(No Model.) 3 Sheets—Sheet 1.

F. COOK.

OPEN EVAPORATING TRAIN AND FURNACE FOR CANE JUICE, &c.

No. 265,024. Patented Sept. 26, 1882.

FIG 1

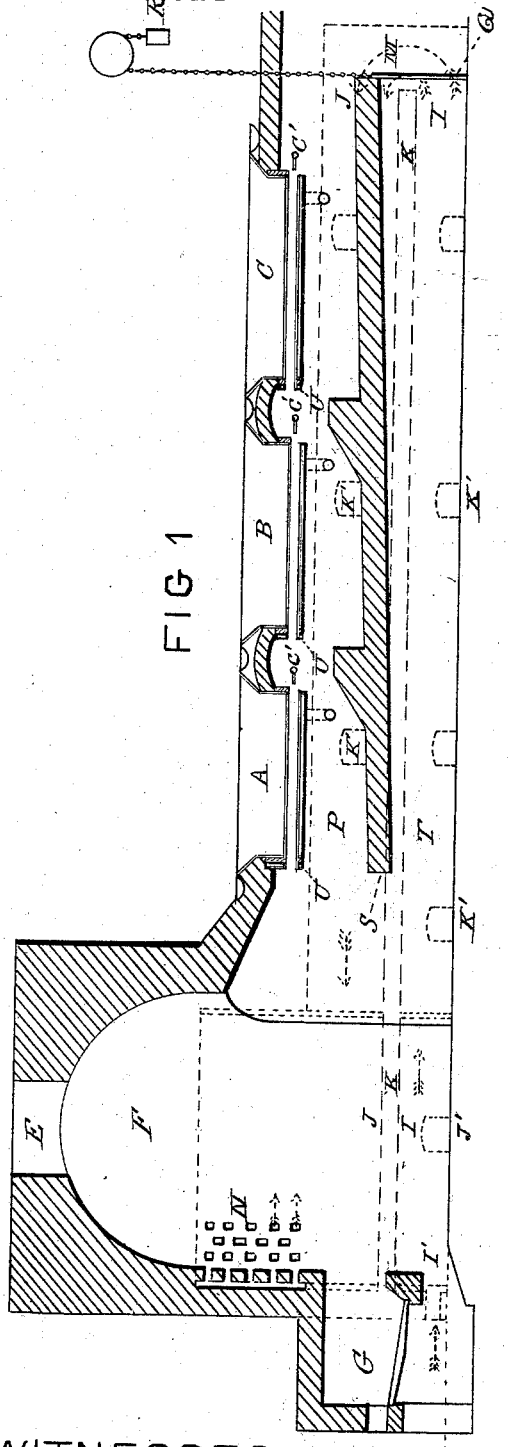
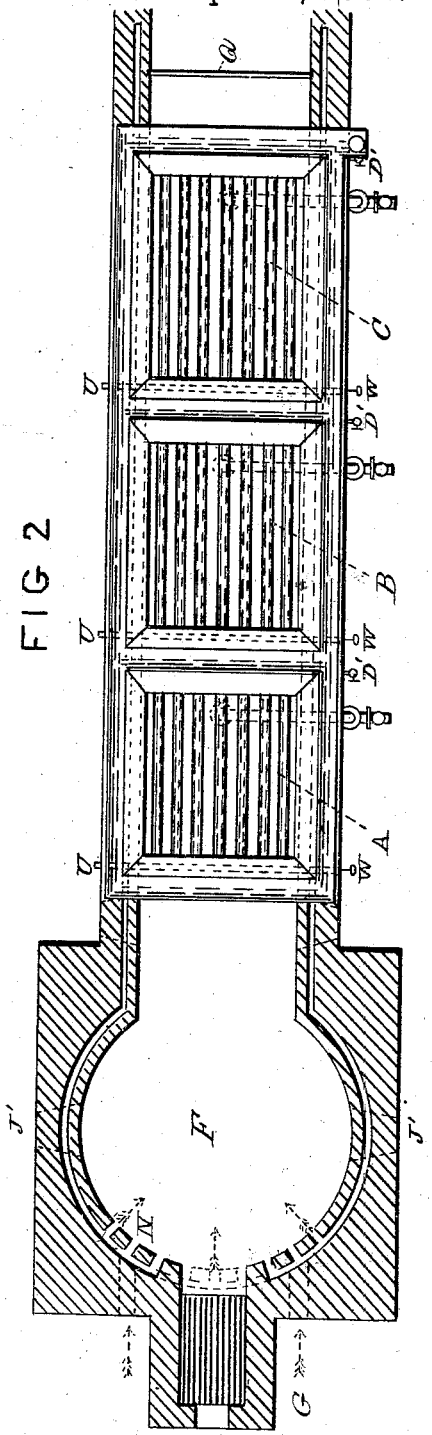


