G. A. HAGEMANN.

Method and Apparatus for Evaporating Liquids.

No. 165,568. Patented July 13, 1875.

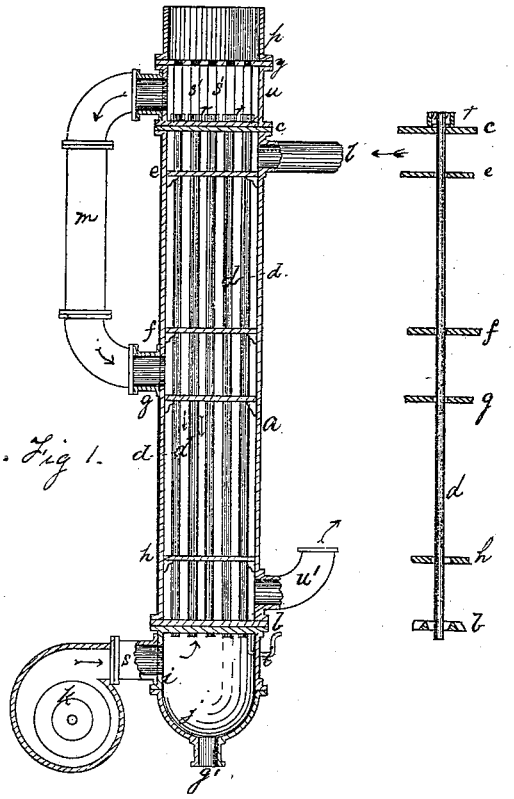

Fig 1.

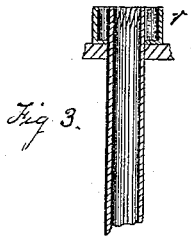

Fig 3.

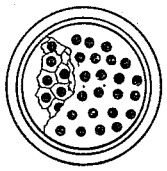

Fig 2

Witnesses

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UNITED STATES PATENT OFFICE.

GUSTAV A. HAGEMANN, OF COPENHAGEN, DENMARK.

IMPROVEMENT IN METHODS AND APPARATUS FOR EVAPORATING LIQUIDS.

Specification forming part of Letters Patent No. **165,568**, dated July 13, 1875; application filed May 21, 1875.

CASE B.

To all whom it may concern:

Be it known that I, GUSTAV A. HAGEMANN, of Copenhagen, Denmark, have invented a new and useful Improvement in Method and Apparatus for Evaporating Liquids; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawing, forming a part of this specification, in which—

Figure 1 is a section of an apparatus embodying my invention and adapted for carrying out my improved process. Fig. 2 is a top view of the receiver; and Fig. 3 is an enlarged view of the upper end of one of the pipes or conduits.

Like letters refer to like parts wherever they occur.

My invention relates to method and apparatus for evaporating and concentrating saccharine and other liquids; and it consists, first, in applying heat to both sides of a thin continuous or flowing film of liquid, the vapors arising being carried off by means of air-currents induced by either a suction or blast; and, secondly, in a series of vertical tubes or pipes, inclosed or jacketed so as to be heated upon one surface by the direct contact of the heated medium, and upon the other surface by communication with means for inducing air-currents; and, thirdly, in slotting or perforating the end of the pipe or tube, and combining the same with a cup or similar device for causing the liquid to distribute itself in film over the surface of the pipe.

I will now proceed to describe my invention, so that others skilled in the art may apply the same.

