

(No Model.)

N. B. RICE.  
EVAPORATOR.

No. 385,202.

Fig. 1. Patented June 26, 1888.

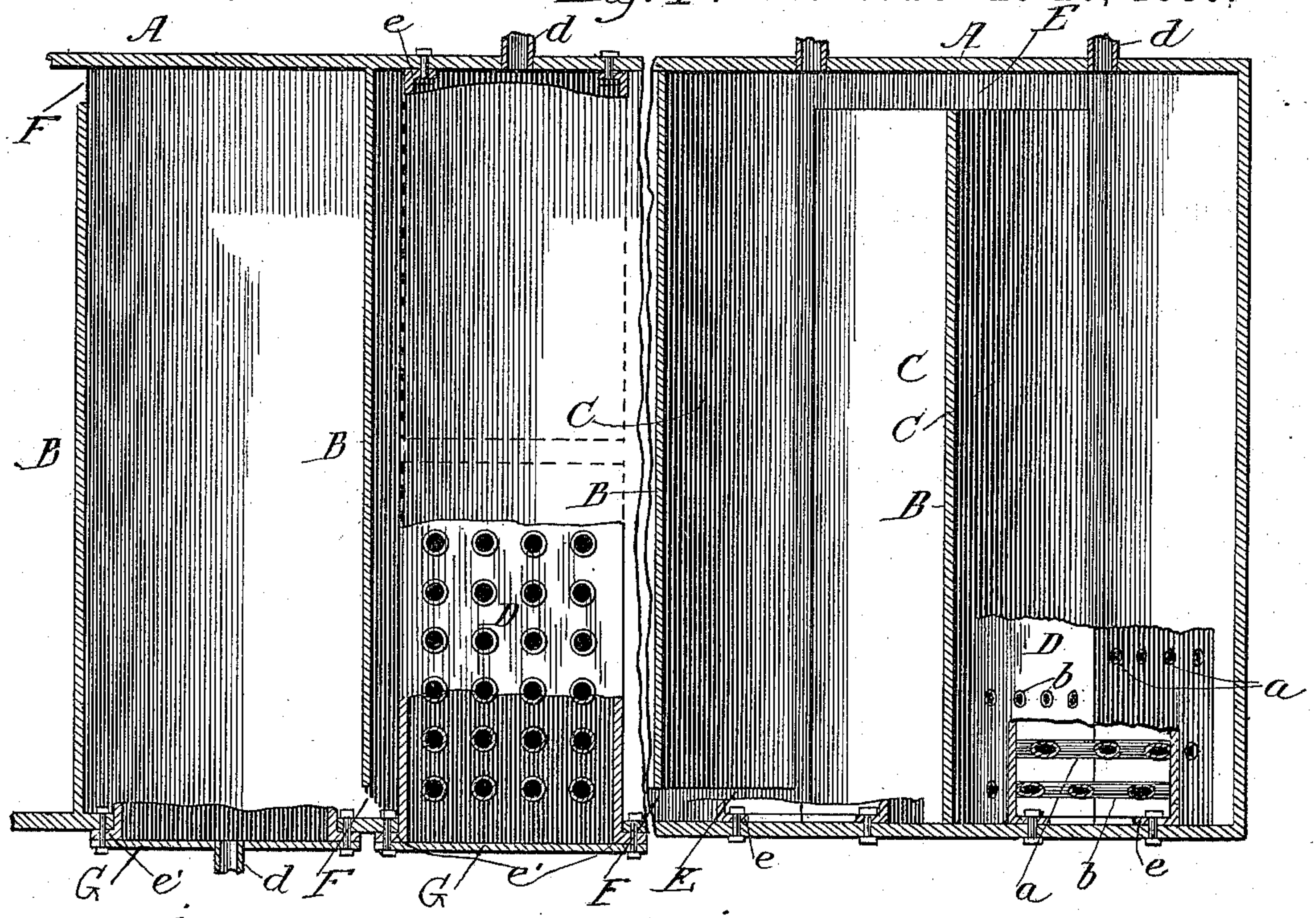


Fig. 3.

Fig. 4.

