

UNITED STATES PATENT OFFICE.

CHARLES HEATON, OF NEW YORK, N. Y.

IMPROVED PROCESS FOR EVAPORATING ALKALINE SOLUTIONS.

Specification forming part of Letters Patent No. 53,298, dated March 20, 1866.

To all whom it may concern:

Be it known that I, CHARLES HEATON, of the city, county, and State of New York, have invented an Improved Method of Evaporating Spent Alkaline Solutions; and I do hereby declare that the following is a full, clear, and exact description of my improved method of proceeding.

The object of my invention is to evaporate spent alkaline solutions for the purpose of recovering the soda contained in the same, and in so evaporating the solution to confine and utilize the steam which is produced from the aqueous solution and ordinarily allowed to escape without being utilized.

In the manufacture of paper heat is required, not only for boiling water, but for heating the driers of the paper-making machinery, as well as for many other purposes. This steam is usually generated in the ordinary manner from water in a steam-boiler, while spent alkaline solutions, which are often produced in large quantities at paper or pulp manufactories, are either thrown away or, if recovered, it is by the ordinary process, which consists in evaporating such solutions to dryness in open evaporating-pans, which may not be always arranged in the same way, but which invariably have heretofore been so arranged as to allow the steam produced in evaporation to pass off and its 1000° of latent heat to be wasted. And it has been found that unless such spent alkaline solutions contain a given amount of soda in solution the cost of the recovery of the same is greater than its value when recovered, owing to the amount and cost of the fuel necessary to evaporate the spent solution to dryness.

My invention is intended to overcome this evil by utilizing the steam and neutralizing the cost of fuel during such evaporation.

To enable those skilled in the art to use my invention, I will proceed to describe the means by which I accomplished my object.

The solution to be evaporated, being collected in a tank or cistern provided for the purpose, is drawn from said tank or cistern and forced into the evaporator by means of an ordinary lift and force pump, usually called a "donkey" pump. The evaporator or boiler I find best suited to the purpose is an ordinary cylindrical boiler without tubes or internal flues. I prefer to have one end of this boiler fitted

with a dome-head and the other end with a conical termination. I set this boiler in brick-work in a vertical position and allow the flues from the furnace to run around the boiler, so as to form what is called a "spiral flue." This flue is carried up to about two-thirds of the height of the boiler, and the remainder is left for steam-space. The dome end of the boiler before spoken of is provided with a safety-valve and steam-pipes precisely like an ordinary steam-boiler, and constitutes the top of the boiler. The conical end or bottom of the boiler is fitted with a large stop-cock or faucet, cast to conform to the shape of the conical end of the boiler, or I may attach an ordinary flange-pipe to the boiler and insert the stop-cock at any convenient point, the object being to provide means for readily blowing the contents of the boiler into a receiver or cistern, which is connected with the said pipe, whenever it may be necessary to do so, as will be described in its order.

In setting the boiler in its perpendicular position in brick-work one-sixth or one-eighth of its length should be so set as to be below the action of the fire, for reasons which I will presently give. The boiler being set is provided with gage-cocks, steam-gage pipe, and fittings usually applied to an ordinary steam-boiler, and the alkaline solution to be evaporated is forced into it and made to furnish steam in the same way that water is used for that purpose.

The effect of heat causes the volatile portion of the contents of the boiler to expand into steam and rise to the surface, while the non-volatile portions of the said contents, whether soda or insoluble vegetable or organic matter, settle and accumulate at the bottom of the boiler, where there is little, if any, agitation, owing to this portion of the boiler being below the action of the fire. When sufficient alkaline solution has been passed or forced into the boiler and evaporated to deposit non-volatile matter enough to fill that portion of the boiler below the action of the fire with a more or less solid accumulation of pasty matter, (the fact of this being the case being readily ascertained by means of a pipe and stop-cock provided for the purpose, which should be fastened to the boiler one or two inches below the fire-line,) I stop the supply of the solution to the boiler by stopping the donkey-pump, and evaporate the contents of the boiler, so as to throw

