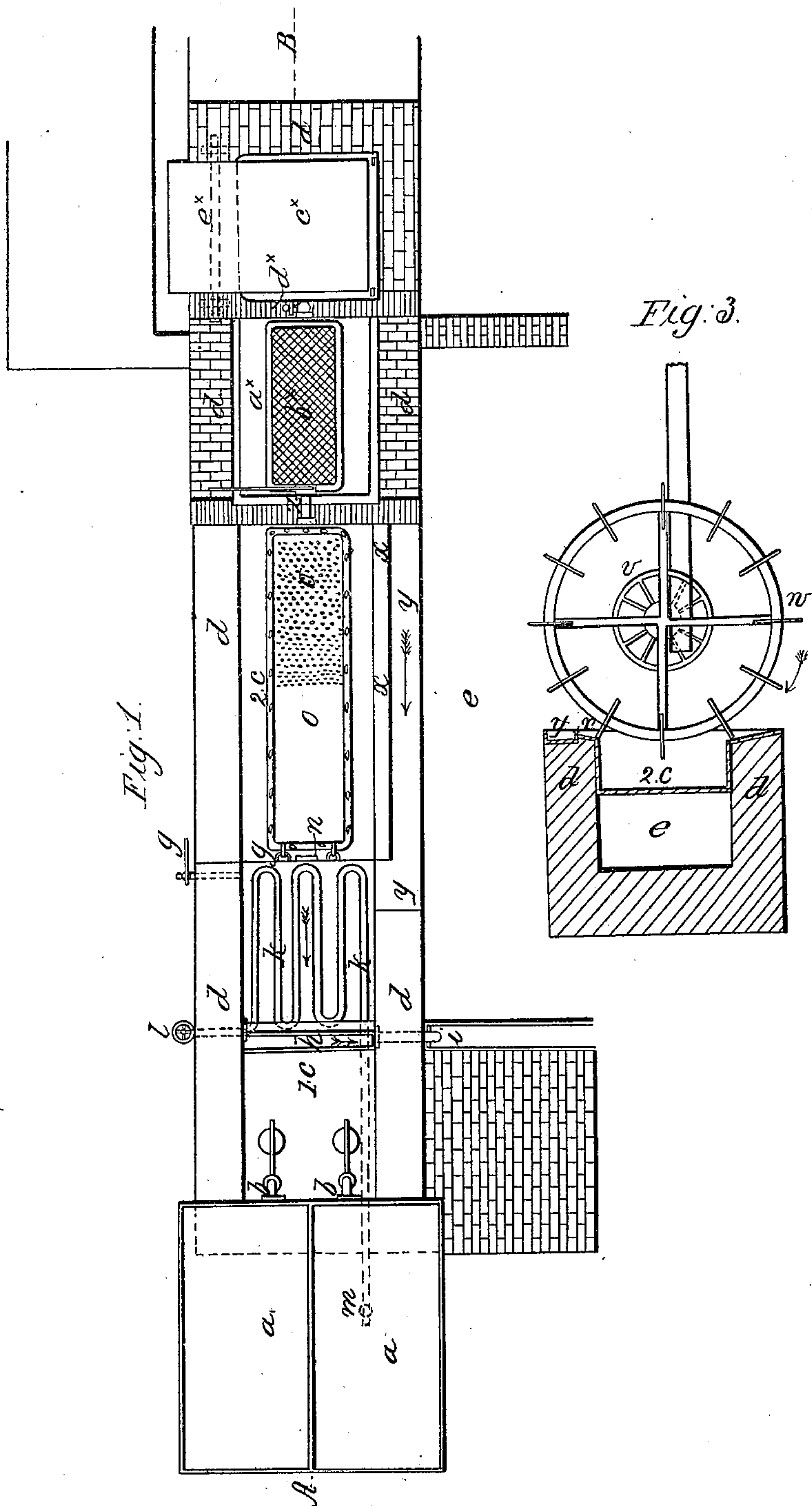


W. H. Clement.  
Making Sugar.

N<sup>o</sup> 9,315.

