(No Model.)

A. A. DENTON.

APPARATUS FOR EVAPORATING LIQUIDS BY AIR.

No. 353,291. **Patented Nov. 30, 1886.**

Fig. 1.

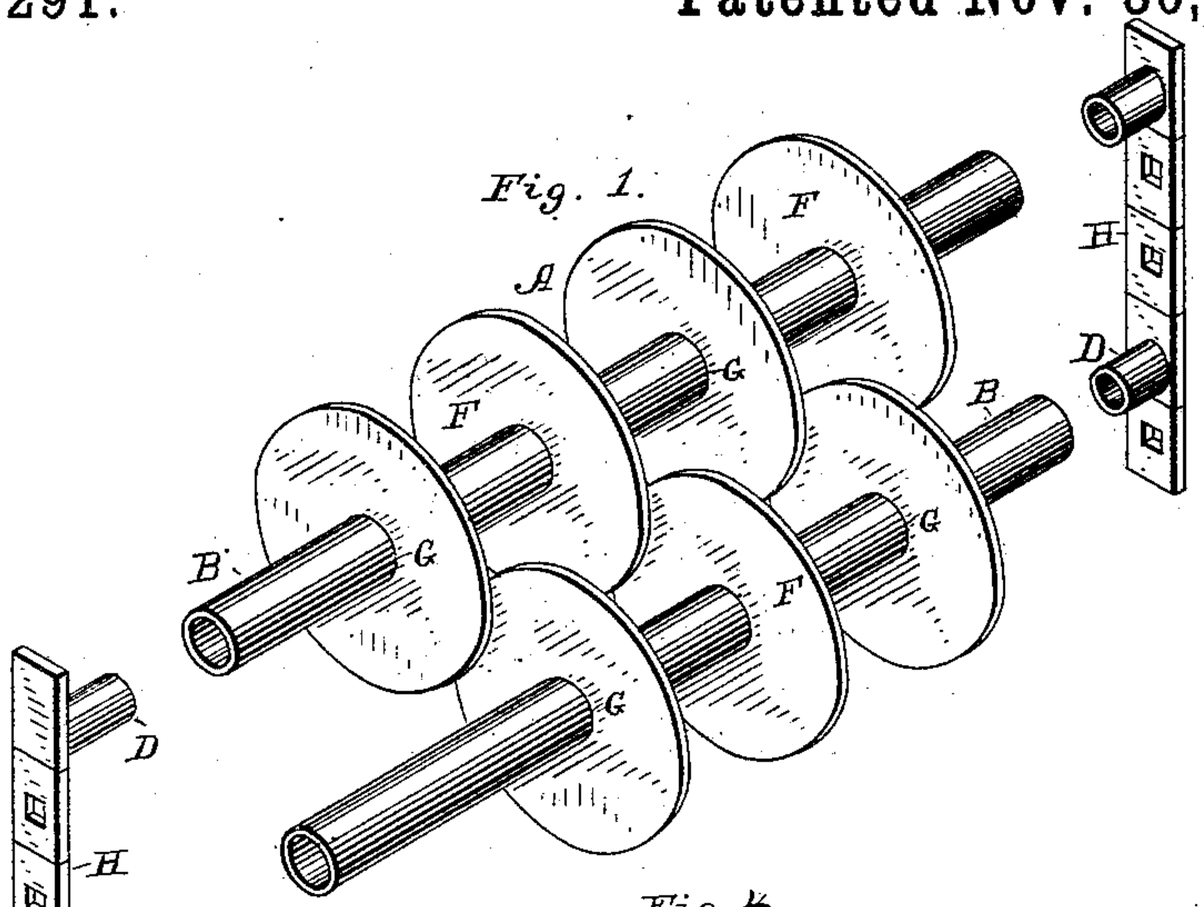


Fig. 4.

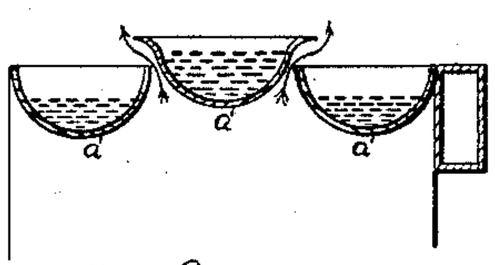


Fig. 5.

