

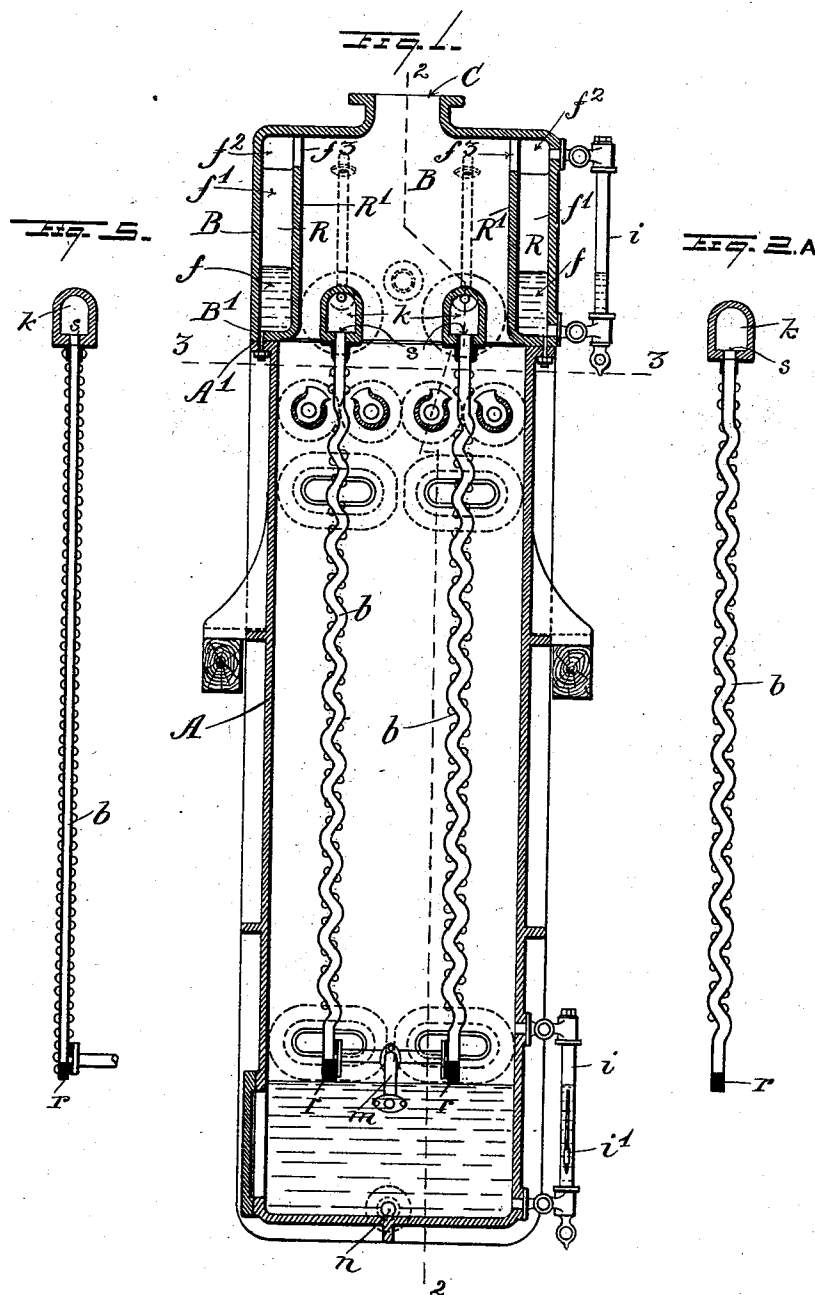
(No Model.)

5 Sheets—Sheet 1.

E. PASSBURG.
VACUUM PAN.

No. 509,045.

Patented Nov. 21, 1893.



