H. C. BOWERS.

SALT WATER EVAPORATOR

No. 188,576. Patented March 20, 1877.

Fig: 1.

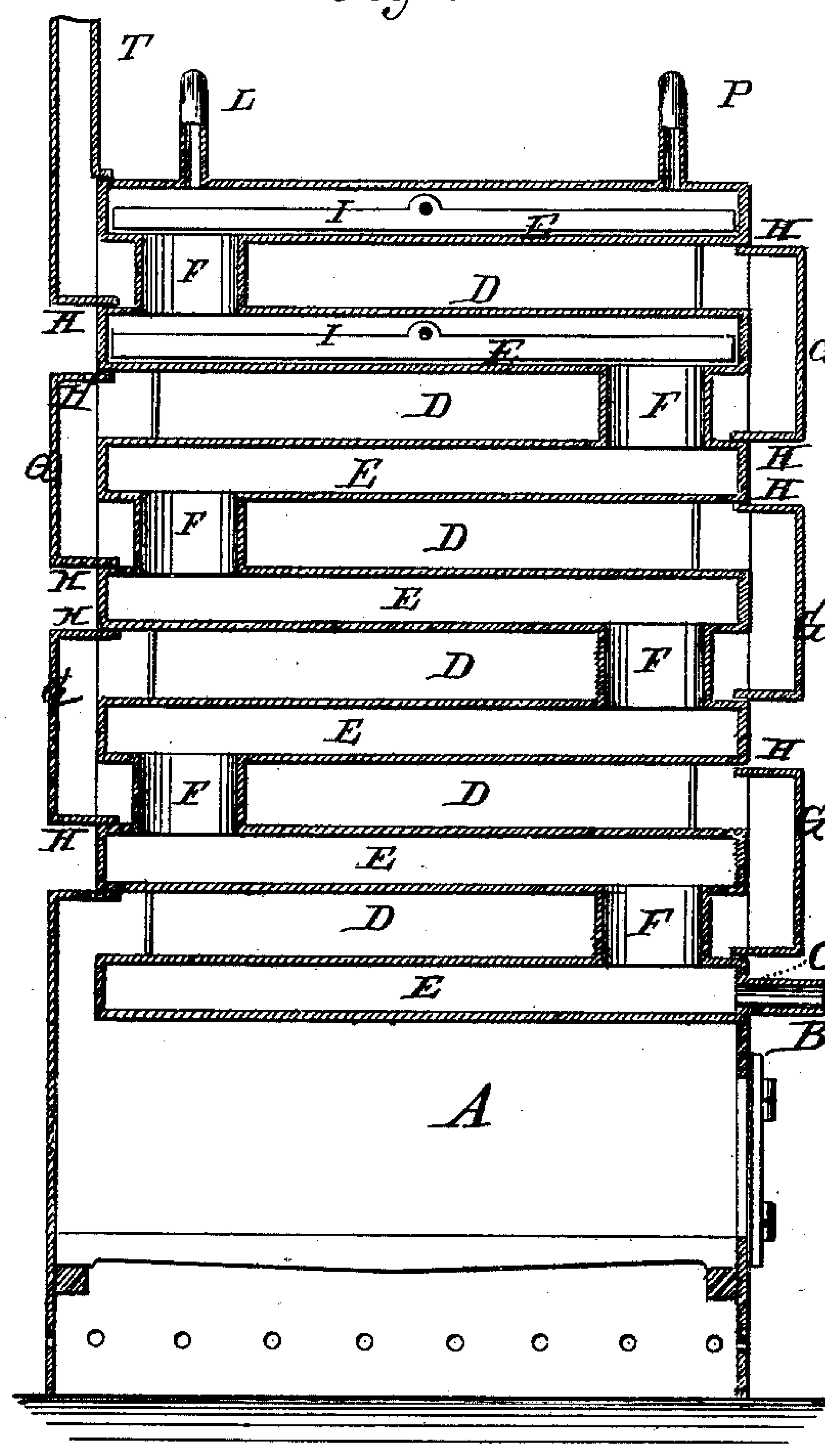


Fig: 2.

