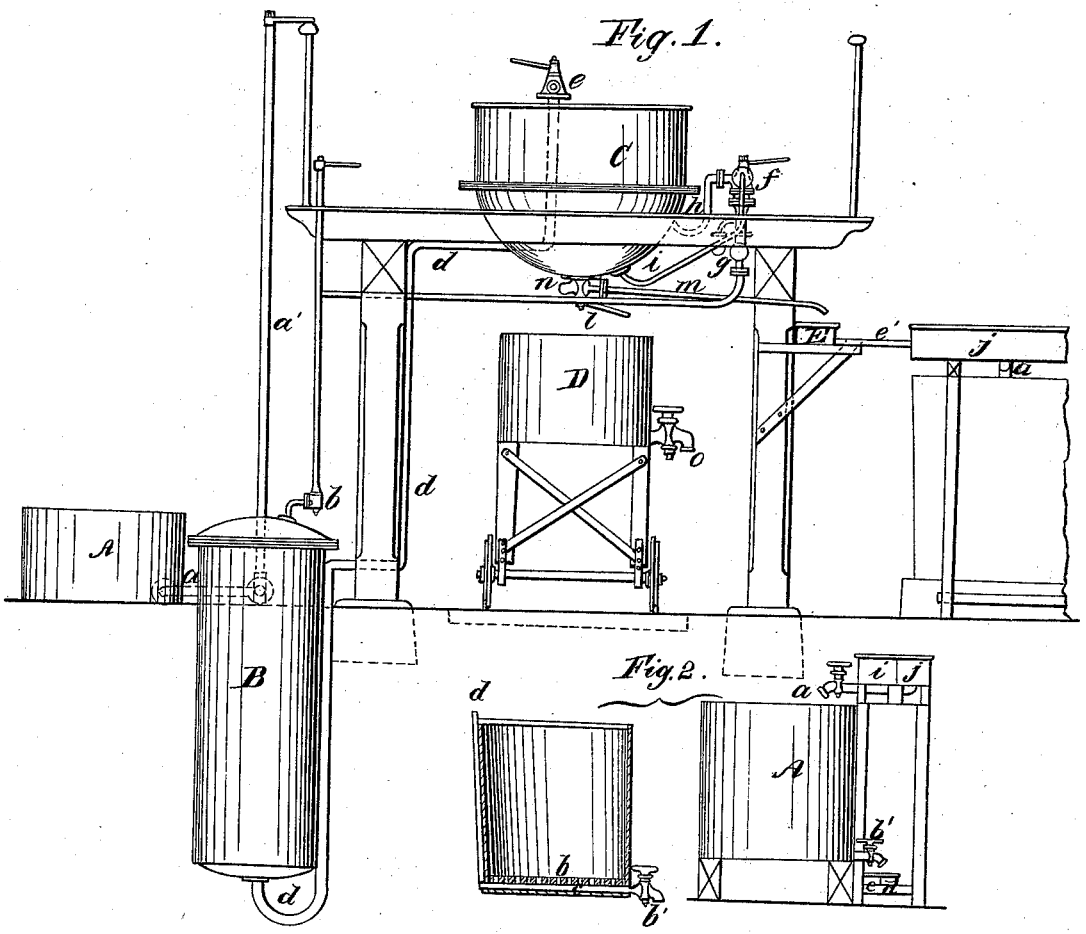
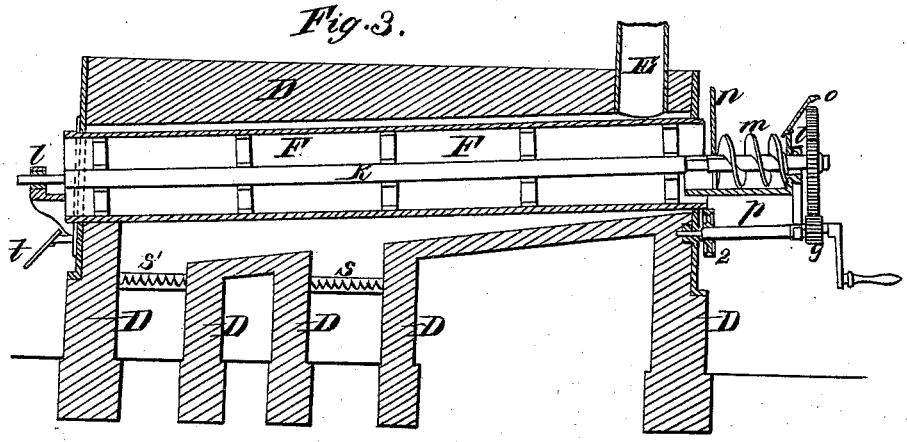


Fig. 2.

