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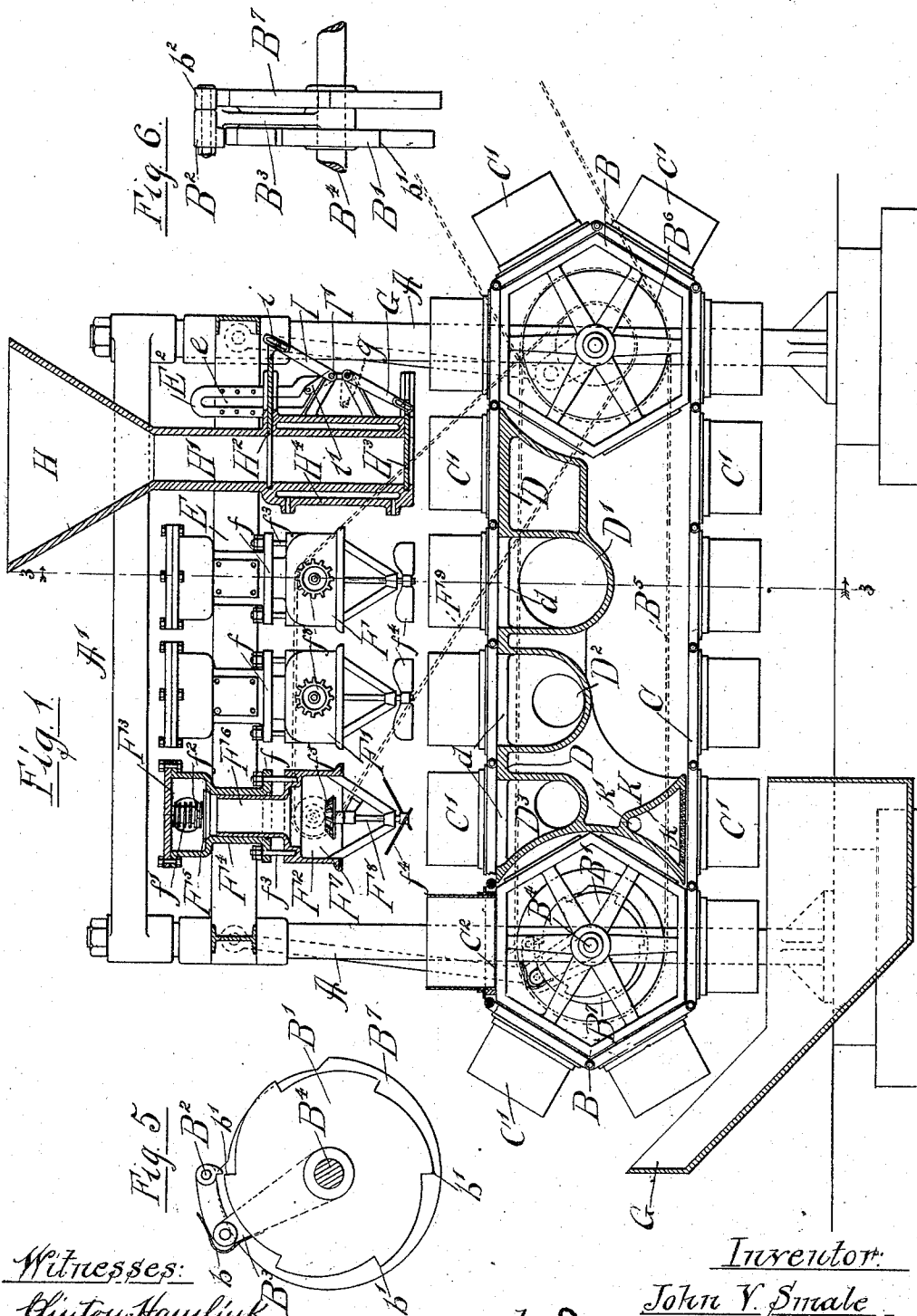
2 Sheets—Sheet 1.