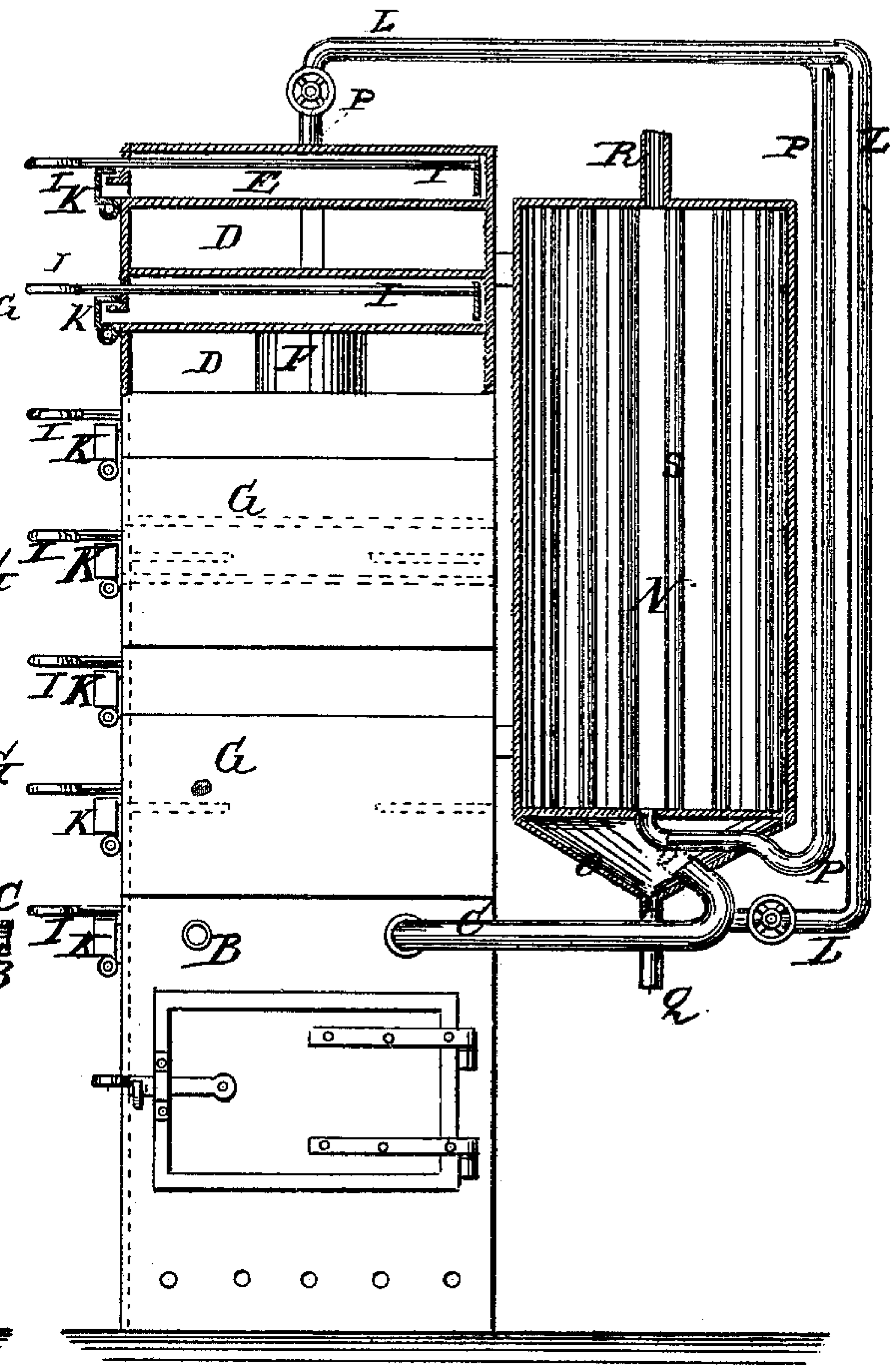