Witnesses
A. J. Haddau
A. E. Melhuish

Inventor
Emil Passburg
by his Attorney *R. Haddau*

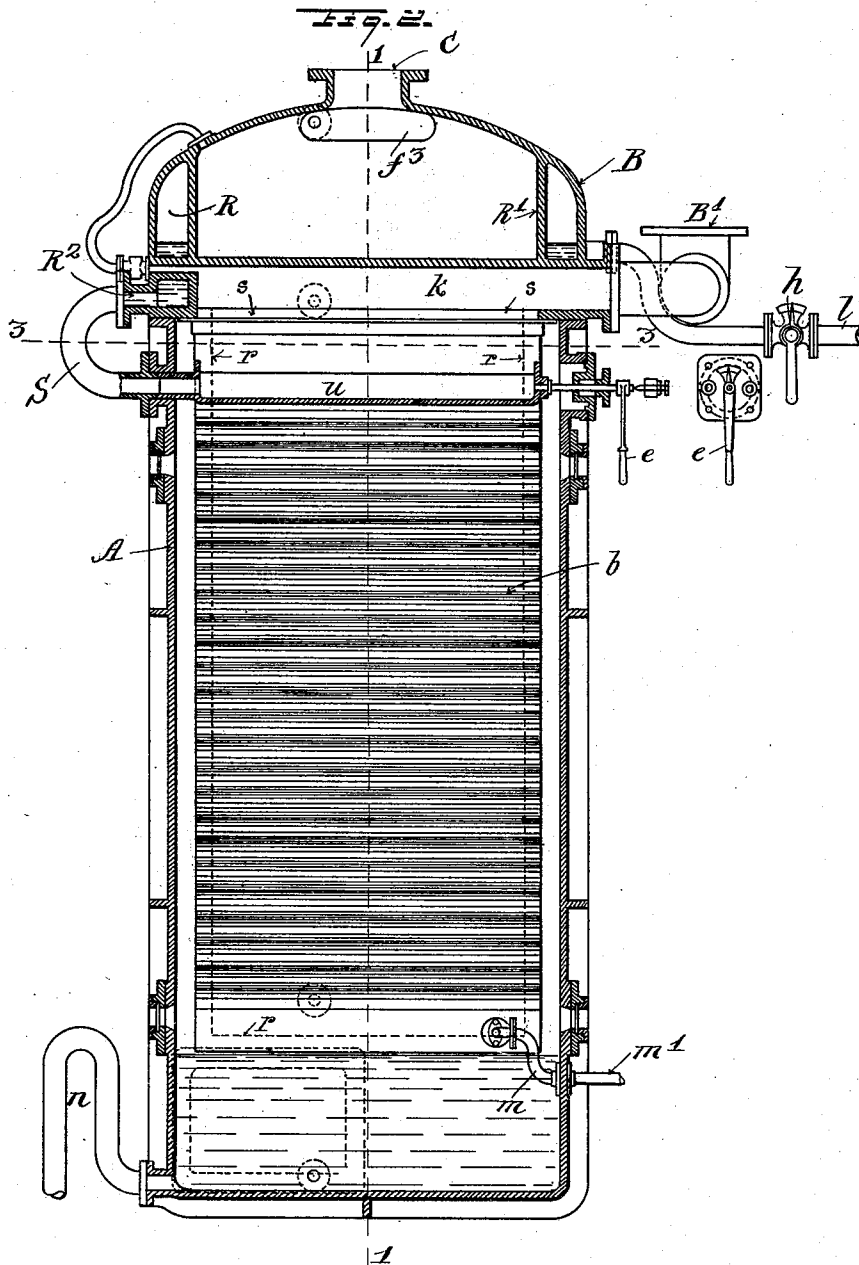
(No Model.)

5 Sheets—Sheet 2.

E. PASSBURG.
VACUUM PAN.

No. 509,045.

Patented Nov. 21, 1893.



Witnesses
A. J. Hadden
A. E. Melhuish

Inventor
Emil Passburg
by his Attorney *A. J. Hadden*

(No Model.)

E. PASSBURG.
VACUUM PAN.

5 Sheets—Sheet 3.

No. 509,045.

Patented Nov. 21, 1893.

Fig. 6.

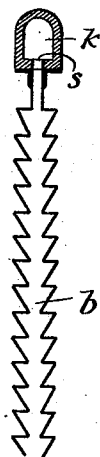


Fig. 7.



Fig. 8.

