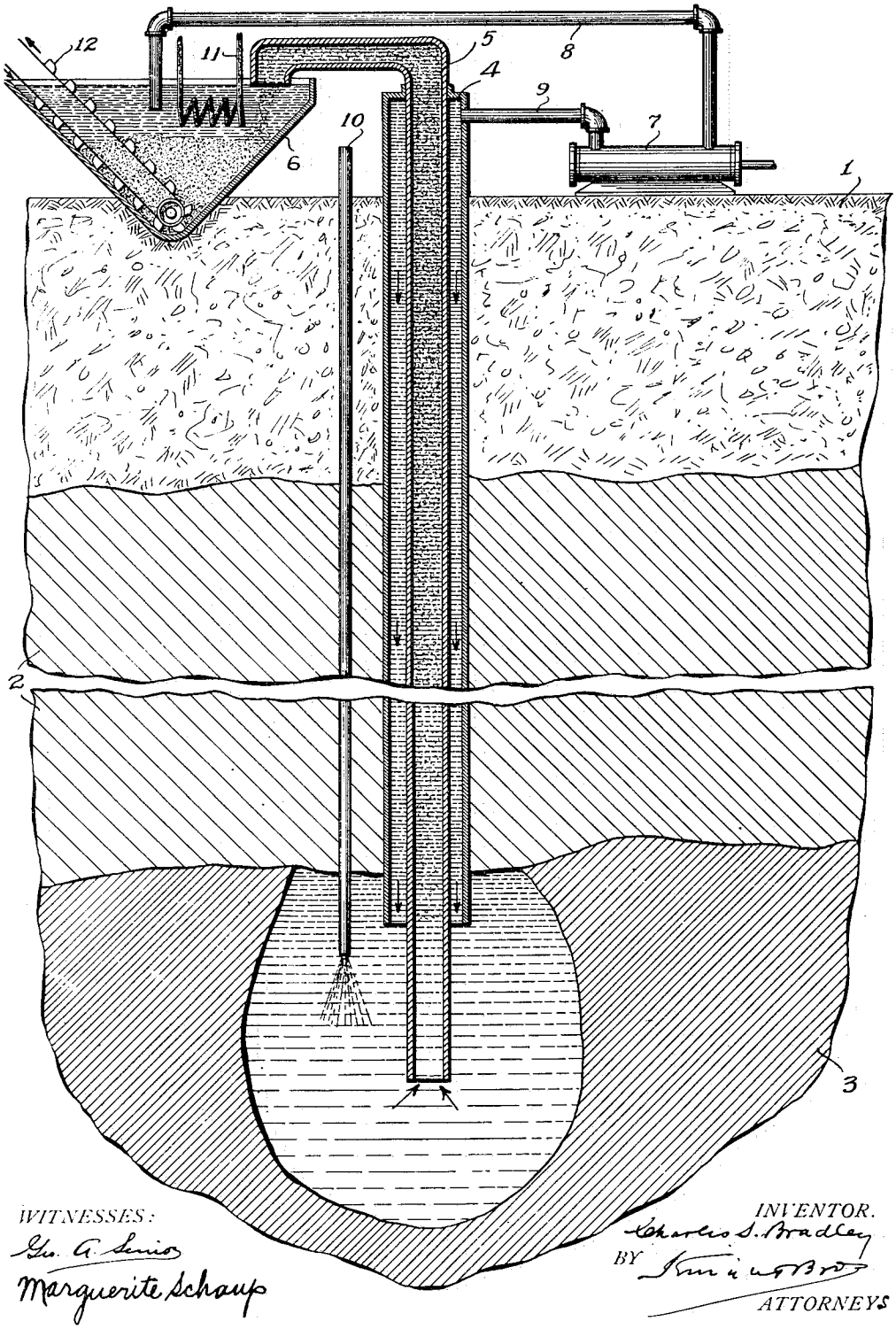
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METHOD AND APPARATUS FOR MINING SALT.

APPLICATION FILED NOV. 18, 1913.

1,121,225. Patented Dec. 15, 1914.



WITNESSES:

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METHOD AND APPARATUS FOR MINING SALT.

1,121,225. Specification of Letters Patent. Patented Dec. 15, 1914.

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To all whom it may concern:

Be it known that I, CHARLES S. BRADLEY, a citizen of the United States, residing in the borough of Manhattan, city, county, and State of New York, have invented certain new and useful Improvements in Methods and Apparatus for Mining Salt, of which the following is a full and clear specification.

My invention relates in general to a method and apparatus for the mining of subterranean salts, such as, for example, ordinary table salt.

