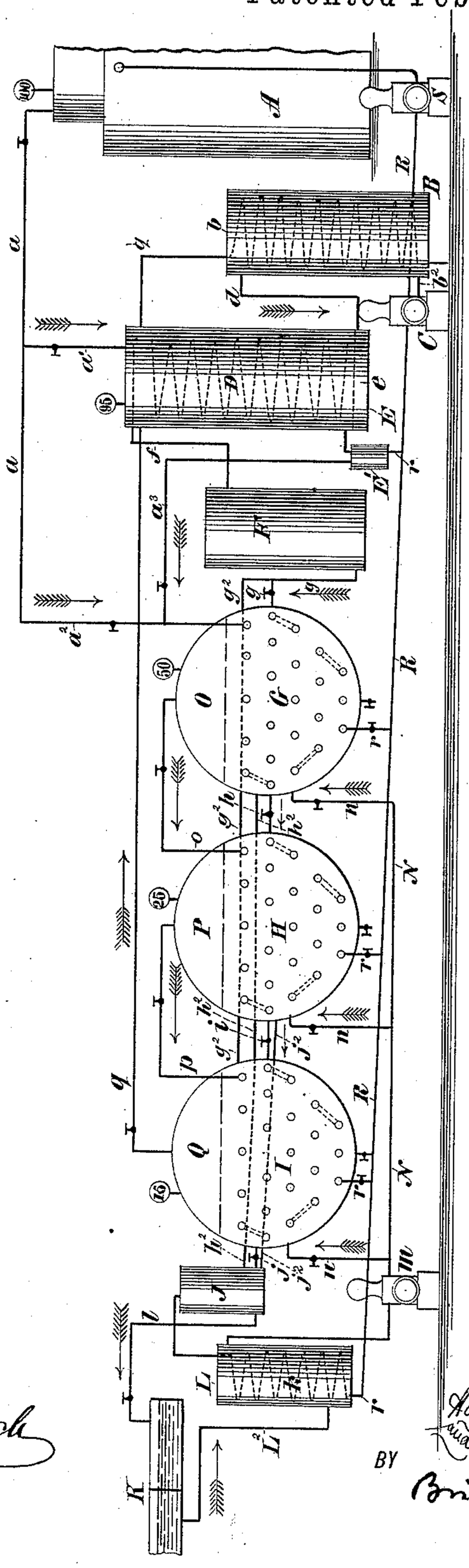
(No Model.)

H. A. HOGEL & O. L. F. BROWNE

APPARATUS FOR MANUFACTURING SALT.

No. 378,684. Patented Feb. 28, 1888.



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APPARATUS FOR MANUFACTURING SALT.

SPECIFICATION forming part of Letters Patent No. 378,684, dated February 28, 1888.

Application filed March 11, 1887. Serial No. 230,495. (No model.)

To all whom it may concern:

Be it known that we, HASCAL A. HOGEL and OLIVER L. F. BROWNE, both of Syracuse, in the county of Onondaga and State of New York, have invented a new and Improved Apparatus for Manufacturing Salt, of which the following is a full, clear, and exact description.

We have found that the mere heating of some liquids, such as brine, in an occluded condition—that is to say, under such hydraulic pressure as to prevent any of such liquid from expanding into steam—dehydrates or crystallizes such impurities as calcium, carbonates, and sulphates. If these liquids be heated in a coil of small pipe, they may be forced through the same so rapidly as to prevent incrustation of said pipe by adhesion of said impurities, and if the liquids are heated in a jacketed receptacle such receptacle may be provided with traps, blow-offs, and man-holes, by which sediment and scales may be readily removed. After the impurities have been thus converted into floating or suspended particles they may be eliminated by means of filtration or precipitation. Purified liquids may then be passed into evaporators for final reduction, and this removal of such incrusting impurities enables the use of one or several closed evaporators, by which a multiple effect of heat is secured.

The object of our invention is to utilize the above-named facts, especially in the manufacture of salt from brine bearing gypsum, &c.; and it consists in combining a casing or boiler, through which passes a coiled steam-pipe and a coil or receptacle, with another heated casing and a filter and heater, evaporator or evaporators, a graining-tank, and with necessary pipes, valves, and heat-generators, as will be more fully hereinafter set forth.

Reference is to be had to the accompanying drawing, which is a longitudinal elevation of our improved apparatus, parts being broken away.

B is a vessel into which is pumped brine from any storage-reservoir by means of the pump C and connecting-pipes b^2. In the vessel B is a coiled steam-pipe, *b*, for heating the brine. The brine passes out of the vessel B through the pipe *d* into the coil D in the dehydrator E. The dehydrator E has preferably a double head at the bottom, forming a space, *e*, into which the pipe *d* and the coil D open. In place of the coil D, I may use any suitable receptacle; but I prefer the coil. The brine passes through the coil D and out of the dehydrator E through the pipe *f* into the filter F. The dehydrator may have only one head at the bottom, and the pipe *d* and the coil D be connected directly together by any suitable means. The brine in the coil D in the dehydrator E is heated without evaporation and in an occluded condition by steam from the boiler A entering the same through pipes *a a'*, and the brine is forced through the small coil D with such speed as to prevent the adhesion of the dehydrated impurities to the coil. The dehydrated impurities are removed from the brine in the filter F, and the clarified brine then passes into a heater-evaporator, G, through the pipe *g*, or it may pass directly into the heater-evaporator I through the pipe g^2.