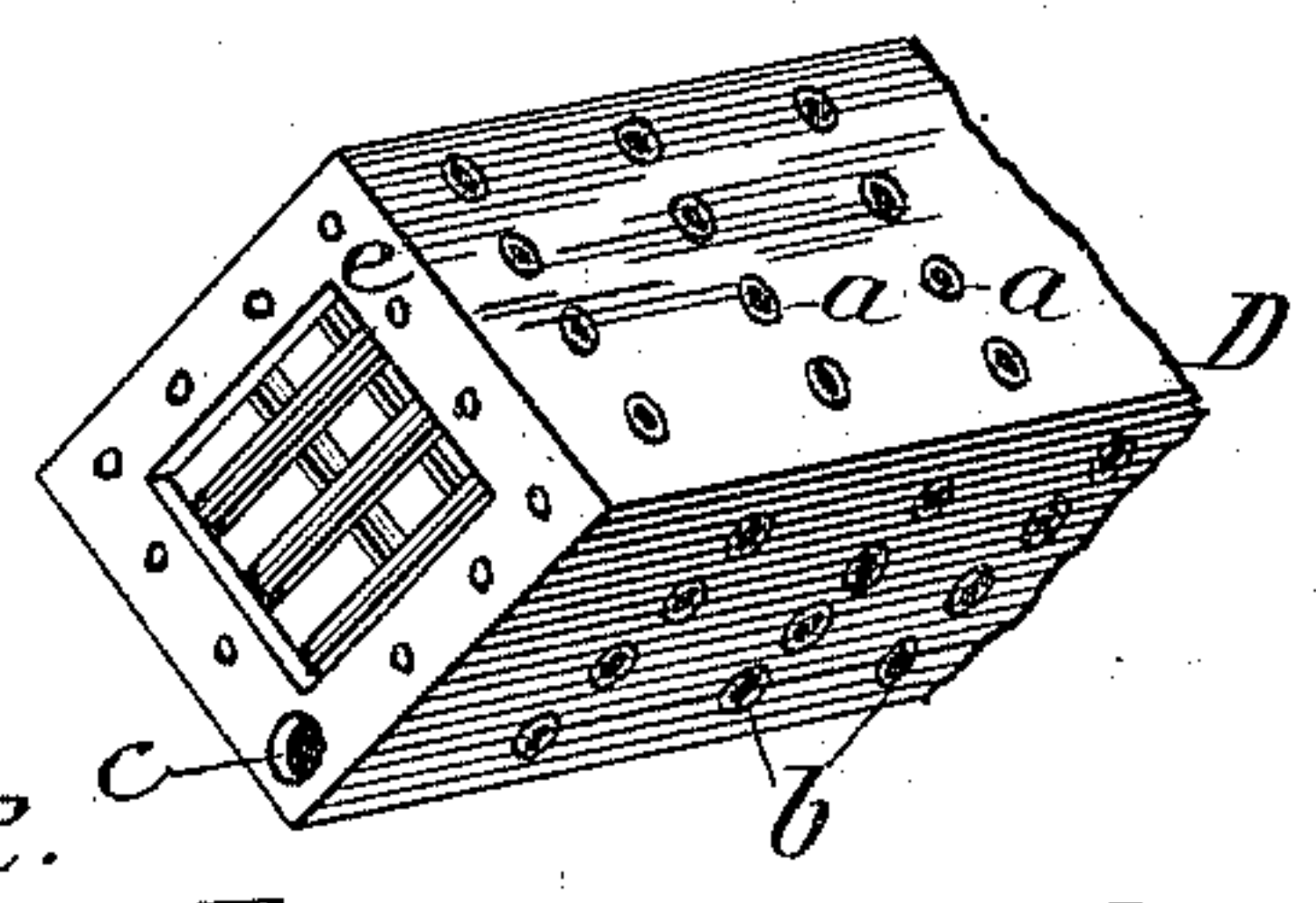