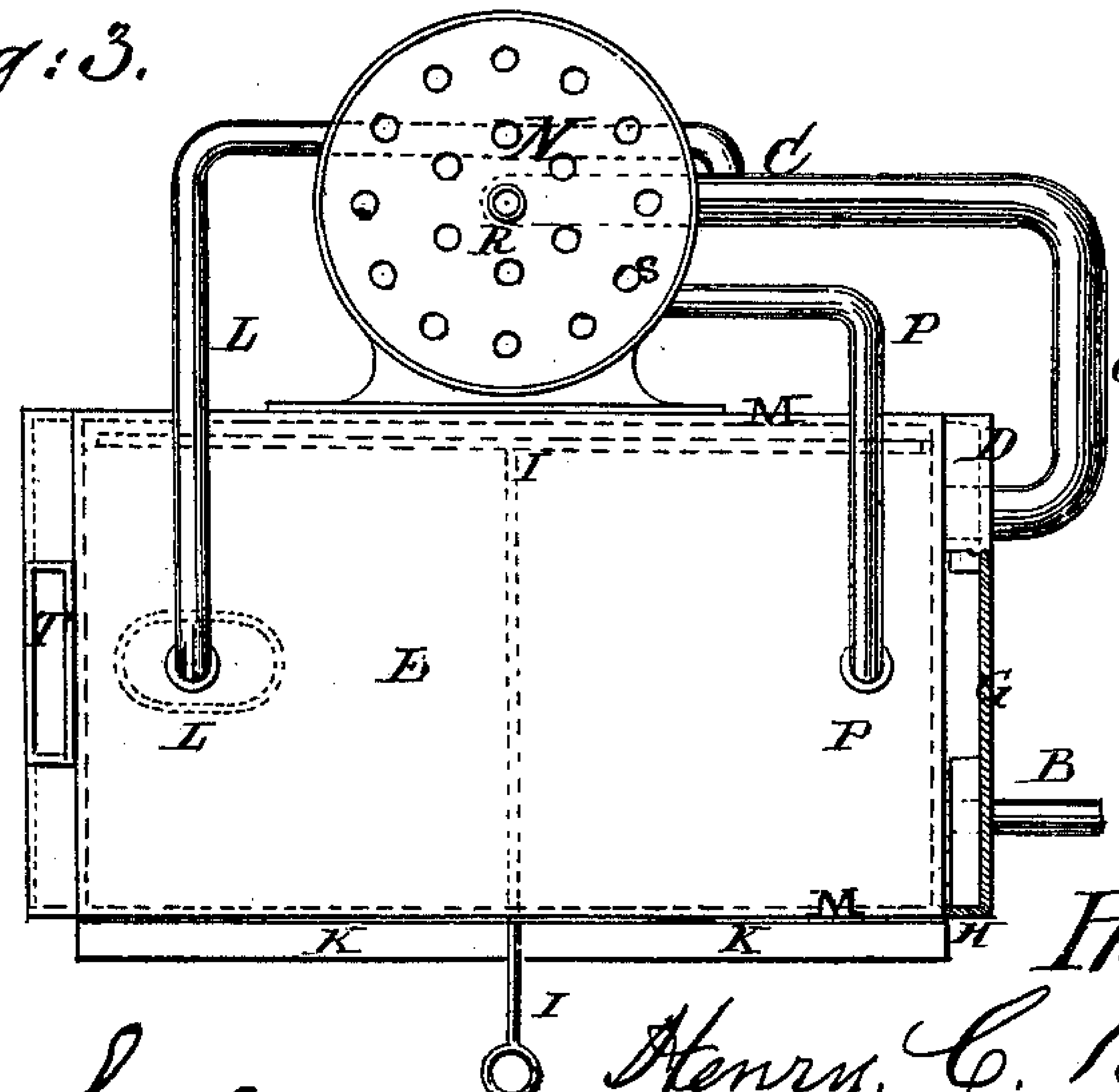