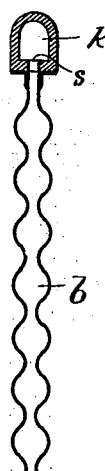
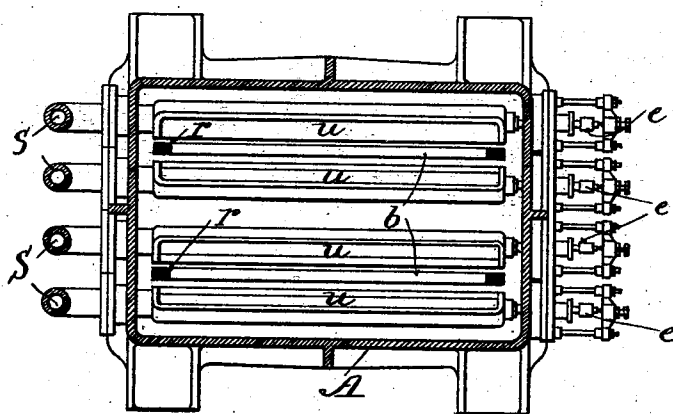


Fig. 9.



Witnesses
A. J. Haddan
A. E. Melhuish

Inventor
Emil Passburg
by his Attorney *A. J. Haddan*

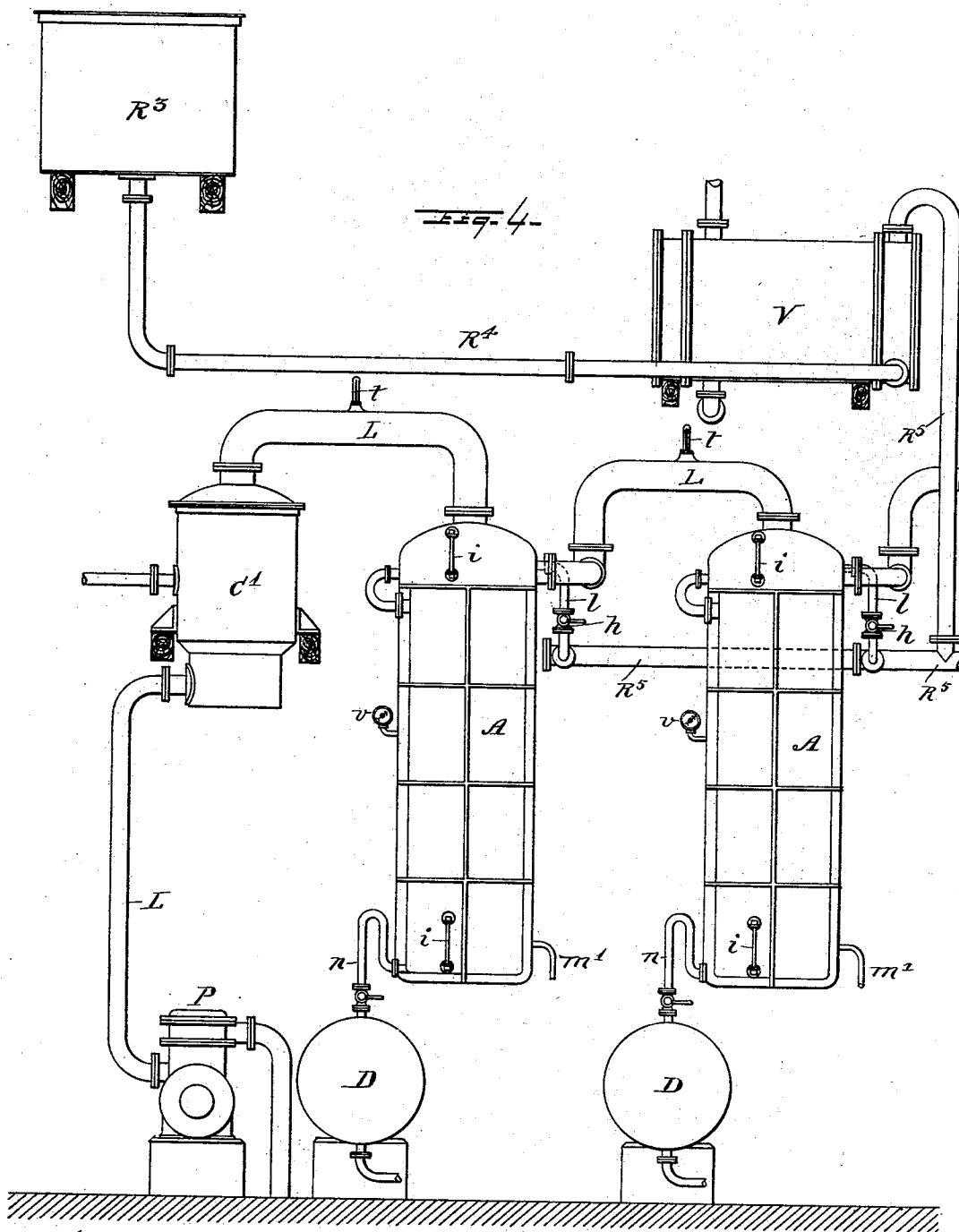
(No Model.)