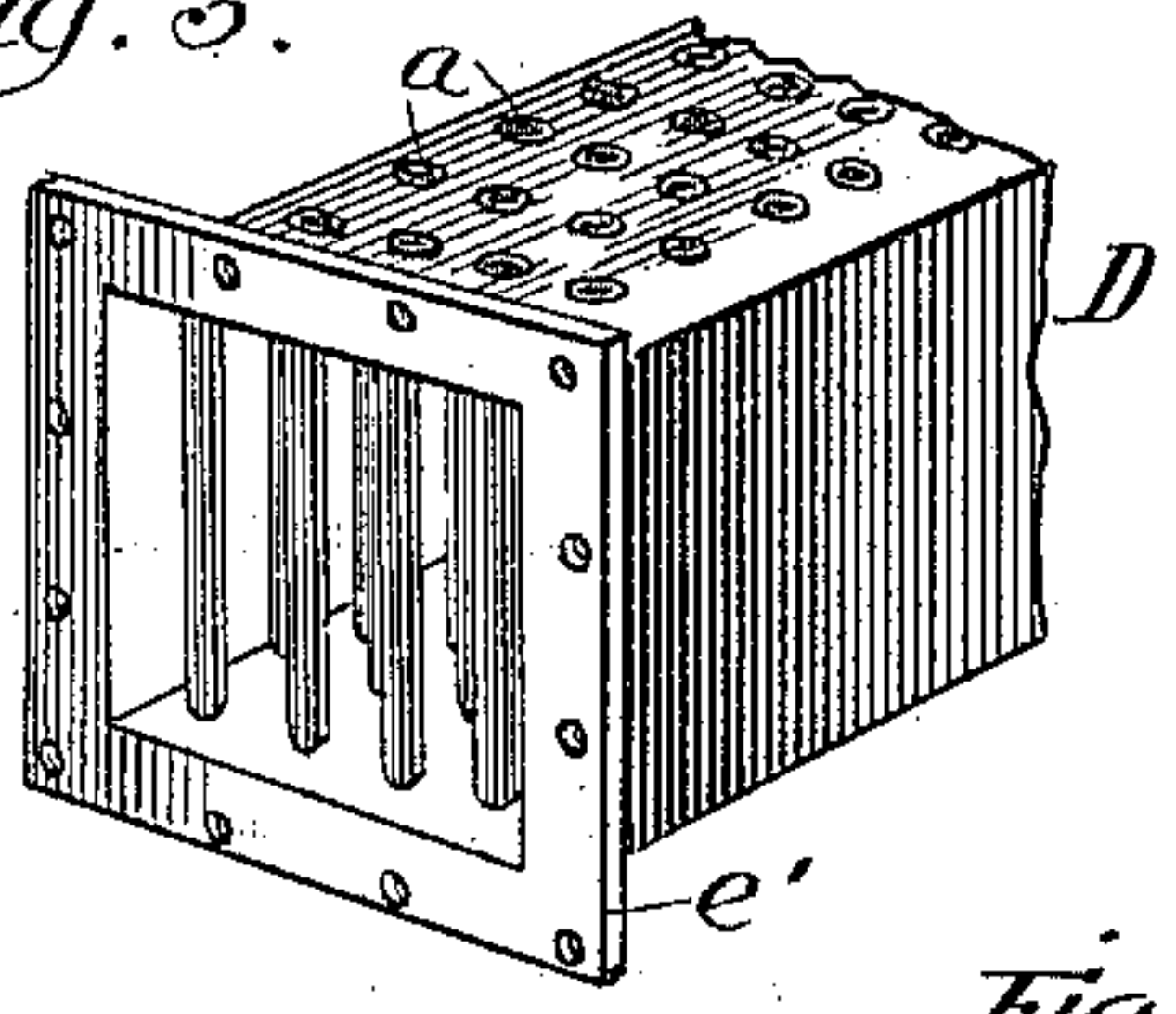