J. V. SMALE.

APPARATUS FOR SEPARATING LIQUID FROM CRYSTALLINE SUGAR.

No. 579,098.

Patented Mar. 16, 1897.



Witnesses:

Clinton Hamlin

John W. Adams

Inventor:

John V. Smale

by Dayton Pool & Brown
his Attorneys

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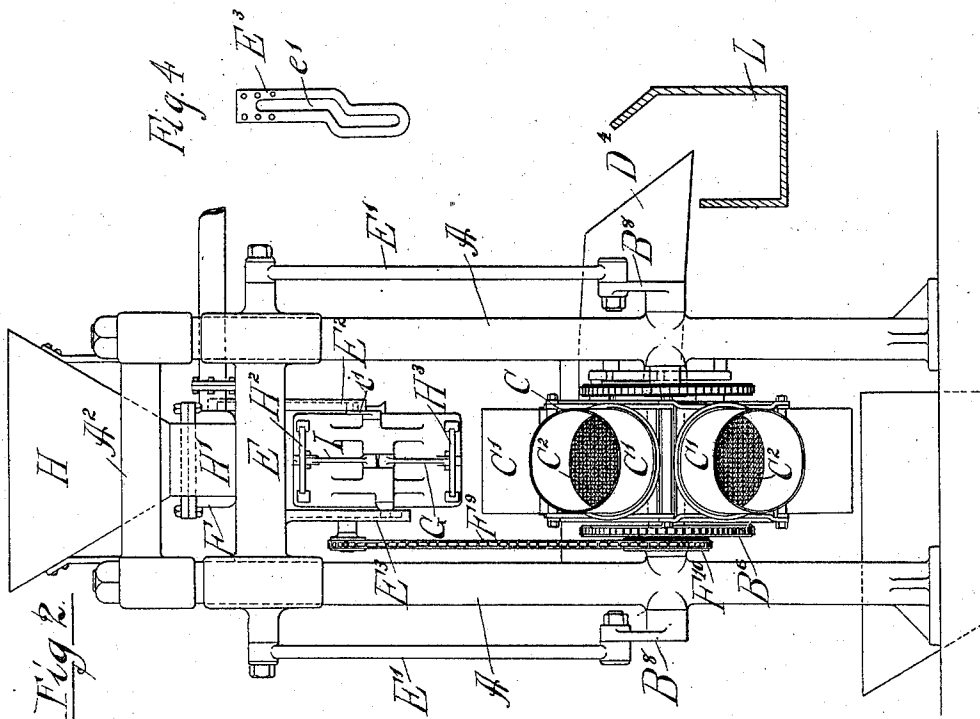
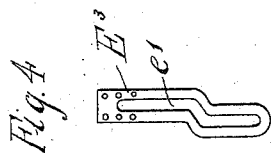
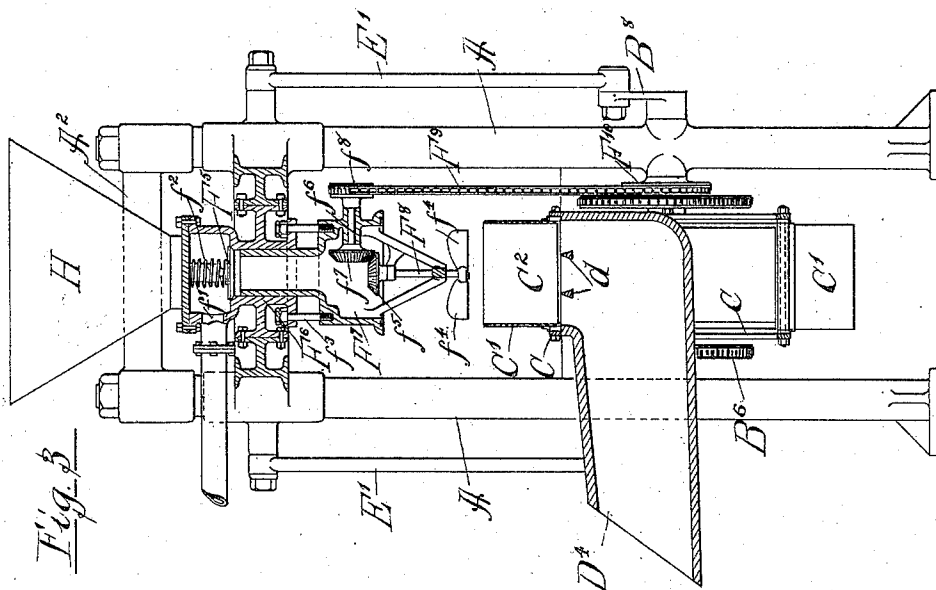
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UNITED STATES PATENT OFFICE.