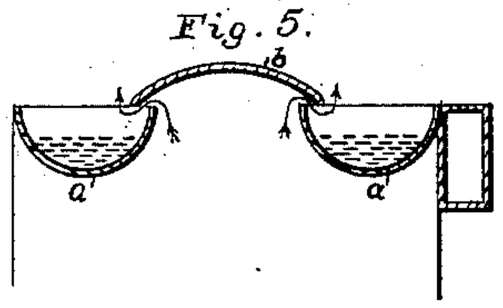


Fig. 2.

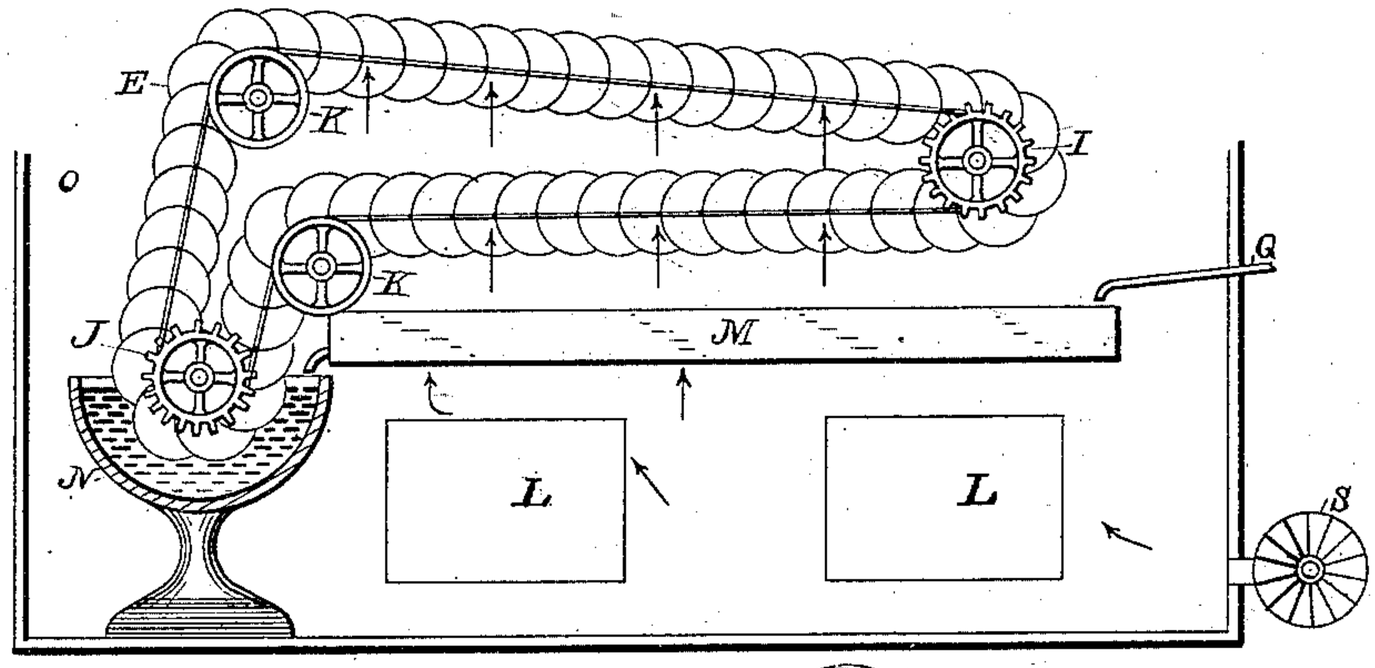
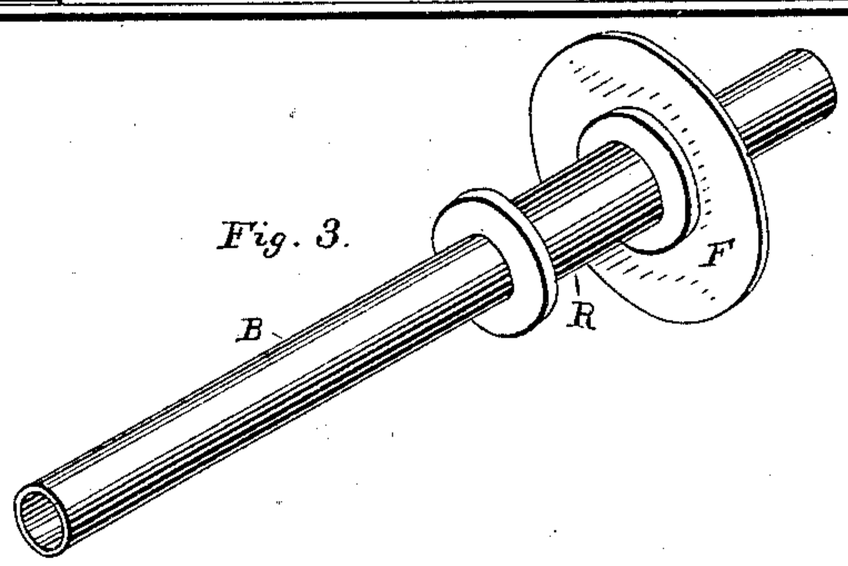


Fig. 3.