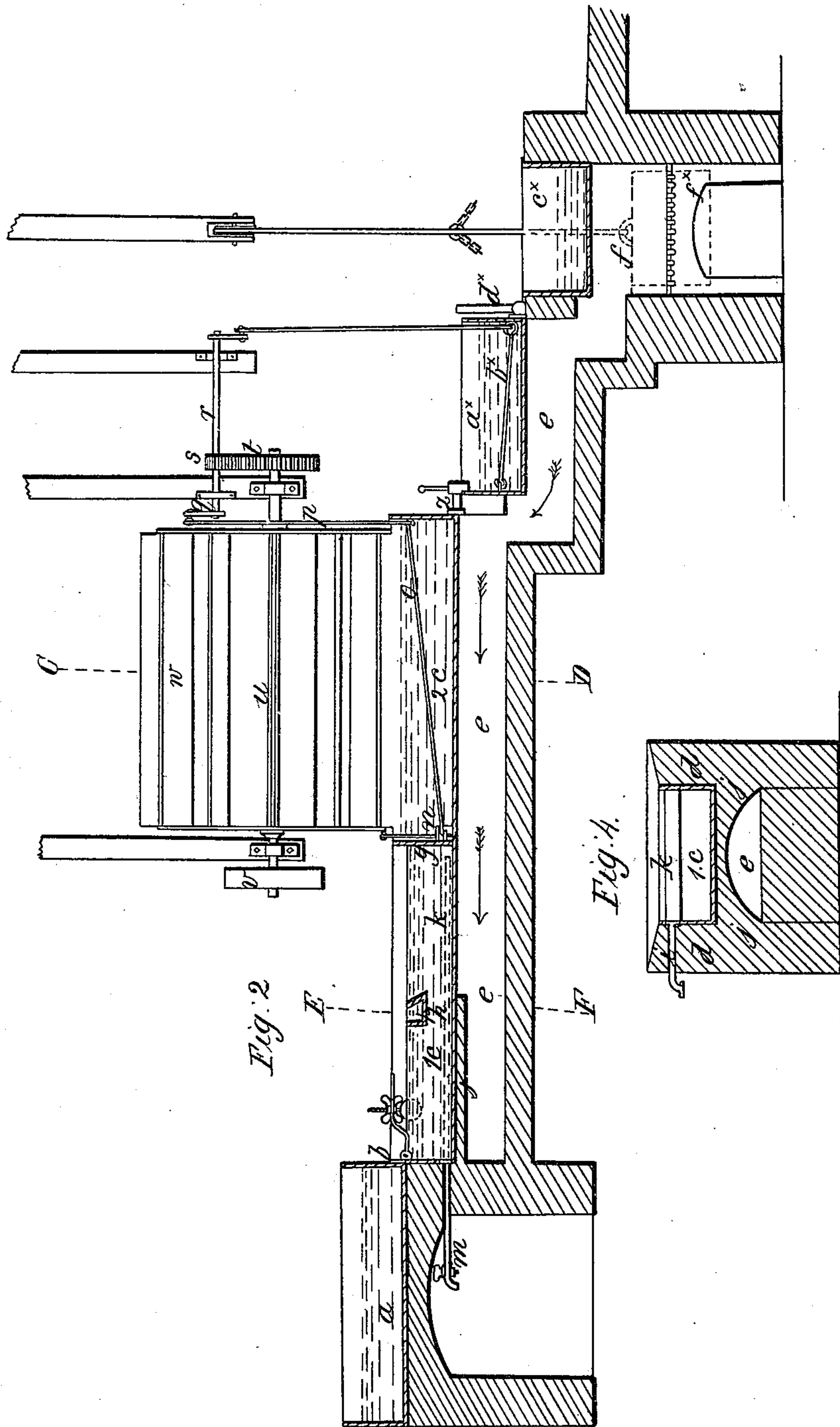
Patented Oct. 12, 1852.



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Patented Oct. 12, 1854.





# UNITED STATES PATENT OFFICE.

WILLIAM H. CLEMENT, OF PHILADELPHIA, PENNSYLVANIA.

## IMPROVEMENT IN SUGAR-BOILING APPARATUS.

Specification forming part of Letters Patent No. 9,315, dated October 12, 1852.

*To all whom it may concern:*

Be it known that I, WILLIAM H. CLEMENT, of the city and county of Philadelphia, and State of Pennsylvania, have invented a new and useful Improvement in the Construction of Apparatus for Manufacturing Sugar from the Cane-Juice; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the annexed drawings, in which—

Figure I represents a horizontal or plan view of the whole apparatus; Fig. II, a longitudinal vertical section of the same, taken on the dotted line A B of Fig. I. Fig. III is a transverse vertical section on the dotted line C D of Fig. II. Fig. IV is a similar view taken in the line E F of the same figure.