Broadly speaking, the invention is based upon the employment of heat in a regenerative manner, whereby the physical transfer of the salt from the salt supply to the point of delivery is accomplished with very little expenditure of energy. In order to make the heat effective I circulate a carrier solution between the salt supply and the point of delivery and manipulate the heat relations in this carrier solution in such way that that portion of the solution which is at the salt supply will be at a temperature corresponding to higher saturation point and that portion which is at the point of delivery will be at a temperature of lower saturation point, whereby a salt increment is taken into solution at the salt supply and delivered in crystallized form at the point of delivery. The heat relations are maintained by a transfer of heat from the concentrated solution coming from the salt supply to the depleted solution going to the salt supply, whereby the greater portion of heat is regenerated and maintained in the system. To effect this transfer of heat, a differential temperature is necessary between the concentrated and depleted solutions and I maintain this differential temperature by introduction of a small quantity of heat at one end of the system and the dissipation or extraction of heat at the other end of the system. For those salts which are more soluble at higher temperature I introduce the outside heat directly or indirectly into the solution at the salt supply so as to raise the temperature at that point, and I dissipate or extract the heat directly or indirectly from the solution at the point of delivery. In this way a differential solubility between the salt supply and the point of delivery is maintained. The same principle of differential solubility may be employed in the case of salts whose solubility is greater at lower temperature, by introducing the outside heat at the point of delivery and dissipating or extracting the heat at the salt supply.

To clearly illustrate the invention I shall describe a specific embodiment thereof having particular reference to the mining of salt from subterranean deposits.

The accompanying drawing shows diagrammatically in vertical section an apparatus embodying the invention as applied to the mining of common salt from subterranean deposits.

In said drawing 1 is the surface soil, 2 a layer of impervious rock and 3 the salt deposit. Subterranean salt deposits are commonly found beneath non-porous rock, as shown in the diagram and in mining the salt according to my invention a shaft is sunk from the surface 1 through the impervious rock 2, into the salt deposit 3. Through this shaft are inserted an inlet pipe 4, closed at the top, and an outlet pipe 5, which latter is disposed within pipe 4 and passes through the top thereof, so as to discharge into a receptacle 6. A pump 7 withdraws the liquid from receptacle 6 through pipe 8 and forces it through pipe 9 into the pipe 4 which discharges the liquid into the salt deposit 3. The liquid ascends from the salt deposit 3 by way of pipe 5 and discharges into receptacle 6, as above stated. An insulated steam pipe 10, or other suitable heating means is introduced through a second shaft into the salt deposit 3 to supply outside heat for maintaining the higher temperature in the salt deposit; and the liquid in receptacle 6 may be exposed to the atmosphere or in some other way subjected to heat dissipation as, for example, by means of a cooling coil 11. An elevator 12 may be employed for continuously removing the salt crystals from the liquid in the receptacle 6. Steam pipe 10 and the cooling coil 11, or other heat dissipating means thus maintain a higher temperature in the salt deposit and a lower temperature in the receptacle 6 which may be regarded as the point of delivery.

The operation is as follows: Pump 7 forces the cool depleted solution through pipe 4 into the salt deposit 3 where outside heat is introduced into the system by means of steam pipe 10. The solution being at a higher temperature in the salt deposit 3 dissolves an increment of salt and the concentrated solution passes up through pipe 5 in heat conductive relation with the depleted solution in pipe 4 and discharges into the

receptacle 6. Heat is dissipated from the solution in receptacle 6, so that the differential solubility is maintained between the salt supply and the point of delivery, and the differential temperature is maintained between the depleted solution in pipe 4 and the concentrated solution in pipe 5. The concentrated solution ascending through pipe 5 therefore transfers a portion of its heat to the depleted solution in pipe 4 and by this transfer of heat the saturation point of the solution is progressively lowered, thus crystallizing the increment of salt taken up in the salt deposit 3 at the higher saturation point and delivering into the vessel 6 the mixture of solution and crystals. The elevator 12 removes the salt crystals and the depleted solution is returned through the cycle of operations by way of pipe 8 and pump 7.

I claim:

1. The method of mining a crystallizable salt, which comprises circulating a conveyer solution between the salt deposit and the surface, effecting an interchange of heat between the respective portions of solution entering and leaving the deposit to respectively raise and lower the saturation point of the solution, and locally maintaining at the salt deposit a temperature corresponding with higher saturation point than that at the surface.

2. The method of mining salt, which comprises introducing a depleted solution into the salt deposit, adding heat locally to the solution within the salt deposit, dissipating heat from the solution at the point of delivery, and withdrawing the heated concentrated solution in heat regenerative relation to the solution entering the salt deposit, whereby the outgoing solution is cooled and salt is crystallized therefrom.

3. Underground salt mining apparatus comprising in combination inlet and outlet pipes extending from the surface to the salt deposit, means for forcing solution through said pipes into and from the salt deposit and means for maintaining the solution within the salt deposit at higher temperature than the solution at the surface.

4. Underground salt mining apparatus comprising in combination inlet and outlet pipes extending in heat regenerative relation with each other from the surface to the salt deposit, means for forcing solution through said pipes into and from the salt deposit, means for locally heating the solution within the salt deposit, and means for dissipating heat at the surface.

5. Underground salt mining apparatus comprising in combination inlet and outlet pipes extending through a common bore hole in heat conductive relation to each other from the surface to the salt deposit, means for forcing a solution through said pipes into and from the salt deposit, a steam pipe leading through a separate bore hole from the surface to the salt deposit for locally heating the solution in the salt deposit, and means for dissipating heat from the solution at the surface.

6. Underground salt mining apparatus comprising in combination inlet and outlet pipes extending through a common bore hole in heat conductive relation to each other from the surface to the salt deposit, means for forcing a solution through said pipes into and from the salt deposit, a steam pipe insulated from said solution pipes and extending from the surface to the salt deposit for locally heating the solution in the salt deposit, and means for dissipating heat from the solution at the surface.

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