

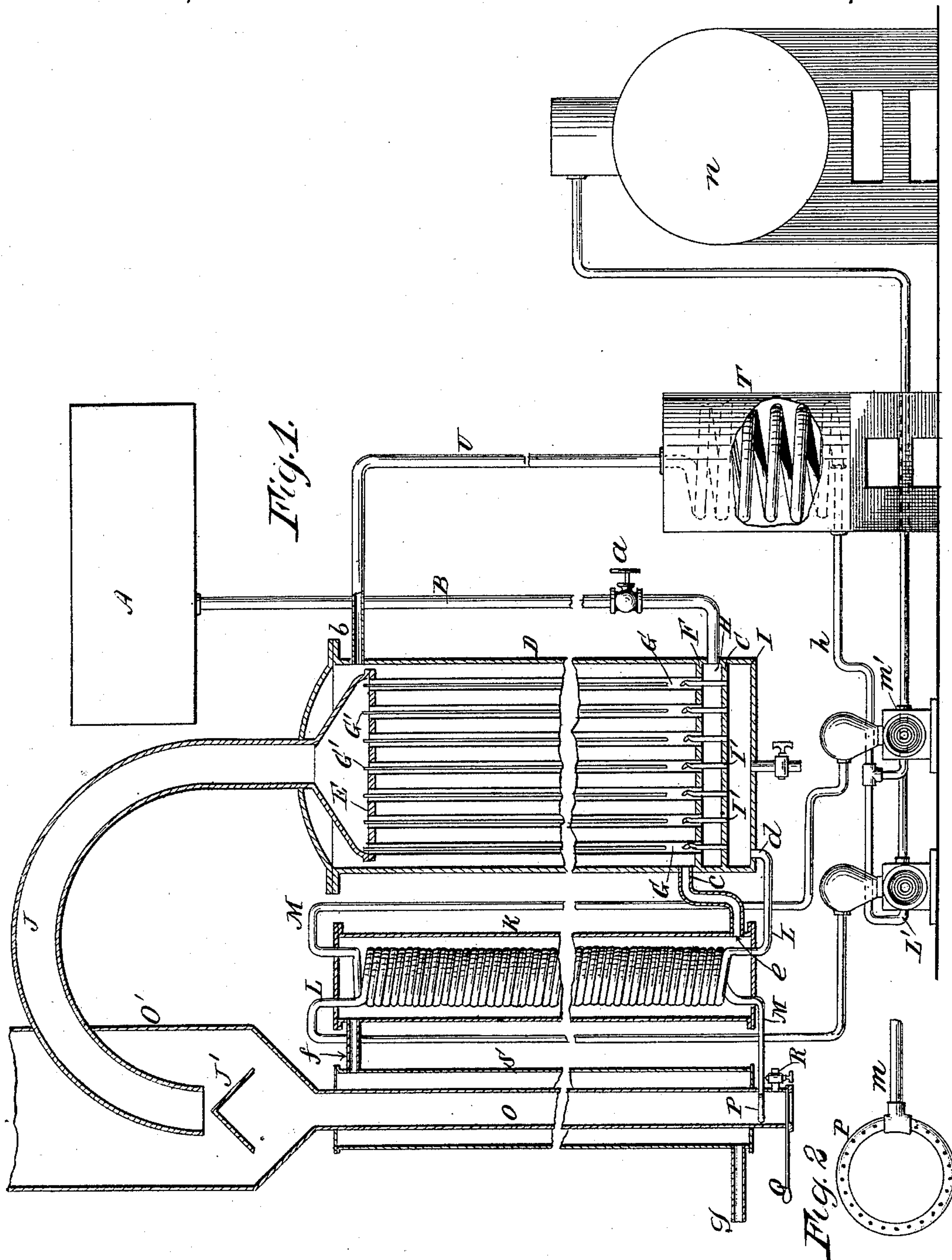
(No Model.)

