

No. 683,281.

Patented Sept. 24, 1901.

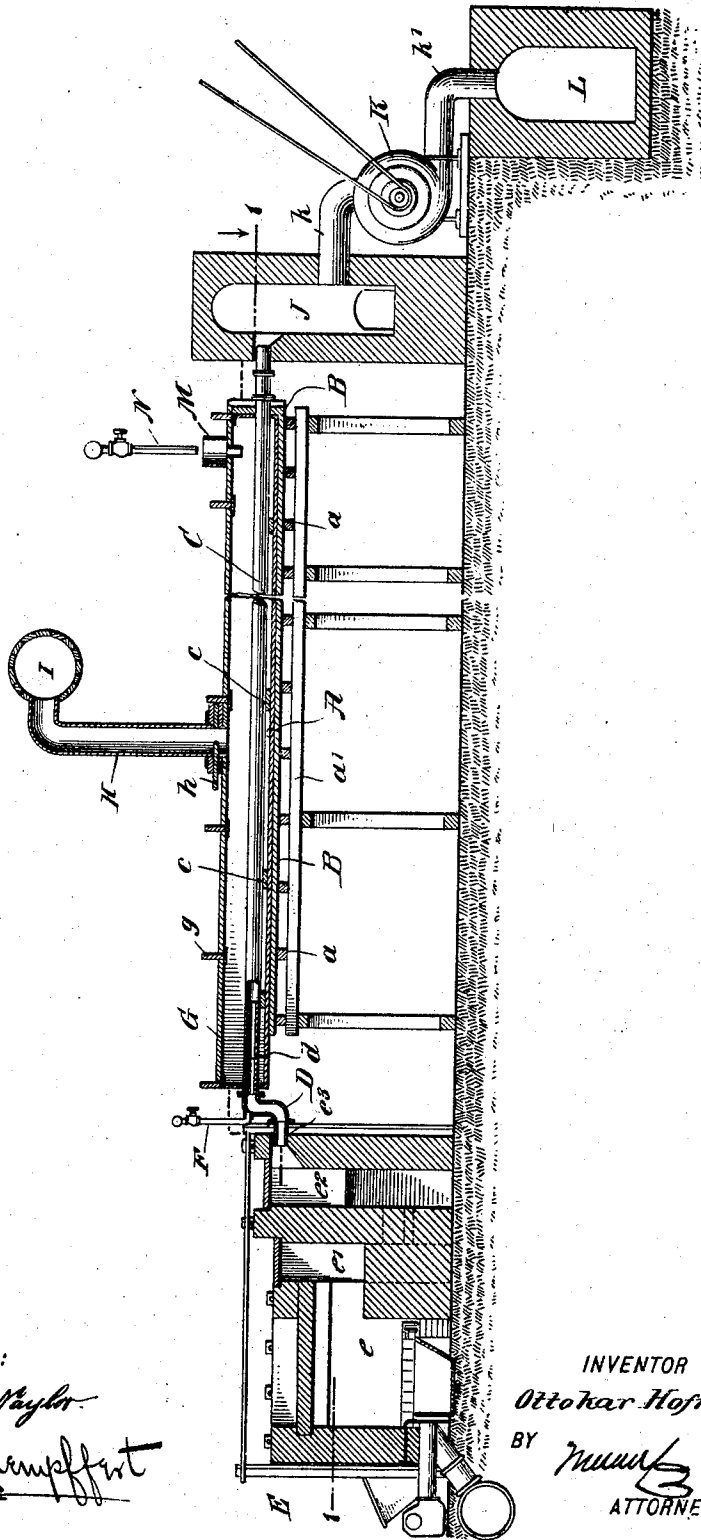
O. HOFMANN.  
EVAPORATING APPARATUS.

(Application filed May 1, 1901.)

(No Model.)