JOHN V. SMALE, OF CHICAGO, ILLINOIS.

APPARATUS FOR SEPARATING LIQUID FROM CRYSTALLINE SUGAR.

SPECIFICATION forming part of Letters Patent No. 579,098, dated March 16, 1897.

Application filed January 17, 1895. Renewed February 18, 1897. Serial No. 624,075. (No model.)

To all whom it may concern:

Be it known that I, JOHN V. SMALE, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful
5 Improvements in Apparatus for Separating Liquid from Crystalline Sugar and Otherwise Treating Sugar; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the
10 accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to improved apparatus for use in the manufacture or refining of
15 sugar; and it has for its objects to shorten the time, lessen the cost, and improve the results of the operations involving the separation of crystalline sugar from the molasses or other liquid with which it may be mixed and
20 drying the sugar.

The nature of the invention will be fully understood from the following description of the construction and as illustrated in the accompanying drawings and stated in the claims
25 appended to the specification.

In the said drawings I have shown a machine organized and adapted to perform three successive operations upon the sugar, two of which are for the practically complete separation of the molasses from the sugar by two
30 separate operations, and the third of which is for drying the sugar after such separation. In addition the machine shows means for charging the boxes or straining vessels one after another with a definite amount of material to be separated and treated, means for clearing the strainers, and means for conducting away the separated molasses.

Figure 1 is a side elevation, in partial section, of one form of machine containing and adapted to practice my invention. Fig. 2 is an end elevation of said machine. Fig. 3 is a transverse vertical section. Fig. 4 is a detail of a cam (not elsewhere shown) in side
45 view. Fig. 5 is an enlarged detail in the carrier-actuating mechanism in side view. Fig. 6 is an end view of parts shown in Fig. 5.

A A represent four frame uprights at the corners of the machine, and A' and A² longitudinal and transverse girders, respectively,
50 connecting the upper ends of the said uprights A. Similar girders or connections may

be provided at the lower ends of the uprights, if desired.

B B are two polygonal wheels or drums 55 mounted to rotate on transverse axes arranged in the same horizontal plane between the pairs of end uprights A A and carrying an endless belt C, which is preferably composed of metal links suitably hinged together, 60 as shown. Upon the links of said chain belt C are mounted a series of equally-spaced similar cylindrical boxes C' C', which are open at the top and are provided at their bottoms each with a suitable strainer C². The links 65 C are of skeleton form and afford spaces in which the boxes C' or over which the strainer-bottoms of the boxes C' are placed, so that material passing through the strainer may descend through the links. 70

D is a table or support over which the upper horizontal part of the endless belt C passes, and D', D², and D³ are recesses or receptacles beneath the upper surface of the table and having across the top of each a series of bars 75 d, which serve to uphold the strainers of the several boxes when at rest above the several receptacles. From each of the receptacles leads a spout D⁴. 80

An intermittent traveling motion is imparted to the endless chain C and series of boxes C' by any suitable means or mechanism adapted to allow the boxes to come to and remain at rest for a desired period over said receptacles D' D², &c. The means for giving 85 appropriate intermittent motion and dwell to the endless chain is shown in this instance to consist of the following devices:

B' is a ratchet-wheel applied to one of the wheels B, and B² is a pawl mounted on the end of an arm D³, which is attached to the continuously-rotating shaft B⁴, upon which the polygonal wheel B is loosely mounted. The shaft B⁴ is continuously driven by a sprocket-chain B⁵, trained over a sprocket-wheel B⁶ on said shaft, and is itself driven by a similar sprocket-wheel on the similar shaft at the opposite end of the machine to which the main driving-pulley is applied, as clearly shown in Fig. 1. The pawl B² is shown to be 90 of the pulling order, and a spring b normally presses it toward the ratchet-wheel B', and since it revolves with the shaft B⁴ a fixed or non-rotative disk B⁷ is provided at the op- 95 100

posite side of the pawl from the ratchet, as shown in Fig. 6, said disk having a suitable extent of its edge projecting beyond the teeth b' of the ratchet and the remaining portion of its edge depressed below the ratchet-teeth. The end of the pawl is provided with a roller b^2 , which is adapted to ride on the elevated portion of the edge of the disk, so that the said pawl may be lifted and may move clear of the ratchet except during a predetermined portion of its rotation. By this means the chain is given proper periods of rest between its successive movements, as is necessarily the case, for reasons that will hereinafter appear.

E is a cross-head which is mounted to slide vertically on the vertical posts or uprights A as guides. This cross-head is centrally open and within the opening thereof are mounted thereon a series of similar cover devices, as F^1 F^2 , adapted to descend upon and to close the subjacent boxes C' . Each of these similar cover devices consists, as here shown, of parts best illustrated in the vertical section at F^2 in Fig. 1. Describing this illustrated construction, F^2 is a chamber closed at the top and having a lower cylindric extension F^4 , which is provided with a peripheral bottom flange f . The upper part of this chamber contains an inlet-opening f' , and the upper end of the cylindric portion F^4 is closed by a vertically-opening valve F^5 , which may be more forcibly closed, if desired, by means of a spring f^2 .

F^6 is a hollow cylinder which is adapted to slide closely within the cylinder F^4 , and said cylinder F^6 is provided at its lower end with an open-bottomed bell F^7 , the lower edge of which is adapted to seat itself closely upon the upper edge of a subjacent box C' . The bell F^7 and its sliding extension F^6 , which projects into the cylinder F^4 , are suspended from the said cylinder when the cross-head is elevated by means of bolts f^3 , which project through and slide in holes in the flange f . In the axis of the bell F^7 is supported a revoluble shaft F^8 , provided at its lower end with inclined wings f^4 and at its upper end with a bevel gear-wheel f^5 . Through the bell passes a horizontal shaft f^6 , which carries within the bell a bevel gear-wheel f^7 , that engages with the similar wheel f^5 above mentioned, and externally to the bell this shaft f^6 is provided with a driving-pulley, here shown to be a sprocket-wheel f^8 , by which the wings f^4 may be revolved when lowered into the subjacent box C' . These wings may be given their revolving motion by a sprocket-chain F^9 leading from a suitable sprocket-wheel F^{10} on the main driving-shaft, as indicated by dotted lines in Fig. 1, or by other suitable means.

The cross-head E is shown to be given its vertical reciprocatory movement by means of crank-arms B^3 , (see Fig. 2,) which are connected with the said cross-head by the pitmen E' . In the descent of the cross-head the bells

F^7 partake of the descending motion of said cross-head until brought to rest upon the subjacent boxes C' , and in a further descent of the cross-head the cylindrical extensions F^6 of said bells rise within the cylinders F^4 and by striking the valves F^5 lift them off their seats, affording communication from the inlet-passages f' , through the cylinders F^6 , to the now tightly-covered subjacent boxes C' , while the revolving wings f^4 agitate the contents of the said boxes.

