(No Model.)

J. A. MORRELL.

PROCESS OF AND APPARATUS FOR EVAPORATING SUGAR SOLUTIONS.

No. 476,891. Patented June 14, 1892.

Fig. 1.

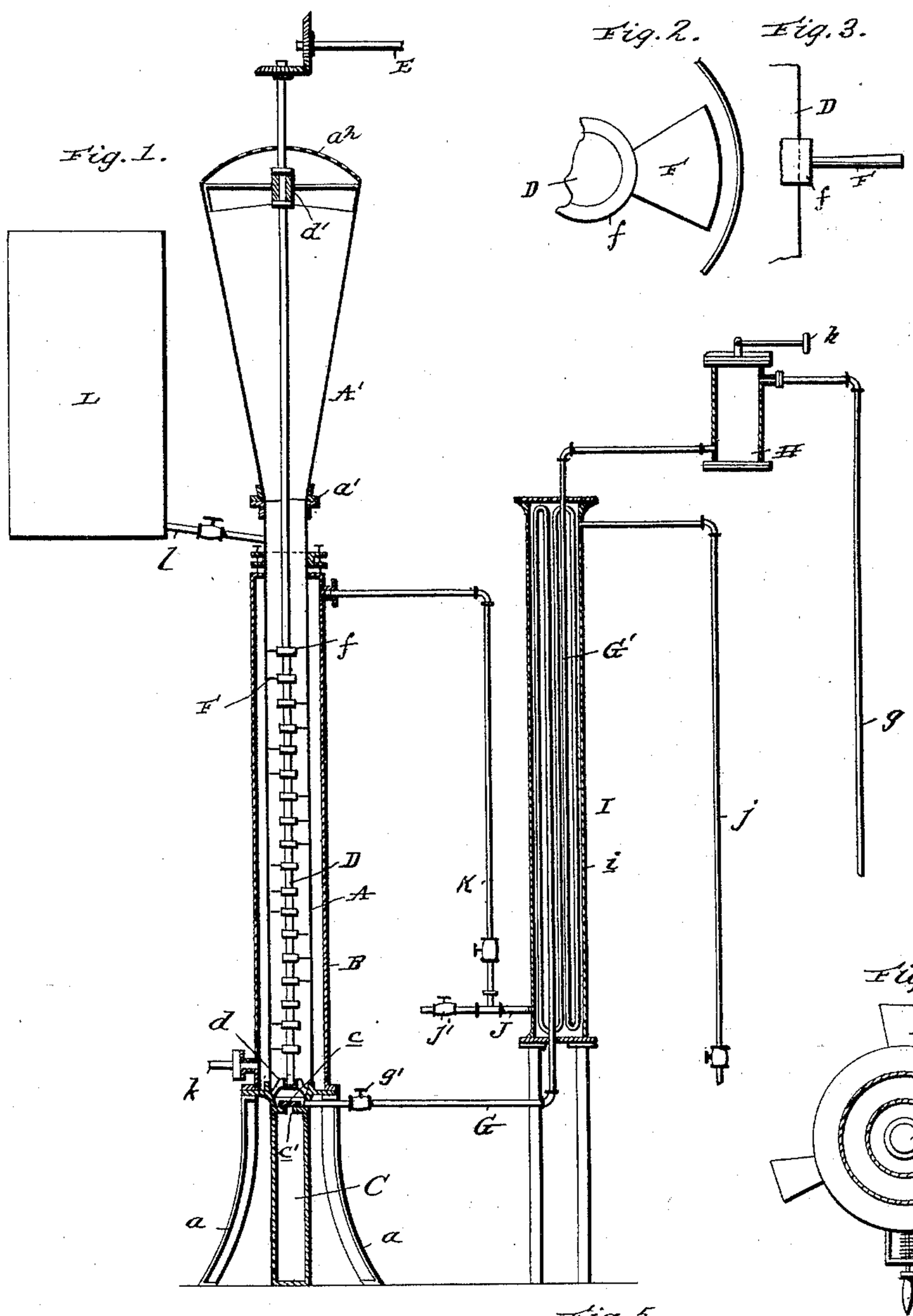
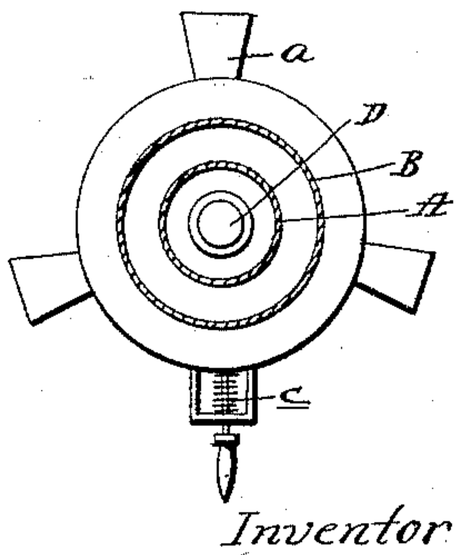


Fig. 2.