Witnesses

F. L. Fischer.

N. B. Wyman

By his Attorney

Inventor

Albert A. Denton

L. Deane

UNITED STATES PATENT OFFICE.

ALBERT A. DENTON, OF BAVARIA, KANSAS.

APPARATUS FOR EVAPORATING LIQUIDS BY AIR.

SPECIFICATION forming part of Letters Patent No. 353,291, dated November 30, 1886.

Application filed March 16, 1886. Serial No. 195,447. (No model.)

To all whom it may concern:

Be it known that I, ALBERT A. DENTON, a citizen of the United States, residing at Bavaria, in the county of Saline and State of Kansas, have invented certain new and useful Improvements in Apparatus for Evaporating Liquids by Air, of which the following is a specification, reference being had therein to the accompanying drawings.

The object of this invention is the improvement of the apparatus for evaporating liquids by air for which Letters Patent were granted me December 23, 1884, No. 309,775, and April 6, 1886, numbered 339,388, 339,389, and 339,390, and for which a patent application is now pending, filed on the same day with this.

Figure 1 is a perspective view showing compound slats and the arrangement and connection thereof, with means to move them. Fig. 2 is a side elevation of the apparatus as in use, the one side and the top of the casing removed; Fig. 3, a detail in perspective of one of the disks on its axis, with one of the separating-thimbles in position; Figs. 4 and 5, details of the arrangement of the troughs.

In this apparatus the object is to cheapen and to simplify the construction.

In this apparatus the object, also, is to improve the working of the apparatus by causing the air to pass the shortest possible distance through the wet evaporating-surfaces of the liquid-conveyer, for hot and dry air is very quickly saturated, and also has its temperature rapidly lowered when passing over wet surfaces, and to attain the best results the air should be allowed to escape from the apparatus as soon as or rather before it is fully saturated.

I accomplish these results in the following way. I construct a compound slat, A, Fig. 1, by using a single axis, B, instead of using a double or compound axis, as heretofore. This axis may be a piece of gas-pipe, as that has less weight and greater rigidity than a solid axis, and its open ends also give an easy method of attachment to the attachment-links of the supporting-chains. Plates or disks of circular or other suitable form, F F, having a central perforation, G, to receive the axis B, are placed upon the axis a suitable distance apart to allow air to pass freely between these plates or disks, and also to pass easily through the liquid in the basin N, Fig. 2. These disks may be soldered or otherwise rigidly fastened to the axis B, or suitably-flanged collars or thimbles P, Fig. 1, may be placed on the axis B, between the disks, to keep them the proper distance apart and in proper position, and in this case the disks may be loose and free to turn upon the axis B. I form the next compound slat, Fig. 1, in the same way, except that the disks are spaced differently upon the axis B, so that each alternate compound slat may work partly within the preceding and the succeeding slat, as shown in Fig. 1. These compound slats, when placed upon the chains H H, Fig. 1, by connecting them with the attachment-links D D, Fig. 1, and the chains placed upon the upper sprocket-wheels, I I, and the lower sprocket-wheels, J J, and the angle wheels or rollers K K, as shown in Fig. 2, compose the liquid-conveyer E.

The object of the angle wheels or rollers K K is to cause the compound slats to descend into and ascend vertically from the liquid in the basin N, Fig. 2, as that is the best way to immerse or wet the slats, and also to cause the compound slats to pass horizontally, or in an inclined position, over the air-heater or the air-heaters L L, as the hot air passes vertically a short distance only over the wet surfaces of the liquid-conveyer E when in that position. In this construction the part of the liquid-conveyer E, Fig. 2, which is below the angle-wheels K K is the wetting portion, and the horizontal part of the liquid-conveyer E is the evaporating part of the liquid-conveyer.

Under the horizontal part of the liquid-conveyer E, Fig. 2, I place a drip-pan, M, to receive the liquid which drops from the liquid-conveyer E while it is in motion, and to return it to the basin N, which contains the liquid being evaporated. This drip-pan M is placed a suitable distance below the liquid-coveyer E, Fig. 2, to allow the air to enter above the drip-pan M, and then pass vertically up through the wet surfaces of the liquid-conveyer E.