Fig. 3.



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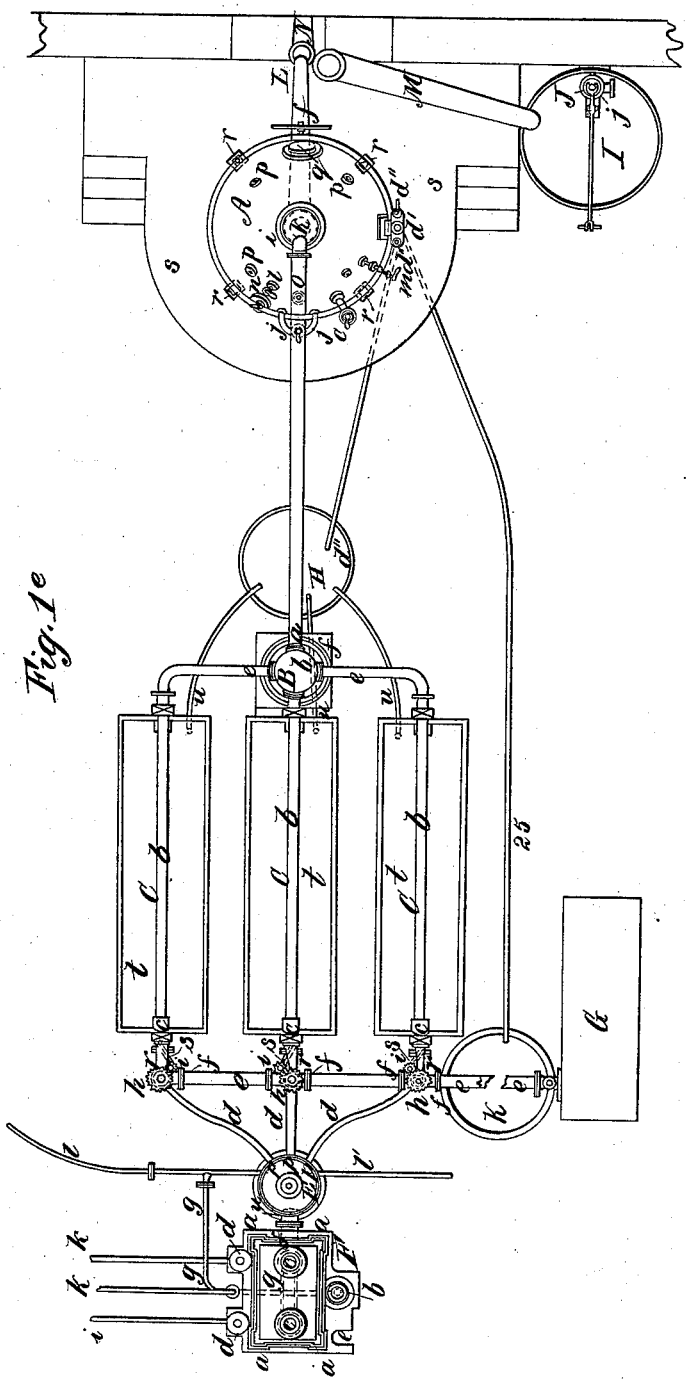
Patented July 10, 1845.