Fig. 3.

Fig. 4.



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JAMES A. MORRELL, OF NEW ORLEANS, LOUISIANA.

PROCESS OF AND APPARATUS FOR EVAPORATING SUGAR SOLUTIONS.

SPECIFICATION forming part of Letters Patent No. 476,891, dated June 14, 1892.

Application filed November 9, 1891. Serial No. 411,413. (No model.)

To all whom it may concern:

Be it known that I, JAMES AUGUSTINE MORRELL, 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 Processes of and Apparatus for Concreting Sugar or Crystallizing Saline or other Solutions; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to a process of and apparatus for concreting sugar or crystallizing saline or other solutions; and the object in view is to economically and quickly convert saccharine, saline, or albuminous solutions into a solid crystalline mass without boiling, as will be hereinafter more fully set forth and claimed.

The apparatus is fully illustrated in the accompanying drawings, forming a part of this specification, and in which—

Figure 1 is a vertical longitudinal sectional view through the upright column or tube and the parts associated therewith. Figs. 2 and 3 are enlarged detail views of one of the agitator-blades in plan and side elevation, respectively, also showing a part of the agitator-shaft and the tube. Fig. 4 is a cross-section through the lower part of the concretor above the legs or standards thereof, and Fig. 5 is a transverse section of the air-heater.

Referring by letter to said drawings, A indicates a vertical column or stand-pipe, which is preferably made of copper, and around this column is arranged a concentric steam-jacket B, which is closed at its upper and lower ends and which tightly encircles the column or stand-pipe. The jacket and column form part of the converter, which is supported or mounted upon a suitable base or the legs *a a*, and between the legs is the conveyer or discharge-pipe C, which is arranged in axial alignment with the upright column or pipe A and which communicates with the lower part thereof, so as to receive the crystallized substance from the same. The communication between the discharge-pipe C and the upright column is controlled by a gate or cut-off *c*, which operates across an outlet-opening *c'* in the lower part of the column A, and above this outer opening is a spider-shaped bearing *d*, in which is stepped the lower end of the vertical agitator-shaft D, that extends longitudinally through the entire length of the upright column. The upper part A' of this column or stand-pipe is made separate from the major portion of the column, and the two parts are joined together by the flange-bolted joint *a'* at a point above the upper end of the steam-jacket B. The stand-pipe proper is preferably of uniform diameter throughout its length; but the upper section A' is flared and enlarged from its lower end to its upper extremity, as shown. The upper flared end of this tapered section A' of the stand-pipe is covered by a foraminated top a^2, which permits of the free egress of the air from the stand-pipe and also serves to practically prevent the liquid in the stand-pipe from escaping therefrom along with the air. In the upper part of the section A' of the column is a bearing *d'* for the upper end of the longitudinal shaft, and this shaft is adapted to be rapidly rotated—say at a speed of one hundred (100) revolutions per minute—by a suitable driving-shaft E, which is preferably geared to the agitator-shaft.

Within the upright column or stand-pipe the agitator-shaft is provided with a series of collars *f*, which are suitably spaced apart and rigidly fastened on the shaft, and each collar has an outwardly-extending blade F, adapted to act on the liquid mass in the column and to throw the watery particles of matter outwardly from the center of the column, and thereby disintegrate the mass, so that the heated and compressed current of air will more readily carry off the watery matter and facilitate the evaporation and crystallization of the residue retained within the column or stand-pipe.

The current of compressed air heated to a temperature below the boiling-point of the saccharine or saline solution in the stand-pipe is conveyed to the latter by means of an air-supply pipe G, which discharges below the spider-bearing *d* in the lower end of the upright column, so that the air can pass through the spider and into direct intimate

contact with the liquid mass within the column.

The air from a suitable compressor (not shown) is conducted by a pipe *g* to an air-reservoir H, which has a pressure-regulated valve *h*, and in this reservoir the air is compressed to the desired pressure—say from ten to twenty-five pounds per square inch. From this air-reservoir leads an air-pipe, which is bent or doubled to form the heating-coil G′, which is housed or inclosed within the shell *i* of the vertical heater I, and from the heating-coil G′ and the bottom of the heater I extends the pipe G, by which the compressed heated air is conducted to the interior of the upright column or stand-pipe A, said pipe G having a suitable regulating-valve or stop-cock *g*′.