off nearly all the volatile matter, and as the water-line in the boiler becomes gradually lower and lower it is indicated by a gage-glass which extends from the "fire-line" to the high-water level of the boiler, and is attached to the boiler in the usual manner. I lower the "flue-line" by closing dampers in the spiral flue before mentioned, so as to arrest and change the direction of the draft in the flue and prevent the formation of unmanageable or superheated steam. As an additional precaution, I also decrease the weight on the safety-valve at the same time that I shut off the supply of the solution to the boiler. When nothing remains in the boiler but a small amount of the solution of from four to six inches in depth of steam and non-volatile matter I stop all egress from the boiler, except the safety-valve, by closing the steam-pipe.

The safety-valve, being set at about twenty pounds to the square inch, may blow off violently. I allow it to do so, and at the same time, by means of a pipe attached to it, I turn the escaping steam into the furnace. When the safety-valve ceases to blow I open the stop-cock in the flange-pipe connected with the bottom of the boiler and allow the accumulation of non-volatile matter to be blown into the receiver or cistern provided for its reception. This receiver has an escape-pipe which allows the steam to escape, but not the non-volatile matter. The contents of this receiver, which may be called "a concentrated spent alkaline solution," is now to be calcined in a fire or furnace. It is then lixiviated with hot water, in the usual manner, and evaporated to dryness to produce the carbonate of soda sought. This last evaporation may also be carried on in the same boiler, or in another one kept and provided for the purpose, the water thrown off in the form of steam being also confined and utilized, as before. This method of evaporation, which utilizes the volatile as well as the non-volatile portions of the solution, enables me to effect a saving of fifty per cent. in the cost of fuel. Even if I have no use for the steam which I utilize by my process, apart from the recovery of the non-volatile matter, as the thousand degrees (1000°) of latent heat contained in the steam at a pressure of one atmosphere can, by my method, be confined and caused to do double duty by using it through coils for evaporating the aqueous portions of the liquid produced by lixiviating, in order to produce the pure carbonate of soda. Where there is any use for the steam, either for power or for transmitting heat, apart from the process of recovering the carbonate

of soda, I am enabled to effect a still greater saving in treating spent alkaline solutions.

In recovering the alkali from spent alkaline solutions which have been neutralized or spent by being applied to vegetable fibrous matter, I find that where the original strength of the caustic alkaline solution was six degrees (6° Baumé) or over the carbonate of soda can be recovered by the ordinary evaporating process for about four cents per pound when coal is twelve dollars (\$12.00) per ton. By my improved method, and under the same conditions, I am enabled to recover the carbonate of soda for about two cents (2 c.) per pound.

My method of evaporating may be equally well applied to other solutions which contain non-volatile matter, such as sugar, with the same saving in the cost of fuel, besides other great advantages, such as the power to regulate the supply and quantity of heat at certain stages with more certainty than fire can be applied.

I am aware that steam made from water has been and is generally used as a means of transmitting heat and power.

I am also aware that it is customary in the manufacture of sugar to boil the solution in closed vessels in vacuum, by which means the boiling-point is reduced in heat from 212° to about 150°; but under these circumstances the steam cannot be utilized, or even gotten out of the boiler in which it is produced, without the aid of a suction-pump.

I do not limit myself to any peculiar kind of boiler for the purpose of evaporating such spent alkaline solutions as I have referred to, as many other plans analogous to the one I have described may be made to answer the same purpose, nor do I limit myself to any specific use for the steam generated in such evaporation.

What I do claim as my invention, and desire to secure by Letters Patent of the United States, is—

1. The above-described process of separating the volatile from the non-volatile portions of alkaline solutions by evaporating such solutions in a closed boiler under a pressure exceeding one atmosphere.

2. Saving the steam generated from an artificial alkaline solution, when such solution is evaporated in whole or in part in a closed boiler, substantially as set forth.

CHAS. HEATON.

Witnesses:

S. D. COZZENS,
CHAS. M. DE LACY.