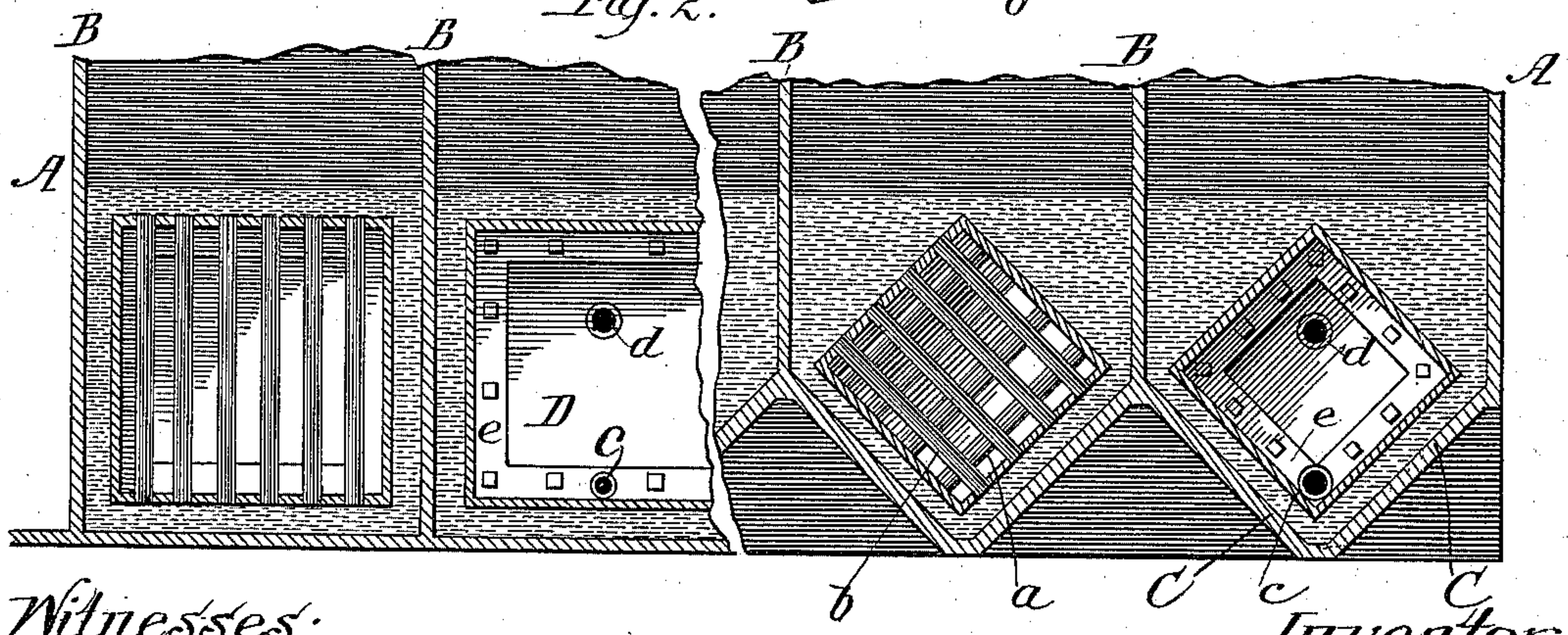