A proper quantity of material composed of crystalline sugar and molasses having been delivered into a box C' before its movement to a position over the receptacle D' and beneath the cover device F , a suitable fluid, as air, may be forced through the inlet f' and downwardly through the mass in the subjacent box C' , giving a forcible current which shall carry the molasses or a considerable portion thereof out of the box through the strainer C^2 thereof and into the subjacent receptacle D' , from which it escapes through the spout D^4 . In like manner a current of air or other fluid may be similarly passed through the contents of this same box after it shall have been moved forward into position over the receptacle D^2 , and again the contents of the same box may be similarly subjected to the force of a fluid-current after it shall have been next moved over the receptacle D^3 .

In the machine as above described it is contemplated that a forcible air-current shall be passed through the cover device F and its subjacent box C' , that a current of steam or of air mixed with steam or other vapor shall be similarly passed through the cover device F' and the subjacent box C' , and that a current of hot air shall be passed through the cover device F^2 and its subjacent box C' . The action will then be as follows: From the mass of sugar and molasses or liquid contained in the box beneath the cover device F the principal part of the liquid will be expelled through the strainer of said box by the forcible air-current. The mass remaining in this box, after it shall have been brought under the cover device F' , will be moistened and any remaining molasses therein will be rendered more liquid by the steam in the current being passed downward through it and so more readily and completely expelled by such current. The mass of sugar now left in the box and heated by the steam or heated air or vapor which had been passed through it while under the device F' will next be brought under the cover device F^2 and will there be dried by a current of hot air.

Manifestly the character of the several fluid-currents may be varied as occasion may require, all that is necessary for such variation being the proper connection of the valved passages of the cover devices with appropriate sources of fluid supply and pressure.

After the material has been successively acted upon, substantially as above indicated,

it is carried over the terminal carrier-wheel B, in which movement the box containing it is turned upside down and its contents delivered into a spout or receptacle G, from

5 which it may be removed by the continuous operation of a familiar conveyer or other means, as may be desired. The automatic charging of the boxes C' is also provided for in the machine, as shown, H being a hopper
10 having a vertical spout H', arranged in position to deliver into each box C' before its advance to a place beneath the cover device F. The spout H' is shown as being provided with two slides H² and H³, arranged at a suitable distance one above the other to contain
15 a proper quantity of the mixture to be delivered at one time into a box C'. The chamber embraced between these slides is also shown as having a hollow jacket H⁴ in order
20 that by means of steam, hot air, or hot water the contents of said chamber may be kept hot or in a measure heated, whereby the liquid therein may be the more easily expelled. These slides H² and H³ are connected with
25 suitable operating mechanism by which the upper slide may be retained in its closed position while the lower one is in any degree open, and the lower one may be held closed while the upper one is in any degree open.
30 For this purpose the upper slide in the particular construction shown has a movable connection with a slot i in a vibratory lever I, which is mounted on a rock-shaft I', having a crank i', the pin of which passes into
35 a slot e in the slotted cam E², that is attached rigidly to the cross-head E. A second lever G, similarly mounted and connected, has its crank g engaged with the slot e' in a second and appropriately-formed cam E³, Fig. 4,
40 which, like the cam E², is secured to the cross-head E and moves up and down with the latter. By means of this hopper and charging device a mass of mixed sugar and molasses or other fluid may be delivered, either by hand
45 or by machine, into the hopper and intermittently charged in proper quantities into the boxes C' as they successively come to rest beneath the charging mechanism, and the operation of charging, treating, and discharging the material operated upon becomes automatic throughout.

K represents a chamber arranged over the lower horizontal portion of the endless chain C and provided with a perforated bottom k, said chamber being so arranged that the
55 boxes C' will be successively brought to rest directly beneath it. This chamber has an inlet k', through which air or steam may be forcibly driven into it, and as such air escapes through the perforations in the bottom of the chamber it will force any impurities out of the meshes of the strainer which have been retained therein.

I have considered it unnecessary to illustrate air or steam forcing devices for producing the pressure-currents through the va-

rious receptacles D' D² D³ and the chamber K, since such devices in themselves form no part of my invention and are of well-known kinds.