J. A. MORRELL.

# PROCESS OF AND APPARATUS FOR EVAPORATING CANE JUICE.

No. 509,749.

Patented Nov. 28, 1893.



Witnesses:

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# UNITED STATES PATENT OFFICE.

JAMES A. MORRELL, OF LANSDALE, PENNSYLVANIA.

## PROCESS OF AND APPARATUS FOR EVAPORATING CANE-JUICE.

SPECIFICATION forming part of Letters Patent No. 509,749, dated November 28, 1893.

Application filed July 12, 1892. Renewed May 2, 1893. Serial No. 472,791. (No model.)

*To all whom it may concern:*

Be it known that I, JAMES A. MORRELL, a citizen of the United States, and a resident of Lansdale, in the county of Montgomery and State of Pennsylvania, have invented certain new and useful Improvements in Processes of and Apparatus for Manufacturing Sugar, of which the following is a specification.

This invention relates to certain new and useful improvements in processes of, and apparatus for, evaporating and crystallizing the juice of the sugar cane, or other saccharine solutions, and has for its object the reduction of sugar to the desired crystallization or solidification, and evaporating the water therefrom, by a single continuous operation or process.

In carrying my invention into practical effect, I employ a combination apparatus in which the cane juice is subjected to a continuous treatment, whereby the water is extracted from the juice, and evaporated, and the juice is discharged from the apparatus in the form of crystallized or concremented sugar.

In the accompanying drawings I have illustrated the construction and arrangement of apparatus I prefer to employ in practicing my invention.

In the drawings: Figure 1, is a view in elevation, and partly in section, of said apparatus; and Fig. 2, is a detail of construction.

A represents a tank or reservoir, containing the liquor or juice of the sugar cane, and arranged at an elevation above the apparatus. This tank is connected by the pipe B, provided with the valve *a*, with the liquor chamber C, near the bottom of what I term the evaporator D. As shown, this evaporator consists of an outer shell, constituting a steam jacket, provided with the inlet *b*, and the outlet *c*, and having arranged within it, the plate E, and the lower partition F, between which are arranged the pipes or tubes G, each provided with the central core G'. The space between partition F, and partition H, constitutes the liquor chamber C, and the space between partition H, and partition I, constitutes the air chamber, provided with the inlet *d*; tubes I', extend through the partitions F, H, and enter the lower ends of tubes G, the free ends of the tubes I', being bent to spiral or screw form, for the purpose hereinafter described.

J, is a goose-neck, extending from the upper ends of tubes G, to an unobstructed stand pipe O, which is surrounded by a steam jacket S. The upper end of this stand pipe is provided with, or connected to, a funnel shaped top O', in which is arranged a cone-shaped deflector J', and the goose-neck discharges against the top of this deflector. The unobstructed stand pipe O, forms what I term the concreter of my apparatus in which the crystallization or solidification of the sugar is finally accomplished.

K, is a steam jacket arranged between the concreter O, and the evaporator D, and having a steam inlet *e*, and a steam outlet *f*. Two air coils L, M, are arranged within this jacket, and these coils are supplied with air respectively by pumps L', and m', which are connected to, and operated by, a suitable boiler or steam generator *n*. The air coil M, terminates at one end in the annular pipe P, which is perforated on its lower surface, and discharges into the bottom of the concreter O. This concreter is provided near its bottom with a slide valve Q, and a test valve R, and is surrounded, as stated, by the steam jacket S, provided with the steam inlet *f*, and the exhaust *g*.

T, is a superheater, connected by the pipe *h*, with the exhaust of pumps L' m', and connected by pipe U, with the steam inlet *b*, of evaporator D.

