

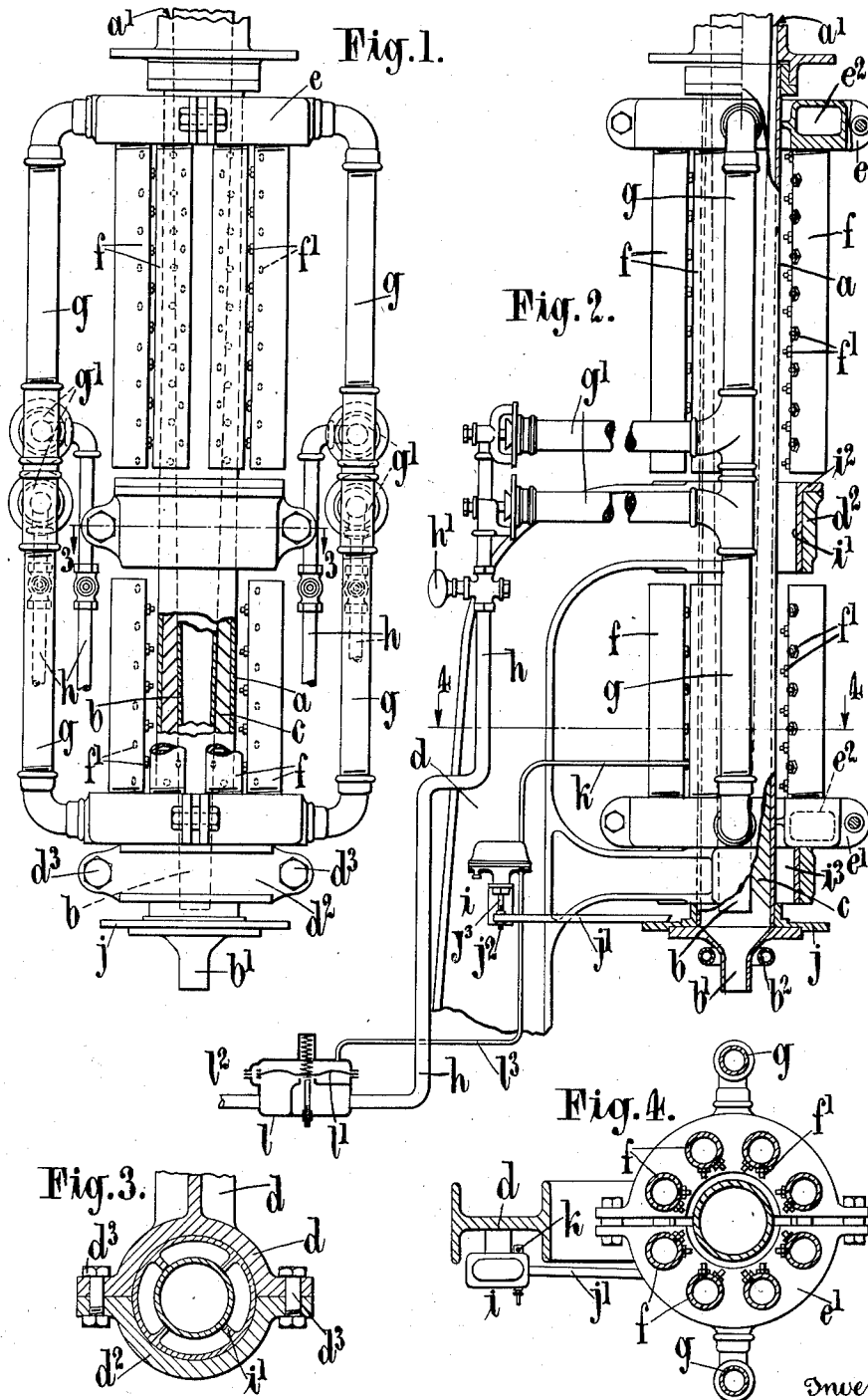
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METHOD AND APPARATUS FOR CONCENTRATING AND EVAPORATING SUGAR SIRUPS.