The first part of my improvement consists in an arrangement for scumming the sugar in the first pan or vessel in which it is heated, and is as follows: The cane-juice is conducted from the mill into the juice-boxes A A, (shown in Figs. I and II,) where the proper charge of lime is added to it. While one of these juice-boxes is filling the limed juice is running from the other through a ball-cock, *b*, into the long narrow, shallow, open pan or evaporator *c*, set in brick-work *d d* over a flue, *e*, extending along its length and proceeding from the furnace at *f* to a chimney-shaft. This evaporator *c* is divided into two parts by a partition, *g*. At about the center of the division 1 of *c* is a small trough or receiver, *h*, placed across the pan at right angles to its length, and which, as will be seen by reference to Figs. II and IV, does not reach to the bottom of the evaporator, but has a pipe, *i*, passing out of it through the side wall, *d*. The liquid in the division 1 of the evaporator *c* is kept by the arrangement of the ball-cock *b* nearly on a level with the edge of the trough *h*. As liquids always circulate in a direction from the hotter to the colder parts of an evaporator, the circulation in the division 1 of *c* will be in the direction of the arrow, for the flames and heated air from the furnace *f* in the flue *e*, over which the evaporator is placed, are proceeding in the same direction, and consequently will heat more from nearer proximity to the furnace—that end of the division 1 of *c* where the arrow is placed—than the farther end

where the cold juice is running in through the ball-cock *b*. The feculencies or scum, which by the effect of heat rise to and on the surface of the cane-juice, are carried by the circulation in the direction of the arrow, and roll over the edge of the trough *h*, from whence they run through the pipe *i* as waste matter. To increase this effect of the circulation of the cane-juice, and at the same time to be enabled to regulate the temperature to that point at which the scum separates most readily from the juice, a part of the bottom of the division 1 of the pan *c* may be bricked over, as shown at *j* in Figs. II and IV, so as to prevent the flames from coming in contact with that part; and this brick-work should cover so much of the bottom as will prevent the juice from reaching the boiling-point in the division 1 of *c*. A coil or worm of steam-pipe, *k*, as will be seen by reference to Figs. I and II, is placed in the pan at that end which is not bricked over underneath. Steam being admitted into this pipe through the valve *l*, and the condensed water being blown out through the cock *m*, the temperature of the juice can be raised to the boiling-point, or, rather, to that point called the “simmering-point,” and at which the scum separates the most readily from the juice. By this arrangement of the ball-cocks and the transverse scumming-trough, together with the circulation produced in the fluid by the difference in the temperature of the two extremities of the pan the apparatus is made to scum itself. This operation is further promoted by the covering up with brick or some non-conductor of the bottom of the pan near the ball-cocks, and by introducing the steam-worm into the body of the fluid distant from these cocks. At the same time the introduction of the steam-pipe enables the temperature of the mass to be more perfectly regulated.

The second part of my improvement relates to the portion of the apparatus for preventing the fluid mass in the vessel *c* from foaming or boiling over when exposed to the increased heat of that portion of the flue over which it is placed, and from being charred, and the evaporator from being burned. While the cane-juice in the division 1 of *c* is clarifying, as above described, it is at the same time run-



ning through a molasses-gate,  $n$ , in the partition  $g$ , into the second division of the evaporator  $c^2$ , where from the greater heat it receives it tends to rise into foam, and would overflow, if not prevented. This result has hitherto caused the failure of shallow vessels to evaporate cane-juice, as what little juice would remain in such a vessel, being in a state of foam, would not evaporate rapidly, and the saccharine matter would be charred and injured by excess of heat, and the evaporator also would be soon destroyed. The reason of this is that cane-juice in a state of foam has not sufficient density to circulate with that rapidity necessary to carry off the heat imparted to it. To prevent the cane-juice in the division 2 of  $c$  from overflowing by a change of density taking place, I place in this division a flat plate of iron,  $O$ , fixed at one end, by a hinge or other suitable fastenings, to the partition  $g$ , in such a manner that it shall be horizontal or nearly horizontal in the liquid contained in the evaporator. To the other end of this plate a rigid rod,  $p$ , as will be seen by reference to Fig. 2, is attached, which is pendent from a pin on a crank,  $q$ , keyed to a horizontal shaft,  $r$ . This rod  $p$  receives a vibratory motion through the cog-wheels  $s$  and  $t$  on the shafts  $r$  and  $u$ , the shaft  $u$  being caused to revolve by a prime mover acting on the pulley  $v$ , or in any other manner. The vibratory motion given to the rod  $p$  in the manner just described is communicated by it to the plate  $O$ , and a constant agitation of the cane-juice in the evaporator is thus produced, and the glutinous or alumnious envelopes of the steam-bubbles being thereby broken, the steam is rapidly freed from the liquid, accelerating the evaporation and preventing too great a rise and overflow. I will here remark that to diminish the resistance of the agitator  $O$  in working it may be pierced with holes, either throughout its length or at that end where the lift is greatest, as is shown in the drawings. Another useful effect produced by this agitation is to separate from the cane-juice the vegetable albumen and other feculencies which it contains, for the vegetable albumen, being partially coagulated by the heat, is beaten into a foam in the same manner as when the whites of eggs (an analogous substance in the animal organization) are beaten up; and as the density of the juice is prevented from diminishing, this foam, which is light, rises to the surface, entangling other matters in it, and is skimmed or brushed off by the paddle-scumming apparatus, which forms the third part of my improvement.