Fig. 1e



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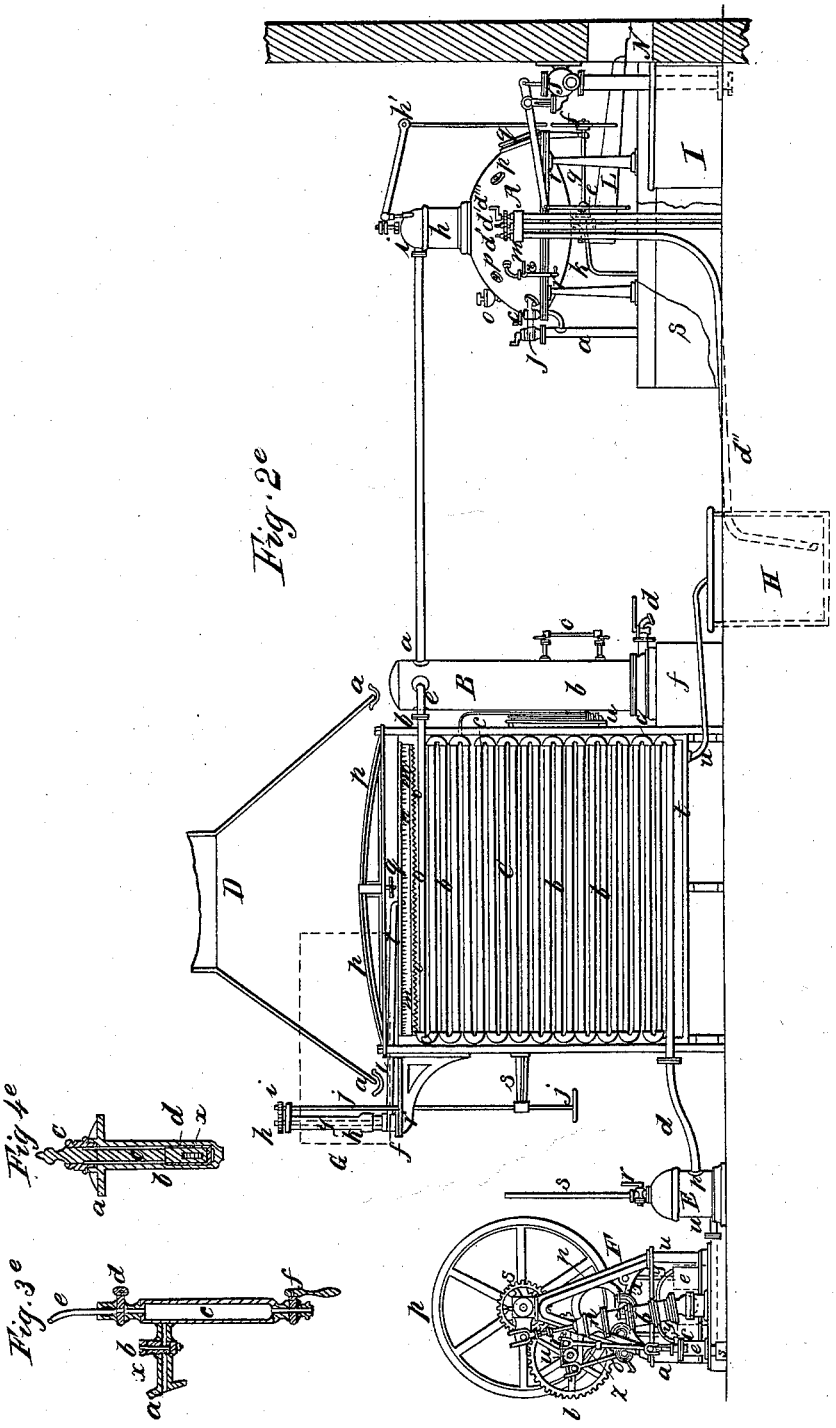