E. PASSBURG.
VACUUM PAN.

5 Sheets—Sheet 4.

No. 509,045.

Patented Nov. 21, 1893.



Witnesses

A. J. Haddad
A. J. Melhuish

Inventor

Emil Passburg
by his Attorney A. J. Haddad

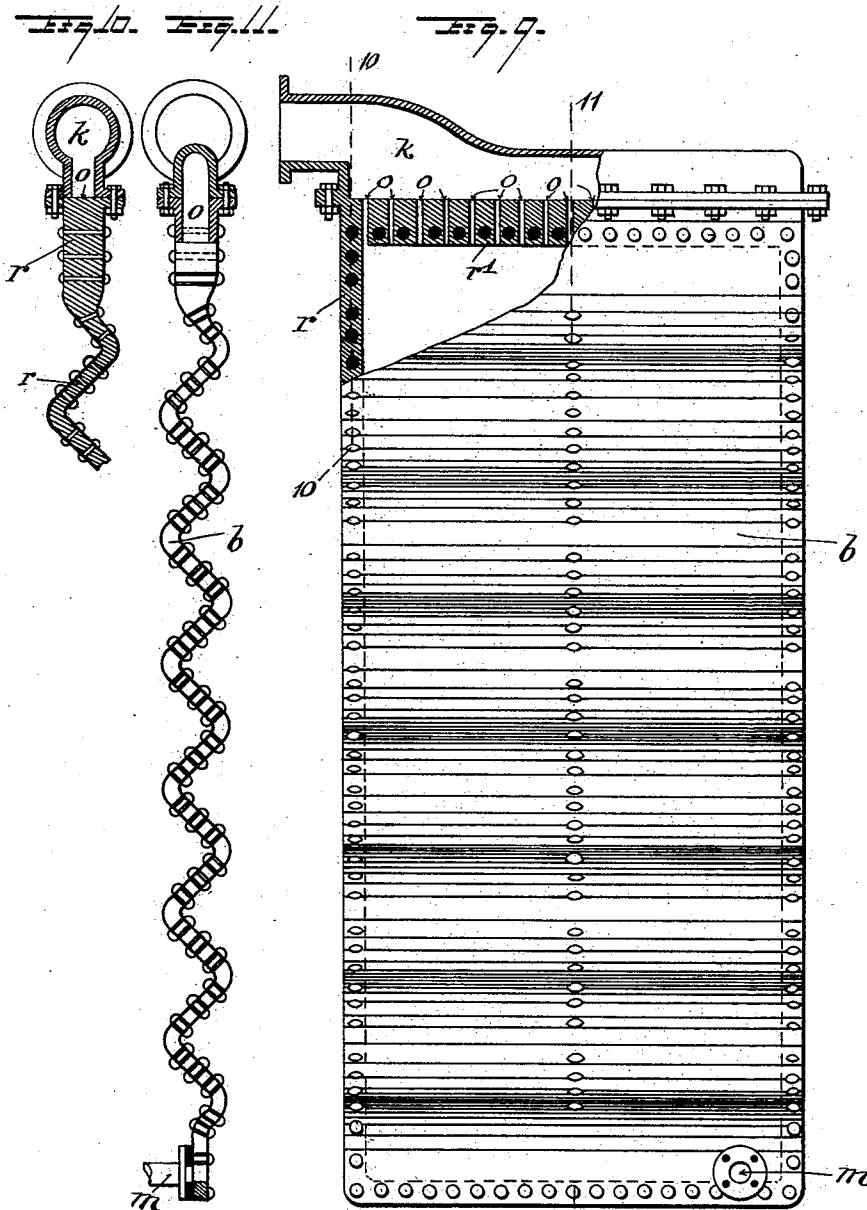
(No Model.)