2 Sheets—Sheet 1.

Fig. 1—



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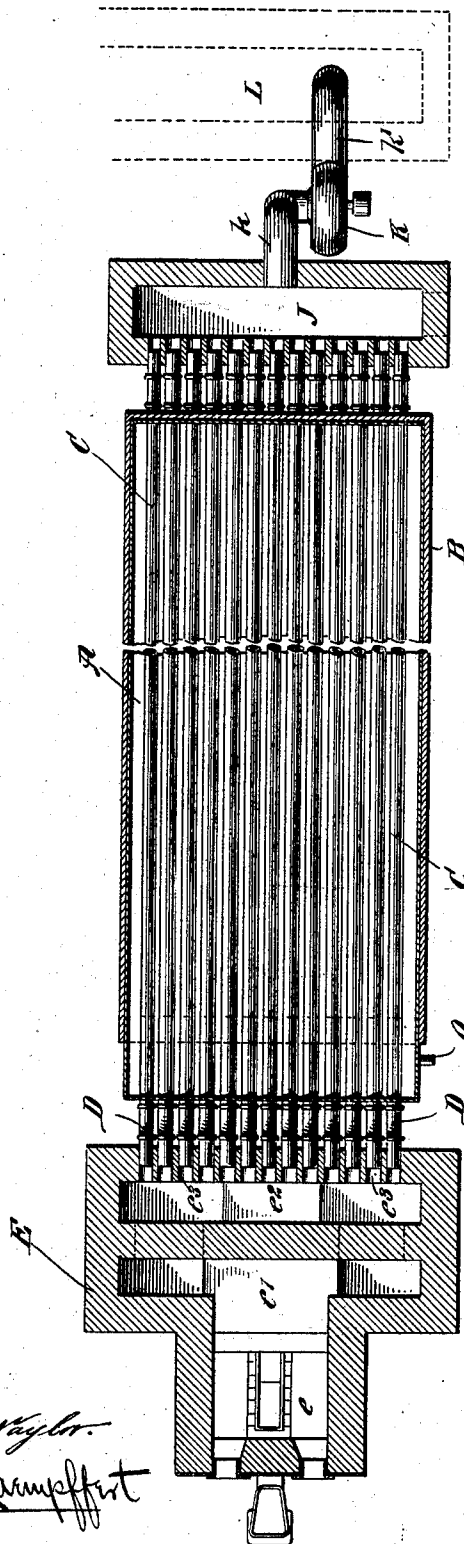
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# UNITED STATES PATENT OFFICE.

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## EVAPORATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 683,281, dated September 24, 1901.

Application filed May 1, 1901. Serial No. 58,342. (No model.)

*To all whom it may concern:*

Be it known that I, OTTOKAR HOFMANN, a citizen of the United States, and a resident of Argentine, in the county of Wyandotte and State of Kansas, have invented a certain new and useful Evaporating Apparatus, of which the following is a full, clear, and exact description.

My invention seeks to provide an efficient apparatus for concentrating by evaporation solutions of metallic and alkali salts for the purpose of crystallizing such salts from the solutions in which they are held and of concentrating liquids which are commonly used in the chemical arts. To this end I have devised a novel evaporating apparatus which comprises a pan traversed by hot-air tubes, serving the purpose of highly heating the solution poured into the pan. The solution is so fed into the pan that it is gradually, though quickly, heated to the temperature of vaporization and that it emerges from the pan highly concentrated.

The particular arrangement of the supply and discharge pipes whereby a continuous operation of my apparatus is secured constitutes one of the novel features of my invention.

The invention consists, further, in the novel construction and combination of parts hereinafter described and claimed.

Reference is to be had to the accompanying drawings, forming part of this specification, similar characters of reference indicating like parts in both the figures.

In the drawings, Figure 1 is a partial longitudinal vertical section of my improved apparatus, and Fig. 2 is a partial horizontal section on the line 1 1 of Fig. 1.

My evaporating apparatus consists of an evaporating-pan A of suitable dimensions, but preferably long and shallow, supported on beams *a*, resting on timbers. The pan A is made of lead, iron, or other material, depending upon the nature of the solution to be concentrated, and is snugly contained in a wooden tank B, so that the radiation of the heat may be reduced to a minimum. Extending longitudinally through the pan A are hot-air tubes C, supported above the bottom of the pan by transverse strips *c*. These tubes C are made of metal which will not be

corroded by the solution to be evaporated. The tubes C are united at one end by S-shaped connections D with a furnace E. If the evaporating-tubes be made of lead, short iron tubes *d* are inserted therein, to which iron tubes the S-shaped connections D are fastened, as clearly indicated in Fig. 1.

The furnace E has a combustion-chamber *e*, to which fuel is supplied, preferably, by underfed mechanical stokers, for the reason that the combustion of the fuel should be as perfect as possible. In the rear of the furnace and in communication with the combustion-chamber are two narrow chambers *e' e''*, placed one behind the other and connected by passages, as indicated by dotted lines, in the partition-walls. The chambers *e' e''* serve the purpose of precipitating and retaining ashes and cinders and of distributing heat uniformly. The rear chamber *e''* is provided with cast-iron tubes *e'''*, corresponding in number with the S-shaped connections D and receiving the lower ends of the said S-shaped connections, so that the evaporating-tubes C communicate with the furnace E.