Fig: 3.



Witnesses:

Frank Fuller.

John Donohue

Inventor:

Henry C. Bowers.

# UNITED STATES PATENT OFFICE.

HENRY C. BOWERS, OF NEW YORK, N. Y.

## IMPROVEMENT IN SALT-WATER EVAPORATORS.

Specification forming part of Letters Patent No. **188,576**, dated March 20, 1877; application filed September 18, 1876.

*To all whom it may concern:*

Be it known that I, HENRY C. BOWERS, of the city, county, and State of New York, have invented a new and useful Improvement in Salt-Water Evaporator; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the drawing accompanying this specification, and making a part thereof.

The object of my invention is to provide a means whereby the watery particles contained in solutions of chloride of sodium or other saline substances may be evaporated by artificial heat with greater economy of fuel than can be done by the use of any other device known to me.

Figure 1 is a transverse vertical section of my evaporator. Fig. 2 is an end view of the same, showing also the heater and its connections. Fig. 3 is a top view of the evaporator and heater.

A is the fire-box, grate, and ash-pit. B is the water or overflow pipe. C is the lower vapor-pipe. D D are the heat-flues between the water-shelves. E E are the inclosed water-shelves. F F are the oblong pipes connecting the water-shelves, and forming with them the water-way. G G are the flue ends. H H are the heads of the flue ends. I I are the hoes or rakes with the projecting handles, with which each shelf is supplied. M M are the front and rear walls extending from shelf to shelf, and forming the flue. K K are the doors opening into the shelves. P is the hot-salt-water-supply pipe. L is the upper vapor-pipe. N is the cylindrical heater, supplied with interior vapor-pipes *s*. O is the conical lower head of said heater, covering the lower end of said vapor-pipes. Q is the fresh-water-waste pipes. R is the cold-salt-water-ingress pipe. S is a vapor-pipe, a large number of which pass from head to head of the heater. T is the termination of the flue or chimney.

The operation of my evaporator is as follows:

A suitable connection by pipe or hose having been effected between the cold-salt-water-ingress pipe R and the elevated tank or other source of supply, the fire is kindled at A, and a small amount of water is allowed to flow through pipe R around the vapor-pipes S in heater N. This water finds its way to and through pipe P to the top of the evaporator, where it is received upon the upper inclosed shelf, and trickles down through the oblong pipe F, connecting this shelf with the next shelf below, and so on until the lowest shelf is reached. The exit of water at the overflow-pipe B, which should be provided with a cock, indicates that the entire interior is supplied with water, and thereafter its ingress is to be regulated by the amount of heat applied. In a short time after the combustion of fuel begins, the water within the lower shelf is vaporized, and the vapor is chiefly disharged through the lower vapor-pipe C into the conical head O of the cylindrical heater N. Such portion of the vapor as finds its exit by way of the shelves E and the connecting-pipes F, through the upper vapor-pipe L, is conducted by said upper vapor-pipe to a point of connection with the lower vapor-pipe C. This upward current of hot vapor passing over the surface of the water in the shelves E, added to the heat which rises from the fire-box through the continuous flue D, extending between the shelves E to the chimney T, heats the water contained in said shelves, and converts its watery particles into vapor with a rapidity dependent upon the amount of fuel consumed. The escaping vapor conducted through the pipes C and L passes into the cylindrical heater N, and speedily and continuously raises the temperature of the cold salt-water received through pipe R to the boiling-point, and thereafter the evaporating process is rapid and continuous. The saline substances of the water are deposited upon the various shelves E, and as fast as they accumulate they are raked through the doors K by the rakes I into any convenient receptacle.