FIG 2



WITNESSES.

Thos. J. Carvill
S. Condit

INVENTOR.

Frederic Cook

(No Model.)

3 Sheets—Sheet 2.

F. COOK.

OPEN EVAPORATING TRAIN AND FURNACE FOR CANE JUICE, &c.

No. 265,024. Patented Sept. 26, 1882.

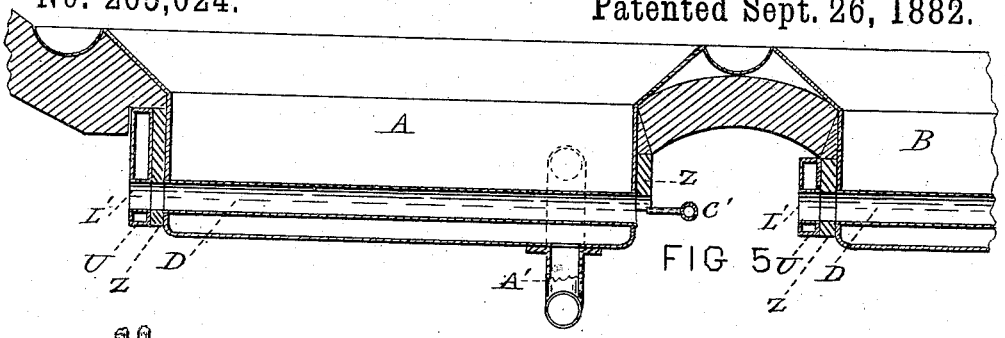


FIG 5

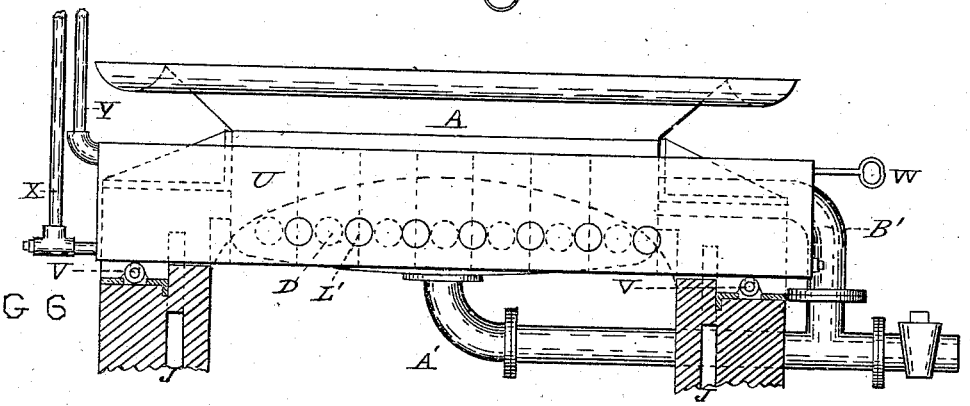


FIG 6

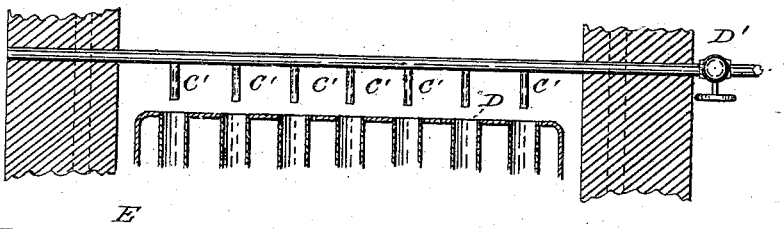


FIG 7

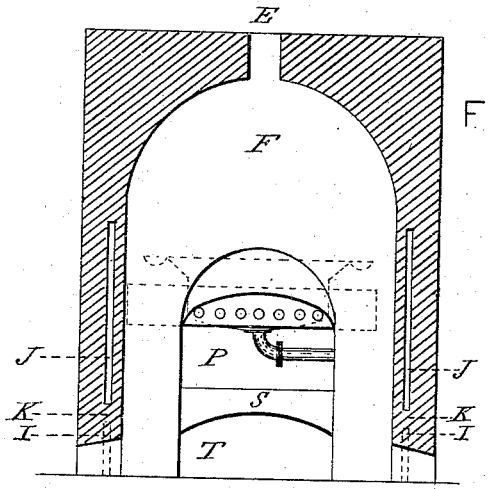
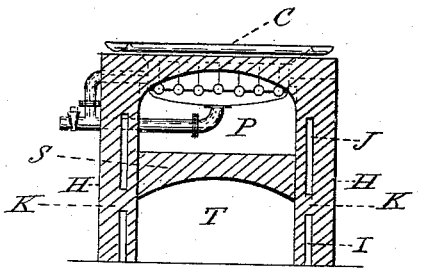


FIG 3

FIG 4



WITNESSES.

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(No Model.) 3 Sheets—Sheet 3.

F. COOK.

OPEN EVAPORATING TRAIN AND FURNACE FOR CANE JUICE, &c.