The drip-pan may consist of a plain shallow basin or trough, which receives the liquid which drips from the horizontal part of the liquid-conveyer, and returns it to the basin containing the liquid which is being evaporated, as is shown in Fig. 3. The drip-pan

may also be composed of troughs *a a a*, with spaces between the troughs, which spaces allow air to ascend between the troughs, and then through the horizontal part of the liquid-conveyer, and these troughs may overlap each other in such manner as to prevent the liquid which drips from the liquid-conveyer from passing between the troughs, and from falling upon the furnace underneath the troughs, as is shown in Fig. 4.

The spaces between the troughs may be protected by suitably-formed shields *b*, as in Fig. 5, which arrest the falling drops of liquid and convey them to the troughs *a a*, which return the liquid to the basin containing the liquid which is being evaporated, and spaces may be allowed between these shields *b* and the troughs *a a*, so that air may ascend between the troughs, and also pass through the liquid-conveyer above the troughs, as shown in Fig. 5. By these means the heater may be underneath the drip-pan and the liquid-conveyer, and the air may ascend more uniformly through the liquid-conveyer than is the case in Fig. 3, and all parts of the evaporator are nearer the source of the heat and then pass vertically up through the wet surfaces of the liquid-conveyer E.

In operating this apparatus the liquid to be evaporated may be admitted to the drip-pan M, Fig. 2, by the pipe Q. The liquid passes through the drip-pan M into the basin N, where it is taken up by the disks which compose the compound slats of the liquid-conveyer, and is carried through the hot air ascending from the air-heaters L L, and the hot air evaporates water from the liquid. By admitting the liquid at Q, Fig. 2, to the drip-pan M the drip-pan M is prevented from becoming dry, as would be the case when but little liquid dropped from the liquid-conveyer E, and the surface of the liquid in the drip-pan M is also an additional evaporating-surface, as it is also in contact with hot air. The air-heater L, or the air-heaters L L, may be placed under the drip-pan M, as shown in Fig. 2, or in any other suitable position. The air-chamber O may be of any suitable shape to cause the air ascending from the heater L to pass through the compound slats which compose the liquid-conveyer E.

In some cases the air-heater L, Fig. 2, may be dispensed with and a fan, S, Fig. 2, may be used to cause currents of air through the apparatus, and the evaporation may be performed by air at any temperature when the nature of the liquid being evaporated will permit; but it will often be desirable to use both the heater and the fan at the same time. By the peculiar arrangement of the conveyer the air is admitted vertically across the conveyer. In this modification of my evaporator there is a very large evaporating-surface, and therefore presents a form of construction best suited for the larger operators. By admitting the fresh air in this way it gains access, while in its driest state, to the horizontal parts of the liquid-conveyer, and thus insures the very best results.

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

1. In an air-evaporator for liquids, a liquid-conveyer consisting of a vertical part for wetting the evaporating-surfaces, and a horizontal or inclined part for evaporating the liquid which adheres to the surfaces of the disks, as set forth.

2. In an air-evaporator, in combination with a liquid-conveyer consisting of a horizontal part and an inclined part, as described, a horizontal or inclined drip-pan to receive the liquid dropping from the liquid-conveyer and to return it to the basin, as set forth.

3. In a compound slat, a single central axis, as set forth.

4. In a compound slat, single disks or plates, with a central or nearly central perforation fitting the central axis, and soldered or otherwise rigidly attached to the central axis, as set forth.

5. In a compound slat, a collar or thimble fitting upon the axis, and preferably flanged for keeping the single plates or disks in proper position, as set forth.

6. In an air-evaporator, the combination of a liquid-conveyer consisting of a vertical part and a horizontal part, and angle wheels or rollers, and a drip-pan and a basin containing the liquid to be evaporated, and an air-chamber and an air-heater and a fan, as set forth.

7. In an air-evaporator, the combination of a liquid-conveyer consisting of a vertical part and a horizontal part, and angle-wheels, and a drip-pan and a basin containing the liquid, and an air-chamber and a fan, as set forth.

8. In an evaporating apparatus, as described, in combination with the liquid-conveyer, consisting of a vertical and horizontal part, as described, a fan whereby air is admitted vertically through the horizontal part of the conveyer, substantially as described.

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

ALBERT A. DENTON.

Witnesses:
ORLO HUBBARD,
C. A. HUBBARD.