a represents a cylinder, which may be of wrought-iron or other suitable material, and is closed at both ends by heads *b c*, perforated for the reception of tubes or pipes *d*. Through the lower head *b* these pipes pass water-tight, being secured by any suitable packing, but through the upper partition *c* they may pass loosely. Between heads *b* and *c* are arranged a series of three or more diaphragms, *e f g h*, through which pipes *d* pass loosely—the diameter of the openings for the passage of the pipes gradually decreasing from *f* toward *c*, the object of the diaphragms being to disseminate the steam or other heating medium. Upon the upper ends of the tubes *d* are formed or secured collars or cups *r*, to direct the liquid from the receiver against the surface of the pipes—the pipes being perforated, or preferably provided with oblique cuts, to distribute the liquid in an even film over the surface of the tubing. The lower end of these pipes pass, water-tight, through head *b*. To the lower end of cylinder or jacket *a* is secured a short cylinder or extension, *i*, with which is connected a pipe, *s*, leading to a fan or other suitable blower, *k*, for inducing a current of air; and to the lower flange of ring *i* is attached the concave or kettle-shaped bottom *j*, having a draw-off opening, *g'*. Above the diaphragm or head *c* are two or more rings, *n p*, forming an extension of the jacket *a*, and divided by a perforated diaphragm, *y*, into an upper chamber or receiver for the reception of the liquid, and an intermediate chamber, connected with jacket *a* by pipe *m*, for conducting off the vapor-charged air. The intermediate chamber is traversed by filaments or wires *s'*, which direct the liquid from the receiver into cups *r* on the upper ends of the pipes *d*. *l* is an inlet-pipe, connected with the jacket *a* at or near its upper end, and *u'* is an exit or exhaust pipe at the lower end, the waters of condensation being trapped from the jacket by pipe *t*.

The above is the general construction of devices used by me, and the method of employing the same is as follows:

The saccharine or other liquid is admitted to the receiver *p* in a steady stream, and, escaping through the perforated bottom, is conducted by the filaments or wires *s* to the cups *r* of pipes *d*, and is thence distributed by means of the perforation or cuts in a thin film over the surface of pipes *d*, from the lower end of which it drips into the kettle or bottom *j* and flows thence by pipe *g'* to a suitable reservoir. The thin film of liquid, in its downward course, meets a current of air induced by a suitable fan or other blower—said air-

current being previously dried and heated, if preferred—takes up vapors and hastens evapotion.

In the meantime steam (generally waste steam) has been admitted to the surface of the pipe opposite the surface covered with the film of liquid, and the heat requisite for inducing evaporation thus obtained, the water of condensation being trapped off in any suitable manner.

In the arrangement of the devices herein shown, the liquid to be evaporated is conducted by copper wires *s* to collars or cups *r* surrounding the ends of the pipes *d*, is thence distributed in a thin film over the interior surface of the pipes, descending meets an upward current of air induced by fan *k*, and finally drops into kettle *j*, passing thence to the reservoir. Steam is admitted to jacket *a* by a pipe surrounds the outside of pipes *d*, is diffused by diaphragms *e*, *f*, *g*, and *h*, and is exhausted or escapes from pipe *w'*. The air from fan *k*, which has passed through pipes *d*, becoming heated and surcharged with moisture, is conducted from chamber *n*, through pipe *m*, into jacket *a*, where any heat is utilized and any waste water of condensation, together with that from the steam, is trapped off by means of pipe *t*, the air finally escaping with the waste steam through pipe *w'*.

It is evident the entire procedure might be reversed, viz: the steam passed through pipes *d*, and the film and air currents on the outer surface thereof, without avoiding either the method or apparatus herein specified.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. The process herein described for evaporating and concentrating liquids, consisting in exposing a thin, continuous, or flowing film of liquid to heat applied on both sides thereof, and to the action of an induced air-current, substantially as specified.

2. In an evaporator for evaporating and concentrating liquids, the combination of one or more vertical tubes or pipes, an inclosing jacket or cylinder, a series of perforated heads or diaphragms, and two or more induction and eduction pipes communicating with the jacket and vertical tubes, substantially as and for the purpose specified.

3. The combination of cylinder *a*, having perforated heads *b c*, and induction and eduction pipes *l u*, with tubes *d*, and blast or exhaust fan *k*, substantially as and for the purpose specified.

4. The combination of blower *k*, pipes *d*, cylinder or jacket *a*, having heads *b c y*, pipe *m*, and eduction-pipe *u*, substantially as and for the purpose specified.

5. The tubes *d*, having one end cut or perforated, and provided with a cup for receiving a liquid and directing it against the surface of the pipe, substantially as specified.

In testimony whereof I, the said GUSTAV A. HAGEMANN, have hereunto set my hand.

GUSTAV ADOLPH HAGEMANN.

Witnesses:
AUG. TRHAG,
J. V. ROODAMME.