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METHOD AND APPARATUS FOR CONCENTRATING AND EVAPORATING SUGAR SIRUPS

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This invention relates to methods and apparatus for concentrating and evaporating sugar sirups and the like, and involves a concentrating or evaporating vessel or element in which the sirup passes or is forced through a spiral passage which may be of gradually increasing area, formed for example by a spiral plate interposed between two tubes, the outer of which is subjected to heat and the inner serves as an outlet for the vapour or steam from the sugar sirup under treatment.

Hitherto such apparatus has been heated by a fluid such as steam under pressure contained in a jacket surrounding the outer tube, but the present invention comprises means for heating the sirup to be treated by means of gas, which does not require a separate power producing plant or equivalent as in the case of steam referred to.

The invention includes means for obtaining a uniform transfer of heat to the sirup under treatment in all parts of the evaporating area.

In order to obtain a uniform transfer of heat the heating elements are suitably located close to the outer tube so that the flames play on to the surface of the tube. The heating elements are appropriately arranged around the tube and said elements are evenly spaced in order to impart uniform heating over the entire evaporating surface.

In the use of gas burners these are preferably of the pre-mixing variety, that is to say, gas and air in the correct proportions for complete combustion are fed to the burners. To ensure a perfectly even distribution of heat over the inner surface of the evaporating wall or tube, such wall may be made of substantial thickness so that the heat applied to its outer surface may penetrate evenly through the mass of the metal due to its conductivity. The whole apparatus may be enclosed by an outer casing or tube having suitable means for carrying off products of combustion, and at or adjacent the outlet for the concentrated or evaporated sirup there may be provided thermostatic means by which the heating elements may be controlled according to a predetermined required temperature so that an even distribution of heat may be

obtained throughout the apparatus. The said thermostatic means may be adjustable according to the degree of heat to be imparted to the sirup under treatment. Such control would however usually be adopted in addition to appropriate manual controlling means for the heating elements.

An embodiment of the improved apparatus to which the heat is applied by means of gas burners is illustrated in the accompanying drawings in which Fig. 1 is a part sectional front elevation, Fig. 2 a part-sectional side elevation, Fig. 3 is a cross-section on line 3—3 of Fig. 1 and Fig. 4 a cross-section on line 4—4 of Fig. 2.

The concentrating and evaporating vessel comprises outer and inner tubes *a* and *b*, respectively; between which is the passage for the sirup constituted by the spiral plate *c*, the said passage being of gradually increasing area from top to bottom. The sirup is fed to the top at *a*¹ by any convenient means between the tubes *a* and *b* and is discharged at the lower end through a nozzle *b*¹ about which is located a gas burner ring *b*². Any other convenient form of evaporating vessel embodying the spiral passage feature may however be adopted.

The said concentrating and evaporating vessel may be supported by a bracket or arm *d* as hereafter explained, and surrounding the upper and lower end portions of said vessel both above and below are castings or heads *e* *e*¹ each provided with an annular gas channel *e*² and formed in two halves or segments bolted together as indicated in Fig. 4. Extending towards the center from each of said castings or heads *e*, *e*¹ is a series of gas pipes *f* communicating with the annular channel *e*² in the respective head, these gas pipes being arranged closely around the exterior of the outer tube *a* of the concentrating vessel in a circle and being provided with burner nozzles or nipples *f*¹ suitably disposed at different angles tangential to the surface of the tube so that the flames emitted play evenly or uniformly over the whole of such surface.

The aforesaid castings or heads are supplied with gas or air by means of pipes *g* shown as provided at each side of the con-

concentrating vessel, two for the upper head and two for the lower head, which pipes in turn are supplied by branch feed pipes g^1 , at the inlets of which are provided injectors of known or suitable form adapted to provide the required pre-mixed proportion of gas and air to the burners. The injectors are fed with gas from supply pipes h having controlling taps h^1 .