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FIG 8

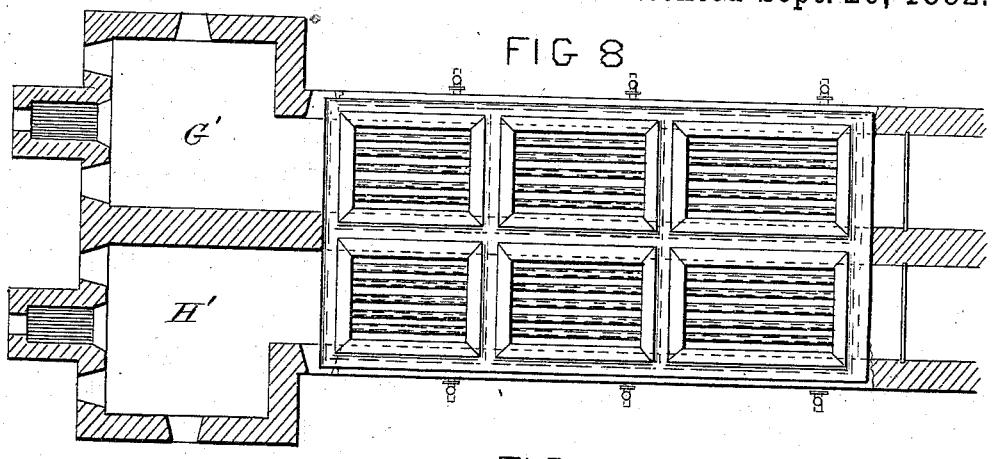


FIG 11

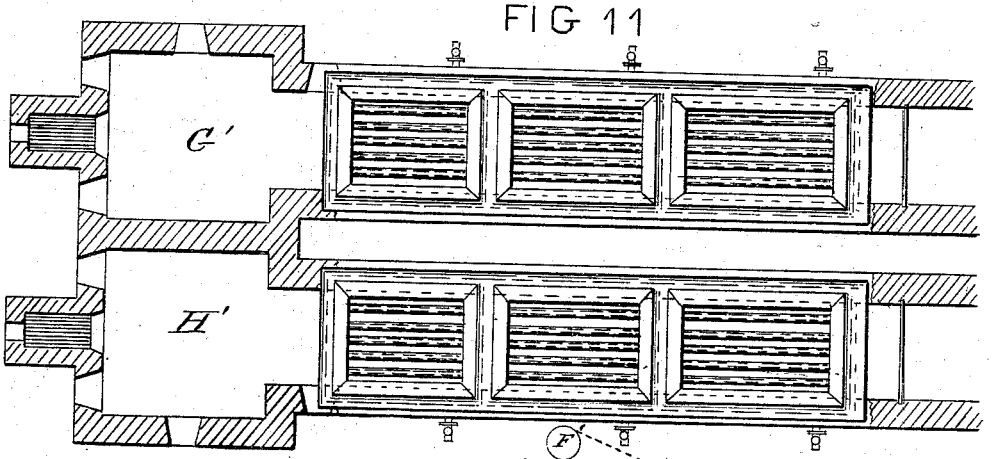


FIG 10

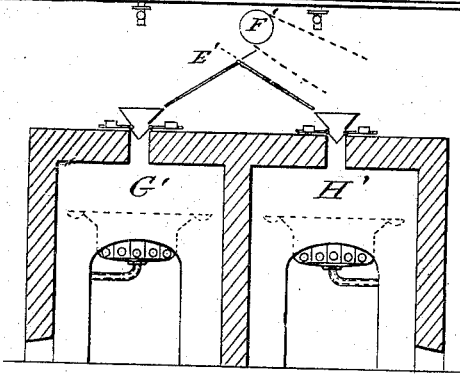
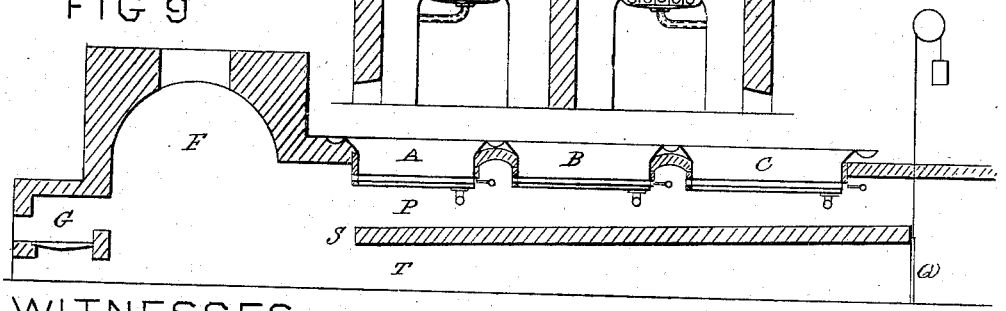


FIG 9



WITNESSES

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UNITED STATES PATENT OFFICE.

FREDERIC COOK, OF NEW ORLEANS, LOUISIANA.

OPEN EVAPORATING TRAIN AND FURNACE FOR CANE-JUICE, &c.

SPECIFICATION forming part of Letters Patent No. 265,024, dated September 26, 1882.

Application filed January 25, 1882. (No model.)

To all whom it may concern:

Be it known that I, FREDERIC COOK, a citizen of the United States, residing at New Orleans, in the parish of Orleans and State of Louisiana, have invented certain new and useful Improvements in Open Evaporating Trains and Furnaces for Cane-Juice and other Liquids, to work with direct heat from bagasse or other fuels, of which the following is a specification.

My invention relates to open evaporating-trains for making sirup from cane-juice, composed of evaporators of large fire-surface working with direct heat from bagasse and other fuel, and arranged so that no juice has to be passed from one evaporator to another, that the heat and train can be regulated at will without disturbing combustion in furnace, and so that each evaporator can be boiled fast or slow, as desired, to give an opportunity to clean the juice, with other improvements hereinafter described. I attain these objects by the invention illustrated in the accompanying drawings, in three sheets, in which—

Figure 1 is a longitudinal section of the train and furnace and setting. Fig. 2 is a plan of the train and a horizontal section of furnace and setting. Fig. 3 is a vertical section of furnace and end view of train. Fig. 4 is a vertical section of train flue and setting and back end of train. Fig. 5 is a longitudinal section of front evaporator and part of the next one and part of setting. Fig. 6 is a front view of a water damper and evaporator and cross-section of a portion of flue-walls. Fig. 7 is a horizontal section of part of back end of an evaporator through tubes with part of walls and steam-jet pipes. Figs. 5, 6, and 7 are on an enlarged scale. Fig. 8 is a plan of a double or twin train, with horizontal section through double or twin furnaces. Fig. 9 is a vertical longitudinal section of Fig. 8 or Fig. 11. Fig. 10 is a vertical cross-section through twin furnaces. Fig. 11 is a plan of double twin train and furnaces arranged with a passage between trains which are directly opposite central line of furnaces. Figs. 8, 9, 10, and 11 are on a reduced scale.