The top view of heater N (shown in Fig. 3) exhibits the upper ends of the vapor-pipes S, along and through which the vapor discharged into the conical base of said heater through pipes C and L passes upward, meeting and heating the salt-water as it passes downward on the outside of said pipes and within the walls of the heater. As fast as condensed the water resulting from this vapor falls back into the conical head to be discharged as distilled water through the pipe Q. Both ends of the heater are alike, with the exception of that the lower end is supplied with the conical cap or head O, and the lower plate covered by said cap, through which the vapor-pipes pass, is otherwise imperforate, except at the point of admission of the pipe P, through which the supply of salt-water reaches the evaporating shelves E.

It will be seen that that my device, when in full operation, provides for a continuous discharge of hot salt-water, in a thin layer, upon an extended inclosed surface, and the descent of the unevaporated portion of said water upon other extended surfaces below, while at the same time the ascending currents of the heated products of combustion are passing upward in a winding course through the flue, and giving off their contained heat to the water within the shelves.

I deem it of great importance that the water to be evaporated should be fed in at the top, as that is the coldest part of the structure, being most remote from the fire, and because any heat not taken up here must inevitably pass up the chimney-flue and be lost. I look upon this method of supplying water at the top, either in a constant stream from a higher body, or intermittently, as from a feed-pump, and allowing it to gravitate downward, as the simplest means of securing its distribution over large surfaces and its rapid conversion into vapor. The distribution in thin volumes over large heated surfaces secures the most rapid evaporation possible, and complete control of the water-supply is always had by means of stop-cocks appropriately situated in the various feed-pipes. I find in practice that the water supplied through the pipe P is always cooler than the interior of the evaporator. The natural tendency of the heated products of combustion is to ascend, and in thus ascending they are constantly brought in contact with the cooler lower surfaces of the shelves, and accordingly surrender a portion of their heat to said shelves and the water contained therein. Thus the heat is continually passing upward from a hotter to a cooler region, and is therefore always giving off heat, while at the same time the water-supply is continually passing downward from a cooler to a hotter locality, and is accordingly taking on heat without intermission and never giving it off. I conceive that there is no practical method by which a more perfect conservation of the heat generated by the combustion of fuel for evaporating purposes can be secured than by this regulated flow of a film of water downward over extended inclosed surfaces, which are met by ascending heat-currents. The only practical addition which experience has enabled me to devise is in the utilization of the waste vapor for the purpose of heating the water before feeding it to the evaporator, as indicated by pipes C and P. This I find to be of great importance, as it prepares the saline solution for the early liberation of its aqueous particles after being passed into the evaporator. I take the vapor from the bottom of the evaporator, because it is the point nearest the fire, and therefore the point at which the water is most rapidly vaporized. Its withdrawal from this point enables it to be replaced with vapor less highly heated, and prevents the lower shelves from being melted by thus carrying off the heat.

The material from which I construct my evaporator is preferably iron, either cast or wrought, although any metal or other substance capable of resisting a high degree of heat may be employed. The dimensions of the several parts may be varied according to the amount of saline solution to be treated. I have so far made my shelves of the same size as the grate-surface, but I do not deem it necessary to confine myself to this method of construction, as each of the shelves may have a larger or smaller superficial area than the fire-box; nor do I limit the number of shelves. I do not deem it absolutely necessary that the fire should be built beneath the shelves, nor that the heat to be employed should be that of a fire placed at any position relative to the shelves, as the same result may be secured by the use of steam in the flues.

With regard to the size of the heater and its pipes, as well as to the number of said pipes, I am not aware that any specific instructions are requisite. It appears that the more numerous are the tubes to be heated by the vapor, the larger is the heating-surface, while the thinner the film of water between the tubes the more rapidly and completely is the salt-water heated for the evaporator.

It is only necessary that ample space be left between the tubes for the reception of a sufficient supply of cold salt-water.

I do not claim, broadly, the use of inclosed or covered shelves, connected by alternating tubes, as similar devices have been made the subject of my application for steam-generator, of even date herewith; but,

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

1. In a salt-water evaporator, the combination, with the covered or inclosed shelves E, having doors K, of the rakes I, for the purposes set forth.

2. The combination of the covered or inclosed shelves E with the heater N and connecting-pipes C, P, and L.

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Witnesses:

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