5 Sheets—Sheet 5.

E. PASSBURG.
VACUUM PAN.

No. 509,045.

Patented Nov. 21, 1893.



Witnesses

A. J. Haddau

A. E. Melchior

11

Inventor

Emil Passburg

by his Attorney *A. J. Haddau*

UNITED STATES PATENT OFFICE.

EMIL PASSBURG, OF Breslau, GERMANY.

VACUUM-PAN.

SPECIFICATION forming part of Letters Patent No. 509,045, dated November 21, 1893.

Application filed March 28, 1893. Serial No. 468,027. (No model.)

To all whom it may concern:

Be it known that I, EMIL PASSBURG, a subject of the Emperor of Germany, and a resident of Breslau, Germany, have invented certain new and useful Improvements in Evaporating Apparatus, of which the following is a specification.

This invention relates to apparatus for evaporating the lighter or more volatile constituents from a liquid of any kind by employment of corrugated or other heaters within a closed chamber more or less exhausted of air and maintained under reduced atmospheric pressure, the liquid to be evaporated and reduced to a greater density being caused to flow in a film down the surfaces of the said heaters.

The purpose of the present invention is to improve this kind of evaporator in certain modifications and additional features of its construction so that its utility in evaporating power may be increased, and consequently the cost of an evaporating plant for a desired output correspondingly diminished. These improvements will be hereinafter described and pointed out in the claims.

Reference being made to the annexed drawings, Figure 1 is a cross section on line 1. 1. of Fig. 2 and Fig. 2 is a similar section on line 2. 2. of Fig. 1 showing the evaporator. Fig. 2^a is a vertical section of the heater removed. Fig. 3 is a horizontal section on line 3. 3. Figs. 1 and 2. Fig. 4 is an elevation of a complete evaporating plant. Figs. 5, 6, 7, 8 are alternative constructions of heater for use in the evaporating chamber, all shown in vertical cross section. Fig. 9 is an elevation partly in section of another modified form of heater and of the framework thereof. Figs. 10 and 11 are sections on lines 10. 10 and 11. 11. respectively in Fig. 9.

The evaporator consists of a chamber A preferably rectangular in form of considerable height and ending above in the flange A' into which the corresponding flange B' of the cover B may be bolted so as to secure an air tight joint. The cap B has an outlet C to which the exhaust pipe may be connected.

b b are the heaters vertically arranged in the chamber A for evaporation of the liquid flowing down their surfaces. These are so constructed that they are suspended only from

the cover B., and with the exception of the draining pipes at the bottom have no connection with or support from the walls of chamber A.

It has been found that if the liquid to be evaporated is subjected to a preliminary heating and while in a state of any considerable temperature is brought in contact with the surface of the heaters *b b* it splutters and will not flow evenly down the surface of the heaters, much of it being projected and falling into the base of the chamber without flowing down the heater. If on the contrary the liquid be not previously heated a considerable portion of its travel over the surface of the heater is occupied in raising the temperature of the liquid to a point at which evaporation will commence so that a proportionate superficial length of the heater is, as regards evaporation itself, not utilized. The purpose of the first improvement is to obviate all difficulties connected with an exact regulation of the temperature of the incoming liquid by affording means whereby liquid heated above the temperature required may be automatically reduced to the desired temperature, that is attemperated to the temperature prevailing in the apparatus. For this purpose the incoming liquid entering through pipe *l* and having its rate of inflow controlled by cock *h* which is connected with an indicator showing the amount of open passage way, is first caused to circulate around the side walls of the cover B within an annular space R partitioned off by a side wall R' cast with the cover and strengthened by cross partitions *f'* so made as to leave spaces *f* at the base for free passage of the liquid and at the top at *f*², the interior partition R' having also holes at the top at *f*³ so that the pressure in the evaporator may be always the same as in the chamber R. The liquid in the chamber R is regulated to the temperature prevailing in the evaporator and passes out at the several outlets R² through return bend pipes S connected at their ends respectively to the cover B and the lower chamber A into which latter chamber the pipes S lead direct into horizontal troughs *u* one into each; the said troughs being located one on each side respectively in each heater in the chamber A and revoluble on their longitudinal axes so as