As shown in Fig. 1, each S-shaped connection D receives a small valved pipe F, through which air is blown into the corresponding evaporating-tube whenever it may be necessary to drive out the fine ashes or cinders which may have passed the chambers *e' e''* of the furnace.

The evaporating-pan A is entirely covered by a wooden cover G, consisting of joists *g* and planks securely fastened together. The cover G is formed with an opening which receives a suction-pipe H, of suitable metal. If there be a number of evaporators in use, the pipe H of each will be connected with a common suction-pipe I, made of wooden staves. If but one evaporator be used, the pipe H is directly connected with a suction-fan. To regulate the suction, a slide *h* may be arranged in the pipe H.

The ends of the evaporating-tubes C opposite the furnace are connected with a draft-chamber J, of masonry. A strong draft is produced in the chamber by a fan K, connected with a pipe *k*, leading to the said chamber J, whereby the furnace-gases are drawn through the evaporating-tubes. If there be a number of evaporators, each will be pro-

vided with a draft-chamber J and a fan K. The cooled gases drawn from the chambers J by the fans K will be conducted by pipes *k'* to a common underground flue L and thence to a chimney. The draft through the evaporating-tubes could obviously be produced by direct connection with a chimney; but I have found in actual practice that the draft arrangement described is more efficient.

16 The dilute solution to be concentrated is supplied to the tray A by means of a funnel or bowl M, inserted in the cover G at the end farthest from the furnace. By means of a valved pipe N the bowl is supplied with solution. The bowl and pipe are separated, as shown in Fig. 1, to facilitate the regulation of the stream of solution. Near its furnace end the pan A is provided with an overflow-tube O, as shown in Fig. 2.

20 In operation the pan A is filled with dilute solution to the level of the overflow-pipe O, whereupon the furnace is fired and the suction-fan K set in motion. When the solution in the pan has been sufficiently heated, the suction-fan connected with the pipe H or I is started to draw off the vapors. The solution in the pan is kept at the same level by opening the valve of the supply-pipe N from time to time until by a test of the liquor near the overflow O it is found that the desired degree of concentration has been attained. Then a continuous stream of solution is allowed to enter the pan, thereby causing a constant overflow through the pipe O. If the influx be properly regulated and the furnace well served, the outflowing solution can be constantly kept at the desired point of concentration without difficulty. Thus a continuous dilute stream enters the apparatus and a continuous concentrated stream flows from the pipe O. The hot furnace-gases enter the tubes at one end, give off their heat to the solution, and emerge from the tubes at a temperature of about 50° centigrade. It is evident that as the hot furnace-gases in their progress through the tubes gradually come in contact with colder portions of the solution they must yield their heat, and that therefore the utilization of the heating power of

the fuel is most efficient. Since the evaporating-pan is covered the suction-fan not only removes all the steam through the pipe H and keeps the working room entirely free from vapor, but creates a partial vacuum, which facilitates evaporation.

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

1. An evaporating apparatus comprising a furnace; a precipitating-chamber for ashes and cinders behind the combustion-chamber of the furnace; an evaporating-pan; tubes extending through the evaporating-pan longitudinally and having connection at one end with the precipitating-chamber of the furnace; a cover for the evaporating-pan; a suction-pipe inserted in the cover to withdraw the vapors; a solution-supply at the end of the pan farthest from the furnace; and an overflow for the pan near the furnace, whereby the solution enters the pan in a continuous cold stream and leaves the pan at the overflow in a continuous concentrated hot stream.

2. An evaporating apparatus comprising a furnace; precipitating-chambers for the furnace, serving the purpose of precipitating ashes and cinders; a horizontally-mounted shallow evaporating-pan; tubes extending longitudinally through the pan and having connection with the rear precipitating-chamber of the furnace and with a fluid-pipe at one end; and with a draft-chamber at the other end; a controlled solution-supply remote from the furnace; and an overflow for the pan near the furnace, whereby the solution enters the pan in a continuous stream at common temperature and leaves the pan at the overflow in a hot concentrated condition.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

OTTOKAR HOFMANN.

Witnesses:

WARREN B. LIPPINCOTT,  
R. H. HATCHETT.