10 Sheets—Sheet 10.

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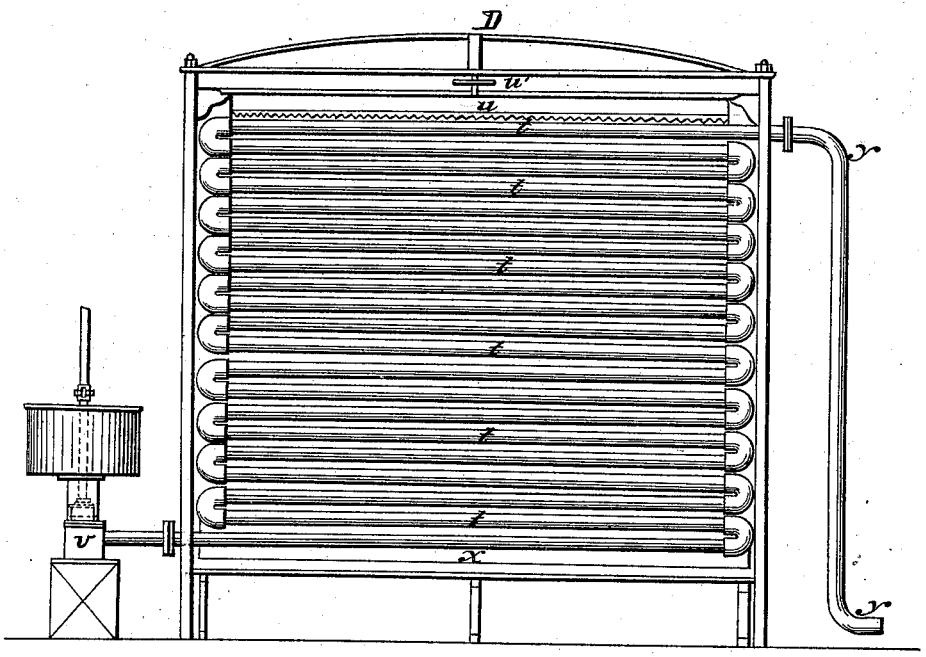

UNITED STATES PATENT OFFICE.

CHARLES DEROSNE, OF PARIS, FRANCE, ASSIGNOR TO JOSEPH F. LAPÉCA.

IMPROVEMENT IN MAKING SUGAR.

Specification forming part of Letters Patent No. **4,108**, dated July 10, 1845.

To all whom it may concern:

Be it known that I, CHARLES LOUIS DEROSNE, of the city of Paris and Kingdom of France, have invented several new and useful Improvements in Manufacturing Sugar of a Superior Quality from Beet-Root, Sugar-Cane, or the Maple-Tree; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, which form a part of this specification, in which the various parts of my apparatus are delineated.

The method of manufacturing is as follows: The juice is expressed from the cane or other material in a mill of usual construction. Shown in the Figure 1, Section A, of Plate 1. This plate represents various horizontal and vertical sections of different parts of a sugar manufactory, and is given for the purpose of more clearly illlustrating the various machines and their relative location in practical operation. The juice, which is taken from the mill in section A, is defecated in pans or boilers, a row of which is shown at *f f f*, Section C, Plate 1. In Plate 2 one of these boilers is represented at C, Fig. 1. The juice from the mill passes into a reservoir, A, Fig. 1, that is connected by a pipe, *a*, with an air-tight cylinder, B, in which pipe there is a stop-cock that is turned by a long handle, *a'*, by turning which the cylinder B can be filled, and the communication can afterward be cut off by admitting steam from the generators or boilers (shown at Plate 1, Fig. 1, G, that supply steam to the engines and heating apparatus of the whole manufactory) into the top of cylinder B. The juice is forced through a pipe, *d*, in the bottom of said cylinder up into the clarifying-boiler C, which is constructed with a double bottom, between which steam is admitted by the tube *h* from the generators, the condensed water being returned to the boilers by a force-pump through the pipe *i*. This construction is common, and a more particular description is not deemed necessary; but the employment of the series of these pans for this purpose has never before been done, or the juice clarified as about to be described. When the cane-juice has reached the point proper for receiving the clarifying-mixture, which point is from 60° to 63° of Reaumur, it is added. This composition is made by a compound of the sulphate of alumina of the cheapest character, either with or without the presence of iron, which is formed by mixing sulphuric acid with aluminous earth, and adding thereto lime, potash, or other similar salt, and a quantity of liquefied blood, either fresh or dried, being incorporated well with this precipitate. This is united with the juice by carefully stirring it while pouring in the mixture, and clarifies it; or, instead of this, lime alone can be used, as in my former processes, the quantity being much greater than that used in the old colonial mode of proceeding, as in this system there is nothing to fear from an excess of lime, which a subsequent part of the process perfectly corrects to any extent that it may have been found necessary to use it, in order to obtain a good clarification. The steam is kept on until the juice begins to boil, and when this point is reached the steam is cut off. The result of this is, when the mixture is used, that at the top of the boiler C a thick and solid coat of scum is formed, and only a very small quantity of matter is precipitated to the bottom of the boiler. In a few minutes the liquor will have become clear, and can be drawn off through a tube, *m*, by turning a cock in the bottom by means of a key, *l*, when it can be ascertained if the liquor is limpid. A small quantity of thick matter usually issues from the tube first; but it soon runs clear. By this mode of proceeding we avoid all the troublesome labor of skimming, &c., which is rendered unnecessary. The juice, after leaving the tube *m*, passes into a gutter, E, which communicates by a pipe, *e'*, with another reservoir, *j*, by which the filters hereinafter described are charged with the juice. When all the clear juice is drawn off, the scum, &c., and the remainder is drawn into a reservoir, D, underneath, after which bags are filled with it, and the sirup is drained and pressed out of it. The clarified cane-juice in the reservoir F is next to be filtered through animal charcoal in grain, and this filtration constitutes one of the most important operations of the manufacture. It purifies the juice to a degree hitherto unknown, and furnishes the means for readily obtaining sugars of the finest quality. In Plate 1, Section C, eight of these filters are represented at *h h h*, all of the same construction. One of them is shown in Plate 2, Fig. 2, in elevation and section. They are