The practice of my process and operation of my improved apparatus are as follows:— The juice or liquor of the sugar cane is run or pumped into the elevated receptacle A, and is carried thence through pipe B, to liquor chamber C, where it is sub-divided and passes into the pipes or tubes G. Steam is generated in the boiler *n*, and the pumps L', m', are started, pumping air into their respective coils L, M, contained in the steam jacket K, and both of said pumps exhaust to the superheater T, from which the steam passes through pipe U, and opening *b*, into evaporator D, heating to a high degree the pipes G, therein, and passing out through pipe *c*, into the jacket K, heating the air in coils L, M, and passing from said jacket K, to the jacket S, heating the concreter O, and escaping or exhausting at *g*. The highly heated air in coil L, is led into the air chamber at *d*, and passes thence by tubes I', into the tubes G, and



through the liquor chamber C. The screw or spiral form of the free end of these tubes I', gives a twisting action to the air current, which, by centrifugal force, causes the liquor in said tubes to assume an annular or tubular form, which end is further attained by the cores G', and as the liquor impelled by the heated air ascends the tubes G, the heated air drives the liquor upwardly, and the intense heat in the evaporator D, drives off the water to a great extent, and the partially evaporated mass passes upwardly through goose-neck J, and is delivered onto the deflector J', where the vapors ascend through the open funnel, and are carried off, while the nearly evaporated mass, in sheets or particles, is directed downwardly against the walls of the concreter O, and falls gradually to the bottom of said concreter. As the mass descends it is subjected to the intense heat of the steam jacket S, and the ascending hot air from the coil M, and the evaporation of the water from the mass is completed, and the latter delivered at the bottom of the pipe O, in a solidified or concreted condition. It will be observed that the openings in the annular pipe P, discharge downwardly so that the force of the ascending blast will not tend to retard the downward movement of the mass to such an extent as to permit burning. From time to time the valve R, may be opened, and a test stick introduced to ascertain the condition of the sugar, and the proper degree of evaporation and crystallization can always be attained by regulating the slide valve Q, in the stand pipe O, and the supply valve a, in the pipe B.

By this apparatus I am enabled to carry out my process and by one continuous operation, to evaporate the water from the cane-juice, and produce raw sugar in concreted form, and of any desired degree of dryness or crystallization, and with little or no liability of loss from burning in transit through the concreter, which being unobstructed, permits the mass to pass downwardly freely and rapidly. I am thus enabled to obtain the more perfect crystallization or concreting of the raw sugar, and at less expense than can be done by any process heretofore followed, and with which I am familiar.

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

1. In the manufacture of sugar, the process of crystallizing and drying the sugar in one continuous operation which consists in subjecting the cane juice in a sub-divided and heated condition to the action of an impelling hot air blast discharged into and mingled with the juice, the product thus partially evaporated being subsequently directed downward and permitted to descend through an unobstructed space against the action of a second and opposing hot air blast, substantially as hereinbefore set forth.

2. An apparatus for crystallizing or concreting cane juice in the manufacture of sugar, comprising a sub-divided evaporator discharging into an unobstructed vertical concreter, means for heating said evaporator and said concreter, and means whereby a hot air blast is discharged into and caused to ascend through each vessel, substantially as described for the purposes set forth.

3. The combination in an apparatus for crystallizing or concreting cane-juice, in the manufacture of sugar, of a sub-divided evaporator discharging into an unobstructed concreter, and means for heating said evaporator and concreter, of a steam jacket arranged between the two, and containing heating coils, respectively discharging into the bottom of said evaporator and concreter, and means for forcing the air at high pressure through said coils, evaporator and concreter, substantially as described.

4. The combination in an apparatus for crystallizing or concreting cane-juice in the manufacture of sugar, of a sub-divided evaporator discharging into an unobstructed concreter, means for heating said evaporator and concreter, a steam jacket arranged between the two, and containing heating coils, respectively discharging into the bottom of said evaporator and concreter, air pumps for forcing the air through said coils, and means for regulating the inflow of cane-juice, and the discharge of the concreted mass, substantially as described.

Signed at New York, in the county of New York and State of New York, this 9th day of July, A. D. 1892.

JAS. A. MORRELL.

Witnesses:

EUGENE V. MYERS,  
JAMES T. HOILE.