Fig. 2.



Witnesses:  
Albert H. Adams.  
Harry T. Jones.

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# UNITED STATES PATENT OFFICE.

NATHANIEL B. RICE, OF CHICAGO, ILLINOIS.

## EVAPORATOR.

SPECIFICATION forming part of Letters Patent No. 385,202, dated June 26, 1888.

Application filed April 9, 1887. Serial No. 234,314. (No model.)

*To all whom it may concern:*

Be it known that I, NATHANIEL B. RICE, residing at Chicago, in the county of Cook and State of Illinois, and a citizen of the United States, have invented a new and useful Improvement in Evaporators, of which the following is a specification, reference being had to the accompanying drawings, in which—

Figure 1 is a plan view of the evaporator with the top or cover removed, parts being broken away; Fig. 2, a vertical section; Fig. 3, a perspective view of one end of a steam-tube standing with its sides vertical; Fig. 4, a similar view of a steam-tube standing with its sides at an angle.

The object of this invention is to provide a steam device for evaporating liquids more rapidly than has heretofore been accomplished, and which may be used in an open evaporator or in a closed one operating as a vacuum evaporator; and it consists in the improvements hereinafter described and claimed as new.

In the drawings, A indicates the outer case or shell; B, partition or division plates; C, inclined bottoms; D, steam-tubes; E, liquid-passages at the end of the inclined bottom; F, liquid-passage through the division-plates; *a b*, circulating and heating pipes; *d*, steam-inlet openings or pipes; *e e'*, flanges for attaching the steam-tubes to the case A; *c*, outlet for condensation.

The case A for small evaporators may be cast and large ones may be made of light boiler-iron or other suitable sheet or plate metal. The shell A is divided by the partitions B into compartments or chambers, of which there may be any desired number—from two upward—according to the desired capacity of the device and the liquid to be treated. The division-plates B extend upward far enough to give chambers of sufficient depth, and they may extend to the top when the device is not used in connection with an exhaust for operating it on the vacuum principle. When operated as a vacuum evaporator the partitions B should not extend to the top.

When the bottom of the device has inclined sides, C, a cross-channel, E, is provided, which runs through the partition, and is on a level with the lowest portion of the bottom of the chambers, so that the liquid can pass from one

to the other without any portion of it being necessarily detained. When the bottoms are horizontal, an opening, F, through the partition at the bottom will be sufficient to pass the liquid, the object being in either case to give the liquid a circulation and a continuous movement from the point of its admission to the point of its outflow, it being understood that the liquid is admitted by a suitable aperture at or near one corner of the case and discharged at or near one of the corners at the opposite end thereof.

The steam-tubes D are made from six to twelve inches or more in cross-section. I usually make them about eleven inches, as for small sizes this tube may be made of malleable cast-iron, copper, or other suitable material, and for larger sizes of the device these tubes may be made in sections, so that two or more will be placed in a single chamber, as by making them in this manner they are more easily applied in placing them in position and handling, and in inserting the cross-pipes *a b*. These tubes D are provided with flanges, which project inward or outward, according to the desired method of attaching them. When they are connected inside of the shell, the inwardly-projecting flange *e* will be used. When the shell is cut away, so that they may be inserted from the outside, then the projecting flange *e'* will be used and plate G placed over the end thereof, and in either case they are securely and tightly bolted to the shell A, as shown.

When the steam-tubes stand at an angle, they are provided with cross-pipes *a b*, as shown in Figs. 2 and 4, and when they stand with their sides vertical the pipes *a*, running in one direction only, will be sufficient, the object of the pipes being to furnish additional heating-surface and a circulation for the liquid, and for this purpose these tubes D will be placed above the bottom, as shown in Fig. 2, so as to give the liquid a free circulation around these tubes and through the pipes *a* or *a b*.

By giving the liquid a circulation in traversing the length of the device and a cross-circulation by means of the pipes *a b*, a thorough intermixture is maintained and a more rapid evaporation obtained.



The steam-tubes D will be supported out of contact with or above the bottoms of the chambers by suitable projections either from the tubes or the chambers, or suspended by their end connections with the casing, or in any other desirable manner. Steam will be admitted through the pipes or openings *d*, and will be brought from the generator by any suitable or well-known means, which it is not necessary to show or describe, as it will be carried out to suit circumstances, and the apparatus for admitting steam or exhausting the vapors, when used as a vacuum device, may be of any of the well-known appliances for these purposes.

It will be understood that the ends of the steam tubes or chambers D will be closed steam-tight when completed, and that the exhaust or escape *e* for the condensed steam will be provided with suitable pipes or outlets.

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

1. In an evaporator, the combination of the

case A, provided with partitions B, said partitions having passages therethrough, with the closed horizontal tubes D, having circulating and heating cross-pipes, said tubes being placed in the chambers formed by the partitions, leaving a space between said tubes and the bottom of the case A, whereby a continuous circulation of the liquid is obtained, substantially as described.

2. In an evaporator, the combination of the case A, provided with partitions B, passages for the liquids at the ends of the partitions, the bottom formed with the inclined sides C, and the horizontal tubes D, having circulating and heating cross-pipes, said tubes being placed within the chambers formed by the partitions, leaving a space between the tubes and the bottom of the case A, substantially as described.

NATHANIEL B. RICE.

Witnesses:

ALBERT H. ADAMS,  
HARRY T. JONES.