constructed to contain about one and one-seventh ton of animal charcoal. They are made of sheet-iron or wood lined with copper, of a square form, narrowing slightly toward the bottom. At the lower part there is a grating, *b*, as shown in the section, leaving a small space, *c*, between that and the bottom, through which the filtered liquid flows. On this grating is placed a thick blanket, for the purpose of supporting the charcoal, which should be sufficiently large to allow the edges to be pressed against the sides. A thick layer of charcoal is then spread over this blanket firmly and evenly, after which another layer of the charcoal is put in, care being taken to equalize it with a trowel as it is thrown in, and the filter is filled thus to about four and a half feet in depth. The upper surface is then carefully smoothed, and it is ready for use. A plate is laid on the place where the cock *a* discharges the juice or sirup into the filter in order that it may spread horizontally over the surface without forming hollows therein. The sirup penetrates the animal charcoal and drives the air down before it, which is discharged through a pipe, *d'*, that leads up from the space below the grating to the top of the filter. The sirup, after passing through the grating, and having deposited all its impurities in the filter above, is drawn off through the cock *b'* in the bottom, from whence it is conducted to a reservoir, (shown in Fig. 1, Plate 1, by the letter *k*,) from which it is elevated by a cylinder, *l*, (same plate,) into a reservoir, *l'*. This cylinder is made and operates precisely the same as that above described, and shown at B, Fig. 1, Plate 2. From the reservoir *l'* of Plate 1, which in Plate 3 is designated by letter G, the juice is conveyed to the evaporator, which is one of the most important parts of my invention, and is constructed as follows, Plate 3, Fig. 1, being a top plan, and Fig. 2 a side elevation, thereof: It consists of a double or triple series of horizontal tubes, each series being placed one over the other, forming two or three parallel lines, *b b*. The tubes of each series are connected together at each end, so as to form one long conductor for the steam by which they are heated, as hereinafter described. The tubes of each series are supported by two upright posts—one at each end—which are connected at the top by a cross-beam or cap-brace, *p*. Just under this beam there is a bracket on the inside of each post, which supports a triangular-shaped trough or distributer, *m*, that extends from one to the other, the lower edge, *o*, of said trough being serrated without being cut through, and standing directly over the center of the upper tube of the series *b*. One side of this trough has a row of small vertical oblong holes, *n*, in it, through which the juice received from the reservoir G percolates, and, guided by the lower serrated edge, drops upon the top of the upper tube, spreads itself around it, and then falls on the next, and so on to the bottom, passing over the entire surface of the tubes, which, by the heat of the steam within them, serves to evaporate some of the aqueous portions of the juice, that is then received at the bottom in a receiver, *t*, and ultimately into the reservoir H, and the juice, being heated by the tubes and being exposed to the action of the air in a state of extreme division, is evaporated and conducted in a proportion determined by the rate at which it escapes from the distributer above, as it falls into the receivers *t*.