Prior to my invention open trains of evaporators have been used to work with heat from bagasse, in which the juice was passed from kettle to kettle as it became reduced in density; but no means have hitherto been provided for regulating the heat on the train so that it could be increased or diminished, and at same time provide a uniform draft for combustion of the bagasse fuel; nor has any means been hitherto provided for regulating the boiling of each separate evaporator so as to enable the juice to be cleaned during a slow boil, or the heat increased so as to boil with rapidity at the will of the sugar-maker, or the heat turned off when sirup is drawn off, all which advantages have hitherto only been possessed by evaporators working with steam heat, but which I accomplish with direct heat at a great saving of cost of fuel.

I do not wish to confine myself to trains of evaporators, as described, in which the juice is not passed from one evaporator to another, as in my trains the juice can be equally as well passed from one evaporator to another (as fast as the juice is cleaned from scum) by means of steam-siphons or any other well-known means.

The juice is first clarified in separate clarifiers, passed into my direct-heat evaporators, cleaned again, and boiled to sirup in same evaporator the juice first enters. The sirup can be boiled to sugar in a steam open pan or a vacuum-pan.

In the drawings, A B C are open evaporating-pans, preferably of wrought metal, and have tubes D expanded into ends or otherwise suitably fastened, and passing from end to end longitudinally near bottom of pan.

The bagasse from mill falls through opening E onto hearth of furnace F and forms a hay-stack shape. The main furnace F has a small furnace, G, outside, provided with grates, in which is burned wood or coal, the heat from which assists in burning the bagasse. The bagasse-furnace F and the train-walls H have air-spaces I J in them. The air-space J is divided from the air-space I by solid brick-work, as shown at K, Figs. 3 and 4, and at K in dotted lines, Fig. 1, where also the air-spaces I and J are shown in dotted lines connecting at M in dotted lines. Cold air enters air-space I in front of furnace at openings indicated by arrows. At M the air rises and returns through air-space J to front of bagasse-burner, by which time it has become highly heated from absorption from walls, and it enters upper part of furnace through openings N, and greatly assists in combustion of the bagasse fuel, and renders

less necessary a large supply of cold air, which is continually cooling the furnace; or the cold air may be admitted at back end of train-walls into air-passages, becomes heated, and enters bagasse-burner through openings in lining, as shown at N. When cold air is thus admitted at back end, the air-spaces I J are made one by the omission of the division K. The heat from furnace passes into flue P, under the evaporators, and through tubes D, which pass through the juice.

At the back of the train is a damper, Q, balanced by a weight, R.

At S is an arch, which runs longitudinally the length of the train and divides the space under it into two flues, P and T.

The damper Q is represented closed over flue T, so all the heat passes into flue P under the train; but by raising damper Q a portion of flue T becomes open to the draft, and as it opens a portion of flue P becomes closed, or entirely so, if desired.

The fire can be regulated at will on train, as above described, and at same time preserve a uniform draft to chimney for combustion of the bagasse fuel, even when the evaporators are quite shut off.

To regulate heat or boiling of each separate evaporator, I employ a damper, U, opposite each front end of evaporators. It extends across walls of train and rests on rollers V, so it is easily moved by handle W. The damper U, I find most durable when made water-tight of boiler-plate and containing water, which is supplied from an overhead tank (not shown) through pipe X. Any steam generated rises through pipe Y, whose upper end turns over edge of tank always under the water-line, so the steam condenses again into water. The damper U is made three or four inches thick, of two plates of boiler-iron preferred, and, made perfectly water-tight, has tubes L′ expanded into it corresponding in diameter and distance apart with tubes D in evaporators. It will be seen from this arrangement that, the damper U being rolled backward or forward, the tubes D can be either wholly exposed to the fire, entirely closed, or graduated to any desired opening, according to the condition of the juice inside. Also, when drawing off sirup, by closing the damper any burning or charring on the juice-surface of tubes is prevented, although in regular working I prefer not to draw sirup below center of tubes and then recharge with juice. A damper made of tile will also answer the same purpose, but is not as durable as a water-damper; or damper U may be made without tubes L′ through it, of plain sides, and no holes for tubes, and be worked up or down in front of pans with a vertical motion. The ends of evaporators are faced with tiles Z preferably, and the tiles are permanently fastened with bolts to pan as a protection against the heat.