The heater-evaporator G is preferably heated by steam from the boiler A by means of pipes *a* and a^2, communicating with a pipe-coil or steam-chamber within said evaporator, but may be heated by steam that has passed through the steam-space of dehydrator E by way of the trap E' and pipe a^3 uniting with pipe a^2, if desired. The brine passes from the heater-evaporator G into the heater-evaporator H through the pipe *h*, and from heater-evaporator H into heater-evaporator I through the pipe *i*. From the evaporator I the brine passes through the trap J, by means of pipes *j* and *l*, into the open graining-tank K, or the brine may pass from G or H directly into trap J, if desired, through their respective pipes, h^2 j^2. The brine having passed into the graining-tank K, at once begins to evaporate, and cooling and crystallization take place and continue to do so as the brine flows on in the tank to the remotest point thereof, and from there it passes through a connecting-pipe, L^2, into the heater L, and is pumped, by means of the pump *m*, through pipes N *n* into any or all of the heater-evaporators G, H, and I, but preferably into I, where it is heated and evaporated to saturation at boiling-point, and thence, augmented by the constant supply coming from the other heater-evaporators or from filter F, it returns

to tank K, and so on until the process is completed. The heater-evaporators and dehydrators may be so arranged that the coils and pipes may be removed to permit of their being cleared of any scale which may result from any imperfect dehydration. In this system attention is given to temperature. The brine is hottest in the coil D or heater-evaporator G, being heated directly from the boiler A, and coldest in the graining-tank K and graduated between. At several points in its course the reduction of pressure on the brine allows some of it to flash into steam. Thus in passing from the filter F into the heater-evaporator G the pressure is reduced and the brine expands into steam, the steam passing into the steam-space O of heater-evaporator G. This steam then passes into a coil in the heater-evaporator H through the pipe *o*, and the brine still further expanding into steam in evaporator H, the steam passes into the steam-space P. From there it passes through pipe *p* into a coil in the evaporator I, and the brine in evaporator I, expanding into steam, passes into the steam-space Q, and thence through the pipe *q* into the coil *b* in vessel B, partially heating the brine that passes from the pump C through the vessel B. As the brine passes from the evaporator I into the trap J, a like expansion takes place, the steam from trap J passing through the coil *k* in the heater L, heating the brine as it passes from the tank K into the evaporator I. The steam formed in the several spaces by the expansion of the brine may be utilized differently, if desired; but I prefer the above-described manner. The condensed steam from the coil *k* and from the evaporator-coils and the dehydrator passes through the pipes *r* into the pipe R, and is thence conducted to the cistern or pump S of the boiler A. Each of the pipes is provided with a valve, as shown, for regulating the supply and pressure of the brine and steam.

It is evident that difference in salinity of brine will require difference in the numbers, proportions, and adjustments of the above parts, and these may therefore be altered without departing from the spirit of our invention.

No crystallization of salt is allowed to take place except in the graining-tank K. In crystallizing, the grain will be finest at the hottest point and coarsest at the coldest point and graduated between; or by mechanical agitation any desired grain may be secured, and different-sized grains may be made in different parts of the tank K at the same time, any suitable means being employed to remove the grains from the tank.

All the pressure regulators and valves to be used are not shown in the drawing; but they may be placed as best suits convenience.

The principal feature of our invention is the forcing of the brine through the heated small pipe D, in which the brine is occluded, so that the impurities will be crystallized, but nevertheless be prevented from adhering to the walls of the narrow conduit D.

The parts G, H, and I each perform two functions, first, that of heating the brine, the result of which is to reduce its relative salinity; and, second, that of evaporating said heated brine to a point next to saturation, which evaporation will not result in crystallization so long as the brine is heated; and for these reasons we have termed the parts G, H, and I each a "heater-evaporator." Another salient feature of our invention is the use of the heater-evaporators, by which we secure multiple effect.

Having now fully described our invention, what we claim, and desire to secure by Letters Patent, is—

1. The combination of an open graining-tank, an auxiliary brine-heater, L, a closed graining heater-evaporator, a trap, J, and a pump between these two heaters, and means for the simultaneous drawing away of the steam formed in said closed graining heater-evaporator and utilization of same, as set forth.

2. In a liquid purifying and evaporating apparatus, the combination of an occluding-dehydrator for dehydrating impurities of said liquids, a clarifier communicating with said dehydrator, an evaporator communicating with said clarifier, a heater within said evaporator communicating with the steam-space of said dehydrator and with the source of steam for heating the brine in the evaporator, a pump and an auxiliary heater, L, a graining-tank, and a pipe, L^2, connecting the tank with the heater L, as set forth.

3. In an apparatus for making salt, the brine-vessel B, steam-coil *b* in said vessel, for heating the brine, occluding-dehydrator E, and the brine-coil D, within said dehydrator, in combination with the filter F, connected with the brine-coil D, as set forth.

4. In an apparatus for making salt, the vessel B, containing a brine-coil, *b*, occluding-dehydrator E, and filter F, connected with the dehydrator E, in combination with closed heater-evaporators G, H, and I, containing steam-coils for heating the evaporating brine, trap J, and means for passing liquid and steam from one to the other, as set forth.

5. In an apparatus for making salt, the vessel B, dehydrator E, filter F, heater-evaporators G, H, and I, and trap J, in combination with tank K and heater L, and means for passing liquid and steam from one to the other, substantially as described, and for the purposes set forth.

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