to supply the liquid evenly and properly along each face of the heater. The adjustable arrangement of these troughs enables any of them to be more sharply tilted than the others
 5 to supply more liquid, and also, since the at-temper-
 10 to supply more liquid, and also, since the at-temper-
 15 to supply more liquid, and also, since the at-temper-
 20 to supply more liquid, and also, since the at-temper-
 25 to supply more liquid, and also, since the at-temper-
 30 to supply more liquid, and also, since the at-temper-
 35 to supply more liquid, and also, since the at-temper-
 40 to supply more liquid, and also, since the at-temper-
 45 to supply more liquid, and also, since the at-temper-
 50 to supply more liquid, and also, since the at-temper-
 55 to supply more liquid, and also, since the at-temper-
 60 to supply more liquid, and also, since the at-temper-
 65 to supply more liquid, and also, since the at-temper-
 70 to supply more liquid, and also, since the at-temper-
 75 to supply more liquid, and also, since the at-temper-
 80 to supply more liquid, and also, since the at-temper-
 85 to supply more liquid, and also, since the at-temper-
 90 to supply more liquid, and also, since the at-temper-
 95 to supply more liquid, and also, since the at-temper-
 100 to supply more liquid, and also, since the at-temper-

Further improvement relates to the construction of the heaters *b* and of the supply conduits thereto. In the base of the cover *B* and extending across the same is a series of closed chambers or pipes *k* continued at one end outside the cover and terminating in short lengths of pipe with flanges for the connection of the supply pipes from the main *B'* through which the heating fluid arrives. Along the lower walls of these pipe-like chambers *k* are slits *s* and the outer under face of the walls of the chambers *k* is made for attachment to the heater proper which is made by riveting two corrugated or other sheets of metal upon a frame *r*. This frame *r* consists of a flattened bar the thickness of which is equivalent to the distance to be had between the corrugated plates or sheets of metal and the breadth of which is sufficient for the holes to be punched through it for riveting the said sheets to it. This bar is bent twice rectangularly in the same plane and thus constitutes a lower member and two side members perpendicular to the ends of the lower member on the same side of the latter and parallel to and equal in length to each other. The frame *r* is now corrugated, if corrugated side plates are employed in place of flat plates and these corrugations will be according to the shape of corrugations of the side plates chosen, and will run transversely on the side members of the frame *r* and parallel to the length of the lower member thereof. The form of the frame *r* is shown by the dotted lines in Fig. 2 indicating its inner edge, the outer edge being flush with the edges of the side plates riveted on it. The heater, when the sides are riveted on the frame *r* will thus possess but one opening or entrance and this opening which corresponds to the distance between the upper ends of the side members of the frame *r* in the one direction and between the edges of the side plates of the heater in the other direction corresponds in breadth and extent to the slit *s* so that when each

heater is soldered or otherwise forced on the under face of the respective chamber *k* the slit *s* affords an unrestricted access to the interior of the heater for the steam or equivalent heating vapor and the heater is suspended from the cover *B* within the chamber *A* out of contact with the walls or floor of the latter. The pipe *m* leading to the wall of the chamber *A* and communicating with the exterior pipe *m'* affords outlet for condensed water from the bottom of the interior of each heater.

n is a siphon outlet pipe for the denser liquid which flows off the heater and collects in the bottom of the chamber *A*.