A is a boiler of a common construction, for boiling by steam in vacuum, with the usual fixtures attached thereto, a particular description of which, therefore, is not deemed necessary. A vacuum is formed by an apparatus, hereinafter named, in the boiler A, and by opening a communication between it and the reservoir H, through the connecting-pipe *d''*, which extends from the bottom of said reservoir to the boiler, the juice contained in H rushes into the boiler. As soon as the boiler is filled, which is ascertained by means of the glasses in the lid of the boiler, the pipe *d''* is stopped, and the steam is introduced into the serpentine heaters of the boiler from the steam-generators. The steam which rises from the juice in the boiler into the cap *h* passes through a tube, *a i*, into a large upright cylinder, B, which I denominate a "safety-vase," and in which any saccharine matter is separated from the steam that has been forced up with it. From the vase B the steam passes, by pipes *e*, into each series of tubes, above described, lettered *b*, entering the upper tubes of the series, and passing out of the lower ones on the opposite side. This steam, in passing through the tubes *b*, is condensed by the juice, which runs down over the outside, the apparatus thus performing the twofold operation of evaporating the juice and forming a condenser for the steam rising from the vacuum-pan. The steam, when condensed into water, runs out of the lower tubes, as above named, into an injecting-cylinder, F, where, if the condensation is not perfect, water can be injected to complete it. From the cylinder E the water of condensation, &c., is drawn off by the action of the air-pumps attached to a steam-engine, all of which are of usual construction, and their location is indicated in the drawings by F.

The pumps and cylinder E, above named, may be omitted, and a ventilator placed in their stead, as will be obvious to any competent mechanic; but the vacuum will not in that case be so complete, although the expense of the apparatus is somewhat reduced.

Instead of attaching the condenser with the vacuum-pan, as above described, it may be connected with the exhaust-pipe of the steam-engine, as shown in Plate IV, in which D is the condenser, and *y y* the pipe connecting the exhaust-pipe therewith. As the depth of juice in boiler A is reduced by evaporation down to the heaters inside, a further supply is to be admitted from H through the pipe *d''*, as in the first instance, and when the juice under

evaporation requires a density of 24° or 25° of Baumé it must be drawn out of the boiler, the passage of the steam to the heater being first cut off, and the vacuum therein destroyed. The sirup, at 25°, then passes through a movable spout, L, which is directed into another spout, M, Plate 3, and thence into the reservoir I, after which the boiler is again charged with juice from H, and the process again proceeds as before. During the operation of emptying and refilling the boiler the time is so short as not to require the stopping of the flow of the cane-juice over the outside of the tubes *b*. From the reservoir I the sirup is raised, by means of a hand-pump, J, into a spout, which is represented at *i*, Fig. 2, Plate 2, and section *c*, Plate 1, by same letter, for feeding the filters, before described. The sirup runs from the spout *i* into either of the filters *h*, Plate 1, through stop-cocks attached thereto for that purpose, and, passing down through the filter, as above described, it is soon after drawn off through the cock *b'* of Fig. 8, Plate 2, and is received into the gutter *e*, whence it is conducted into the reservoir K', Plates 1 and 3; and when there is a sufficient quantity therein to fill the boiler A the other processes are stopped and the boiler A is filled with the sirup from the reservoir K' by means of a pipe, 25, which connects them by a proceeding similar to that for filling the boiler from the reservoir H. The evaporation of this sirup of 25° is then proceeded with until it is sufficiently boiled, which is ascertained by the testing-rod *n* of common form. When the sirup is in a proper state of condensation, the boiler is to be emptied by means of the movable spout L through the spout N into one or other of the heating-pans shown in Plate 1, Fig. 1, and section D by the letter F.

Section D is the filling-house. The pans F placed therein have double bottoms, and are supplied with steam from the generators between the two bottoms, by which they are heated until the temperature of the sirup contained therein reaches 70° Reaumur, at which point crystallization almost immediately commences, and when it is quite determined the mixture of crystals and sirup must be stirred with a wooden spatula, care being taken to distribute the crystals formed on the bottom and sides equally. The matter is then, while in a liquid state, ready to pour in the molds. These are shown at section E.

In the process of filtration, hereinbefore named, as soon as it is found that from the use of the filter the sirup of 25° comes from it less pure than at first, it is stopped and turned into another filter. The clarified juice is then admitted into the filter from spout *j'*. This drives the sirup still contained in the filter down and takes its place. When the degree of the flowing sirup is found to be reduced to 15°, the juice flowing from cock *a'* is directed into the gutter *d*, which conducts it into the reservoir *k* of Plate 1, from whence it takes its course, as before indicated.