In Fig. 2 I have shown a molasses-trough at L, arranged beneath the delivery ends of the several spouts D⁴, which proceed from the receptacles D', D², and D³, by which the molasses and impurities expelled may be carried away.

It is to be observed that an apparatus embodying the essential principles of the invention as above pointed out is distinguished from an apparatus whereby the separation is effected by centrifugal force, and that such apparatus may be equally applied to the refining of sugar and its original manufacture.

It is obvious that the apparatus above described, and illustrated in the accompanying drawings, may be modified in its mechanical features without change in the essential characteristics or principles of the machine, and hence I do not desire to be limited to the precise details of construction shown.

I claim as my invention—

1. In an apparatus for separating molasses or other liquid from crystalline sugar, the combination of a series of traveling vessels each provided with a strainer, a series of movable covers adapted to simultaneously close a corresponding number of said series of vessels and means for forcing fluid currents through said covers into and through the vessels which they close and outwardly through the strainers thereof.

2. In an apparatus for separating molasses or other liquid from crystalline sugar, the combination of a series of traveling vessels provided with strainers, of one or more receptacles communicating with a plurality of the said vessels through their strainers, a series of movable covers adapted to simultaneously close a corresponding number of said traveling vessels, means for forcing fluid through said covers into and through the vessels which they close and outwardly through the strainers thereof, and means for stirring the contents of said vessels while the fluid currents are being driven through them.

3. In apparatus for separating molasses or other liquid from crystalline sugar, the combination, with an endless carrier, of a series of straining vessels arranged at equal intervals upon said carrier, means for giving an intermittent movement to said carrier with suitable intervals of rest, one or more movable covers adapted to close a corresponding number of said vessels when at rest, a stirrer revolubly mounted upon each of said covers and adapted to enter the vessel closed thereby, means for revolving said stirrer when within the vessel, a valve in a passage through the cover which valve is automatically opened when the cover is seated upon the vessel, said passage being in communication with a source of fluid-pressure, and a liquid-recepta-

cle communicating with the interior of the covered straining vessel or vessels through the strainer or strainers thereof.

4. The combination, with an endless carrier
5 provided with a series of equally-spaced, open-
topped straining vessels and means for inter-
mittently moving said carrier with periods of
rest between its successive movements, a se-
ries of chambered covers for a corresponding
10 number of said straining vessels, said covers
being each provided with a valved passage
for the admission of a fluid under pressure,
means for moving said covers to and from the
vessels, and stirrers for agitating the contents
15 of the vessels, whereby a mixture of sugar and
molasses or other liquid placed in either of
the stirring vessels on the carrier may be suc-
cessively subjected to fluid currents that may
be varied in kind for the separation of the
20 molasses or other liquid from the crystalline
sugar.

5. In combination with an endless carrier
and a series of straining vessels mounted at
equal intervals thereon, one or more auto-
25 matically-moved vessel-covers provided each
with a valved passage for the admission of a
forceful fluid current when the cover is upon
the vessel, and an automatic charging device

arranged to charge the several vessels on the
carrier successively as they advance with the
carrier to their places beneath the cover or
covers. 30

6. In apparatus for the separation of mo-
lasses or other liquid from crystalline sugar,
the combination of an endless carrier, a se- 35
ries of equally-spaced strainer vessels mount-
ed on said carrier, means for giving inter-
mittent movement to said carrier, a series of
liquid-receptacles severally arranged to com-
municate with the interior of a corresponding 40
number of said vessels through their strainers,
said receptacles being each provided with a
discharge-opening, and means for forcing a
fluid current through the contents of the ves-
sel and outwardly through their strainers, 45
whereby the liquid element of the mass in the
vessels is discharged through their strainers
into the several connecting receptacles, sub-
stantially as described.

In testimony that I claim the foregoing as 50
my invention I affix my signature in presence
of two witnesses.

JOHN V. SMALE.

Witnesses:

M. E. DAYTON,
C. CLARENCE POOLE.