From the above it will be apparent that substantially the entire surface of the tube a will be adequately heated by the flames impinging thereon from the burners f^1 and that the heat furnished may be uniform throughout or may be varied as to the upper and lower parts of the concentrating vessel by controlling the supply of gas to the respective heads e, e^1 .

As previously mentioned, thermostatic means may be provided by which the supply of gas may be controlled according to a predetermined required temperature, and such device is more particularly shown in Figs. 2 and 4 where it is designated i . In this device the operation is due to the difference of expansion between two members, for example the bracket or arm d and the outer tube a of the concentrating vessel. The said tube a has connected thereto, as by brazing, a spider i^1 (Fig. 3) secured within the bracket and having a flange i^2 (Fig. 2) which rests on the bracket d and thus supports the concentrating vessel. A cap d^2 is fitted around part of the spider and is secured by bolts d^3 .

At the lower end the tube a may be centered by means of a similar spider i^3 . The tube a is also provided with a flange j to which is riveted or otherwise attached one end of a bar j^1 the other end of which is adjustably connected as by a screw and nut j^2 to the rod j^3 of the valve (not shown) of the thermostat. Thus when the tube a expands, due to the heat communicated to it, the bar j^1 will cause the rod j^3 of the thermostat to be drawn down but the bracket will remain comparatively cool, and the aforesaid valve in the thermostat i will be closed, which in turn will close through connection l^3 the diaphragm valve l^1 of the governor l , thus shutting off supply of gas through the governor by way of pipe h to the burners, the governor being fed through pipe l^2 . By adjustment of the screw and nut j^2 the supply of gas can be controlled through the thermostat for heating the concentrating element to a predetermined temperature. In Fig. 2, k designates a pipe by which any surplus or leakage of gas from the thermostat may be delivered adjacent one of the burners f and there burnt.

What we claim as our invention and desire to secure by Letters Patent of the United States is:—

1. In apparatus for concentrating and evaporating sugar sirups, the combination of a concentrating vessel containing a spiral pas-

sage for the sirup, and vertical gas pipes surrounding the outer surface of said vessel and provided with burner nipples disposed tangentially to the surface of the concentrating vessel at different angles so as to cause the flames emitted to play uniformly over the surface of said vessel.

2. Apparatus for concentrating and evaporating sugar sirups, comprising a concentrating vessel; upper and lower annular heads encircling the top and bottom portions of the vessel; an annular series of gas pipes extending from each head toward the central portion of the vessel and disposed to surround said vessel in close proximity to its outer surface, said pipes being provided with a plurality of burner nipples directed immediately toward said surface; a pair of gas supply pipes extending vertically in opposite directions and attached at their outer ends to said heads, the lower ends of said supply pipes being located opposite the said central portion of said vessel; a main source of gas; and a separate connection between such source and each supply pipe.

3. Concentrating apparatus, according to claim 1, in which the gas pipes surrounding the concentrating vessel are divided into separate upper and lower series, each series having controlling means for regulating the supply of gas thereto independently of the other series.

4. A method of concentrating and evaporating sugar sirups, comprising the steps of passing the sirup continuously through an elongated chamber, and constantly directing flames at close range tangentially against the external wall of the chamber on all sides thereof in a manner to play uniformly over the surface of such wall.

5. A method of concentrating and evaporating sugar sirups, comprising the steps of passing the sirup continuously through an elongated chamber, and constantly directing flames at different angles against the external wall of the chamber on all sides thereof in a manner to play uniformly over the surface of such wall.

6. A method of concentrating and evaporating sugar sirups, comprising the steps of passing the sirup continuously through an elongated chamber, and constantly directing flames at close range tangentially against the external wall of the chamber on all sides thereof in a manner to play uniformly over the surface of such wall, while automatically regulating the action of the flames throughout the heating operation according to a predetermined required temperature.

In witness whereof we have signed this specification.

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