The discharge-pipe A′ is provided with a supply-elbow, B′, entering side of evaporator over tubes D. This is to provide for a circulation of juice and to prevent burning inside discharge-pipe. As the juice in portion exposed to heat boils and rises into evaporator it is fed by elbow B′ from evaporator, and constant circulation ensues.

To provide for cleaning out ashes from tubes while hot, I use a steam-jet, C′, at back end of each tube D. A valve, D′, outside being opened, every tube is blown out at same time. This steam-jet may also be used to check the draft through tubes and blow the fire back out of them, instead of damper U, or may be used in connection with it.

There are some cases in which it is desirable to make small evaporators of half capacity of the usual size, and to provide for such cases I set the trains side by side, as shown at Figs. 8 and 11, using twin bagasse-burners, in which half the bagasse is burned in each and charged alternately by a suitable arrangement of reversible chute. One manner is illustrated at Fig. 10, where the small reversible chute E′ turns the bagasse from carrier F′ to one or the other burner G′ or H′; or, again, there are cases where double the usual quantity of bagasse has to be burned and double the amount of juice evaporated. In such a case I make twin trains and burners of full size—say six hundred gallons each evaporator—and by the twin arrangement get more juice nearer the fire and better evaporation than if the pans were extended in one line on one flue, besides being better able to consume a very large quantity of bagasse in two furnaces than in one. Otherwise than as above stated, the manner of making, setting, and working the twin trains and burners is the same as the single one illustrated at Figs. 1, 2, 3, and 4, before described. The bagasse-furnace F has a draft-door, I′, and clean-out doors J′. The flues P and T have clean-out doors K′.

I do not claim as my invention a small furnace outside a large chamber, it being shown and described in "Knapp's Chemistry Applied to the Arts," published in 1848, and has long been in use; nor do I claim to be the inventor of the bagasse-burning furnace; but

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

1. A bagasse-furnace and train of evaporators arranged or set with a divided fire-flue, and provided with dampers to close the heat from each evaporator, and to turn or direct the heat into a separate or independent flue, substantially in the manner and for the purposes described.

2. The combination of the furnace F, the furnace G, and the divided air-flues I J for heated air, substantially as described.

3. Evaporating tubular open pans to work with direct heat, in combination with flues P and T and damper Q, substantially as set forth.

4. The flues T and P, in combination with a damper, Q, for the purpose described and set forth.

5. A damper through which water circulates to keep it cool, supplied from a head higher

than itself, and to which head the steam generated is returned under the water-level and condenses again into water.

6. The circulating discharge-pipe A′ B′, substantially as set forth.

7. A tubular evaporating-pan, as described, in combination with a registering-damper to graduate the heat in tubes, as set forth.

8. The method of regulating the passage of heat through tubes of open evaporating-pans working with fire heat by means of a jet of steam blown in against the draft, as set forth.

9. Twin trains of tubular open evaporating-pans acting with fire heat from bagasse, in combination with twin bagasse-burners and outside furnaces for solid fuel.

10. In a bagasse-furnace having trains of evaporators of the character set forth, the arrangement in the walls of the furnace of longitudinal air-passages, substantially as and for the purposes described.

11. The combination, substantially as described, of an open evaporating-pan arranged to work with fire heat, and a water-damper or its described equivalent, located in front of the pan, to direct or turn the heat partially or entirely away from said pan into another flue when the pan is empty, as and for the purposes set forth.

FREDERIC COOK.

Witnesses:
THOS. J. CARVER,
S. CONDIT.