When the animal charcoal is sufficiently exhausted by the filtration of the clarified juice, water is let onto the filter and assumes the place of the clarified juice in the same way as the juice did the sirup. By this means the greater part of the juice is recovered, the flow being stopped when the degree of the liquid is too weak to be of value. The coal is then taken out of the filter and conveyed to the revivifier, to be presently described, and the filter is again refilled with fresh black.

The machine for restoring the animal black is composed of a cylinder (represented in Plate 2, Fig. 3, F) placed in a position a little inclined from the horizontal, and on the upper end of its shaft *k* there is a screw, *m*, that is placed in the lower part of a hopper, into which the coal from the filters is put. By the revolution of the cylinder the screw that turns with it conveys the coal from the hopper into it, and the coal gradually passes down the cylinder and out at the lower end. The cylinder is surrounded by brick-work D, leaving a sufficient space between them for the circulation of heat all around the cylinder. Below the front or lower end of the cylinder there is a furnace, S', built in the brick-work, and about one-third the distance between that and the hopper there is another furnace, S', constructed in a similar manner. The smoke is conveyed off near the hopper by means of a pipe, E, passing through the top of the furnace. The animal charcoal going into the cylinder is gradually heated up and dried as it passes over the furnace S', and so down, approaching still nearer to the fire at the furnace S', where it is heated up to a red heat and in the most perfect and equal manner, thus subjecting each particle, by a gradual increase, to the highest temperature required without overheating and spoiling any, as it is absolutely necessary that the coal should be only heated up to a dull red that requires a dark place to be distinguished in. The black is then fit to be used again in the filters.

The cylinder may be turned by any mechanical means, and the fires should be regulated with accuracy.

Instead of the animal charcoal above mentioned, and which is constanly growing dearer and more difficult to obtain, I have invented a substitute which I denominate "vegeto-mineral black." Considering it a principle that the molecular division of carbon, combined with a certain porosity in the texture of animal charcoal, was the cause of its whitening properties, I have produced a compound which seems to unite these two properties, that may be produced in all sugar-works in any position.

The principle ingredient used to supply the carbon is saccharine matter combined with a clay base to give it due consistence. The sacharine matter I use for this purpose is taken in the form of molasses or the residuum of sirups, which is rarely of much value in sugar-works. This is mixed with a white or gray clay, as they contain little or no iron.

Take any quantity of this clay and about one-third as much molasses, by weight, to which is added about the same quantity of water; pour the liquid into a reservoir and mix the clay with it gradually and uniformly, so as to form a homogeneous mass. The paste thus produced will have the consistencies of stiff mortar. Iron cylinders are then filled with this mortar, care being taken to dispose of it in layers of three or four inches thickness. When the cylinders are full to within an inch of the top, three or four holes are made through the center of the mass with a stick that will reach the bottom, and one or two pieces of wood may be introduced in the middle of the mass to accelerate carbonization, which is effected in the same manner as the process of carbonizing bones. The pulverizing and sifting is also similar to the process used in forming the animal charcoal. The vegeto-mineral carbon thus produced has the appearance of the finest animal carbon, and its whitening properties are equal thereto with a still higher power of absorption. It is quite as solid, is not disturbed by water, and may be used either coarsely or finely powdered like the animal carbon. This black may also be revived in precisely the same way as was before described for animal carbon.

Having thus fully described my apparatus and the process of manufacturing sugar, what I claim therein as my invention, and desire to secure by Letters Patent, is—

1. The method of renewing or restoring the animal charcoal, as herein set forth, by means of the revolving cylinder placed over two fires in the manner specified, by which it is heated gradually to the proper temperature.

2. The employment of a series of horizontal tubes placed one above another, in the manner described, having a current of steam passing between them, and the cane-juice flowing over their exterior surface, by which the steam is condensed and the juice is somewhat concentrated, thus serving the double purpose of a condenser and an evaporator, as hereinbefore described, said condenser being attached either to the vacuum-pan or exhaust-pipe of the steam-engine.

CH. DEROSNE.

Witnesses:
ALFRED STILLMAN,
J. J. GREENOUGH.