The third part of my improvement relates to an arrangement for scumming the surface of the reservoir  $c^2$ ; and this portion of my invention is an improvement on a former invention of mine patented or intended to have been patented. It consists of the paddle-wheel seen at  $W$ , Figs. II and III, and is now arranged and operated as follows: This pad-

dle-wheel has the main driving-shaft  $w$  for its axis, and, as will be seen more particularly in Fig. III, is so adjusted over the division 2 of the evaporator  $c$ , that the float, boards, or paddles will, as they successively come round by the rotation of the wheel in the direction of the arrow, dip into the liquid and push the scum on the surface to one side of the evaporator, and up the inclined curb or flange  $x$ , into a trough or gutter,  $y$ , placed at a sufficient height to conduct this scum back into the division 1 of  $c$ , when it runs off with the scum in that division in the manner already described. This gutter  $y$  is shown in plan view in Fig. I. In my former invention the use of this wheel was suggested, but without the curb or flange  $x$ , and hence other arrangements were there required to elevate the skimmings.

The last part of my improvement consists in the further application of an agitator to the vessel  $a^*$ , in which the sugar is concentrated. The cane-juice being now clarified, as shown above, is run from the division 2 of  $c$  through the gate  $z$  into the concentrator  $a^*$ . In this concentrator is placed an agitator,  $b^*$ , which is worked in precisely the same manner as the agitator  $O$ , already described, as will be seen in the drawings, but is constructed of wire-gauze fastened onto an iron frame. I will here remark that the agitator  $O$  may be constructed of wire-gauze, or the agitator  $b^*$  may be made of iron pierced with holes, and that as both of the agitators work in the body of the juice (the agitator  $O$  beneath the puddles of the wheel  $w$ ) there is no admixture of air with the juice, which is considered injurious to the ultimate product. The agitator in the concentrator  $a^*$  accelerates the evaporation and brings the cane-juice to a state of sirup. It is then run through a goose-neck,  $d^*$ , into the tilt-pan  $e^*$ , which is placed over the furnace  $f$ , and is capable of being raised on an axis,  $e^*$ , to empty the charge it contains (when a proper degree of concentration has been reached) into a canal or gutter to conduct it to the coolers, where the crystallization takes place. When the tilt-pan is raised from its seat, the air-entrance to the furnace should be closed to prevent the flames coming up. A damper,  $f^*$ , attached to the other end of the rope or chain, by which the tilt-pan is raised, may be made to descend as the pan rises, and close the air-entrance, as is indicated in dotted lines in Fig. II.

In Fig. I,  $g^*$  is a pipe with a cock to draw off the cane-juice from the division 1 of  $c$ , when required, as in stopping off when it is necessary to empty the division 1 of  $c$  of juice and to fill it with water.

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

1. The arrangement and combination of the simmering-vessel  $c$  1, with the ball-cock, and the scumming-trough  $h$ , substantially as de-



scribed in the first part of the foregoing specification, and I claim this arrangement and combination, whether alone or in further combination with a partial covering of the bottom of the simmering-vessel, or the introduction of the steam-worm, as thus described.

2. The agitator O, arranged and operating

in the manner and for the purposes substantially as described in the second and fourth parts of the foregoing specification.

WM. H. CLEMENT.

Witnesses:

GEORGE HARDING,

CHARLES D. FREEMAN.