In the modification shown in Figs. 9 10 and 11 the heater *b* is constructed upon a four sided rectangular frame, instead of upon the frame before mentioned having a lower member and two side members only, but the fourth side *r'* of this frame corresponding to the open side of the three membered frame is provided with a number of passage ways *o o* of collectively as great a cross sectional area as the aforesaid slit *s*. To enable this area to be attained this side of the frame must be made thicker and the cross area of the heater gradually reduced from the extra breadth needed to the ordinary breadth between the plates within a short distance below the upper end of the heater.

The complete plant for evaporating is shown in Fig. 4, there being any desired number of evaporators *A* connected in the same manner as the two shown. *R*³ is the tank containing liquid to be subjected to evaporation. Pipe *R*⁴ carries this liquid to boiler *V* or heater of any convenient kind and pipe *R*⁵ carries the heated liquid to the several evaporators. The air pump *P* draws off the vapors through pipes *L* and causes them to be condensed in any convenient condenser *C'*. In the arrangement shown the vapors from each evaporator are employed as the evaporating agent in the heaters of the next evaporator in series and their condensed liquid consequently runs out at the pipes *m'* to any convenient receiver. The denser liquors from the pipes *n* are received in vessels *D D*.

For control of the process thermometers *t* are placed in the pipes *L*, gage level glasses in connection with the chambers *R* and *A* as shown at *i i* and pressure gages at *v v*. The level gages *i* may contain hydrometers as at *i'* Fig. 1 for indication of the density of the resultant liquid.

Having now described my invention, I claim and desire to secure by Letters Patent—

1. In an evaporator, the combination of a chamber *A*, a cover *B* thereto, cross pipes *k* in the base of said cover, hollow heaters *b* depending severally from said cross pipes and communicating therewith, troughs for supplying the liquid to be evaporated to the surface of said heaters, an annular compartment *R* in said cover, an inlet for liquid thereto

and outlets for same therefrom, and pipes S severally connecting said outlets and troughs, for the purpose set forth.

2. In an evaporator, the combination of a chamber A, a cover B thereto, cross pipes k in the base of said cover, hollow heaters b depending severally from the said cross pipes and communicating therewith, troughs for supplying the liquid to be evaporated onto the surface of said heaters, said troughs being journaled to revolve on their longitudinal horizontal axes, an annular compartment R in said cover, an inlet for liquid thereto and outlets for same therefrom, and pipes S severally connecting said outlets and troughs for the purpose set forth.

3. In an evaporator the combination with a heater b adapted to receive liquid flowing down the surface thereof in a film, of a trough arranged horizontal and parallel to the surface of the heater and revoluble about its longitudinal axis for the supply of liquid to said surface.

4. In an evaporator the combination of a casing, a heater b suspended therein adapted to receive liquid flowing down the surface thereof in a film, and a trough horizontal and parallel to the surface of the heater, a hollow trunnion through which liquid is supplied to said trough at one end and a projecting trunnion for revolving the trough at the other end.

5. In an evaporator the combination of a chamber A, a cover B thereto, cross pipes k in said cover and heaters composed each of a rectangular frame and two surface plates attached along the lower faces respectively

of the pipes k and having a communication therewith equal in cross sectional area to the cross sectional area of the heater.

6. In an evaporator the combination of a chamber A, a cover B thereto, cross pipes k in said cover longitudinal slits s in said cross pipes and heaters composed each of a frame having a lower member and two side members perpendicular to the said lower member and two surface plates attached along the lower faces of said pipes k respectively and having uninterrupted communication therewith through the slits s .

7. In an evaporator, the combination of a chamber A, a cover B adapted to be fixed airtight thereon, an outlet C in said cover, an annular passage R therein, an inlet for liquid thereto, and a series of outlets from said passage, horizontal cross pipes k in said cover, heaters composed each of a rectangular frame and two facing plates connected respectively to said cross pipes and suspended thereby in the chamber A, a series of troughs u one on each side of each heater and revoluble on their longitudinal axes, hollow trunnions attached to one end of said troughs and pipes S exterior to the chamber A and cover B connecting the hollow trunnions and outlets of passage R, the whole substantially as set forth.

In witness whereof I have signed this specification in presence of two witnesses.

EMIL PASSBURG.

Witnesses:

DR. STAMMER,
ERNST STORCH.