Steam is supplied to the shell of the vertical heater I by means of a steam-pipe *j*, which takes the steam from the exhaust of the engine provided for running the air-compressor, and the steam circulates around the air-heating-coil G′ and within the shell *i* to heat the air in said coil G′ to the proper temperature. The waste steam from the air-heater I is conducted away by means of a pipe J, having a valve *j*′, and from the exhaust-pipe J leads a valved pipe K, which conducts the steam from the air-heater to the steam-jacket B around the upright column A. A discharge-pipe *k* leads from the bottom of the steam-jacket B to convey off the water of condensation from the jacket and permit the remaining steam therein to escape. The saccharine or saline solution is stored in an elevated tank L, and from this tank leads a valved liquid-supply pipe *l*, which discharges into the upper part of the column or stand-pipe.

This being the construction of my apparatus, the operation is as follows: The air-compressor is started to charge the air-reservoir H, the agitator-shaft is rotated by the shaft D, and the waste steam from the engine-exhaust is conducted to the air-heater I and the steam-jacket B to heat the said parts to the proper temperature. The molasses or other saccharine or saline solution is run from the tank L into the column or stand-pipe until a proper supply is obtained therein, and the heated compressed air is admitted to the column or stand-pipe at the bottom thereof. As the shaft D rotates very rapidly in the liquid mass, the latter is subjected to the centrifugal action of the heaters or agitators thereon and the heated compressed current of air passes upwardly through the agitated mass and in direct intimate contact with the same. A test as to the consistency of the material can be made through the inlet-opening *c*, which is controlled by the gate or cut-off, or a test-cock may be attached to the concretor, if desired.

One of the most important advantages of my invention is that I am enabled to evaporate and crystallize the mass at a low heat below the boiling temperature and without caramelizing or inverting the substance, whereby I am enabled in treating saccharine matter to convert all the output from the sugar-cane into sugar. By forcing the compressed heated-air blast into direct and intimate contact with the agitated mass the latter is kept very much lighter than when it is heated by the vacuum process, and, furthermore, disintegration of the particles of moisture from the solid residue is secured, thus producing evaporation and crystallization without boiling or inversion. Again, saccharine matter treated by my process has a tendency to bleach the solid crystals of sugar and the saccharine material can be brought to any desired density from string-proof to solid concrete. The rapid action of the blades or beaters F on the saccharine matter serves to drive out therefrom all the watery particles and a light dry sugar is obtained which, in fact, is drier than can be obtained by the well-known centrifugal machine, and as the watery particles are all eliminated from the saccharine solution no molasses is left and a product is secured which will not deliquesce.

The invention also enables me to economically convert solutions in general into a solid mass, and I have found that the lowest grades of molasses, which are unmerchantable and which average about fifty gallons to the barrel, can be converted into a solidified or concrete state, thus enabling a sugar-planter to convert all of his crop into sugar.

I am aware that changes in the construction of the apparatus herein shown and described as one embodiment of my invention can be made without departing from the spirit or sacrificing the advantages of my invention, and I therefore reserve the right to make such alterations and modifications as fairly fall within the scope of my invention.

Having described my invention, what I claim is—

1. The process of evaporating and crystallizing saccharine liquids, which consists in maintaining in a state of violent agitation a vertical column of such liquid and then forcing through such agitated column of liquid a current of compressed air which has been previously heated to a temperature below the boiling-point of the liquid so treated and keeping up such action until the liquid has been reduced to a solid, as and for the purpose described.

2. In an apparatus for crystallizing saccharine and saline solutions, the combination of a stand-pipe adapted to be heated upon its exterior surface, a supply-pipe connected with the upper portion of said stand-pipe, an agitator passing through said pipe, and an air-supply pipe entering the lower end of the stand-pipe and adapted to discharge air up through the mass therein, substantially as specified.

3. In an apparatus for evaporating and crystallizing saccharine and saline solutions, the combination of the stand-pipe, a liquid-supply tank therefor, a longitudinal agitator-shaft extending through the stand-pipe, an air-reservoir, an air-pipe leading from the air-reservoir to the stand-pipe, a steam-heater inclosing the air-pipe, and a steam-jacket surrounding the stand-pipe and connected to the steam-heater, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

JAMES A. MORRELL.

Witnesses:

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