(No Model.)

A. MUELLER.

PROCESS OF AND APPARATUS FOR EXPELLING CARBON DIOXID.

No. 536,642. Patented Apr. 2, 1895.

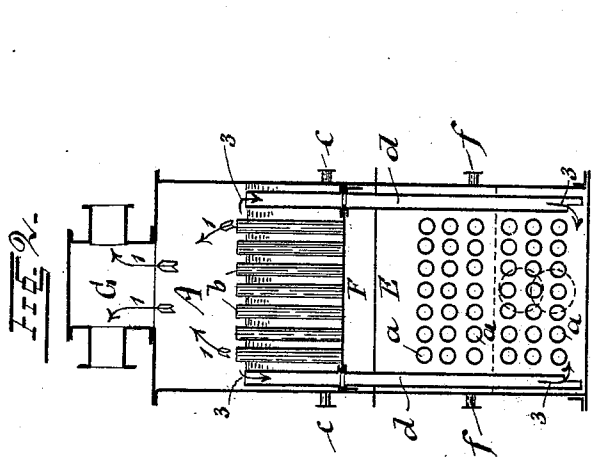

Fig. 2.

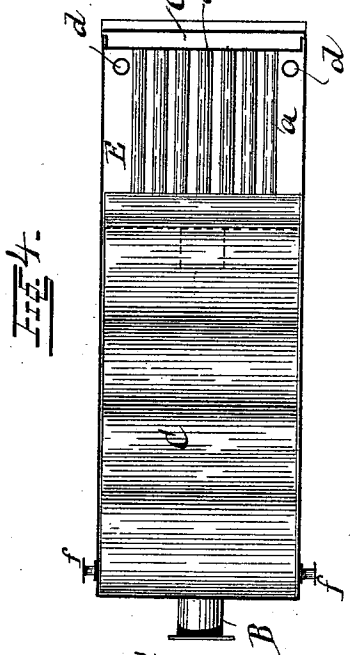

Fig. 4.

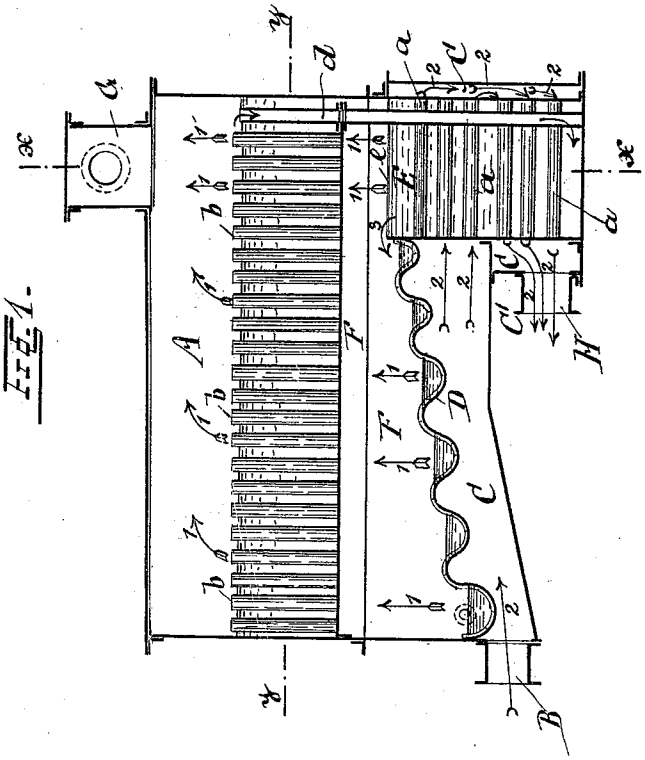

Fig. 1.

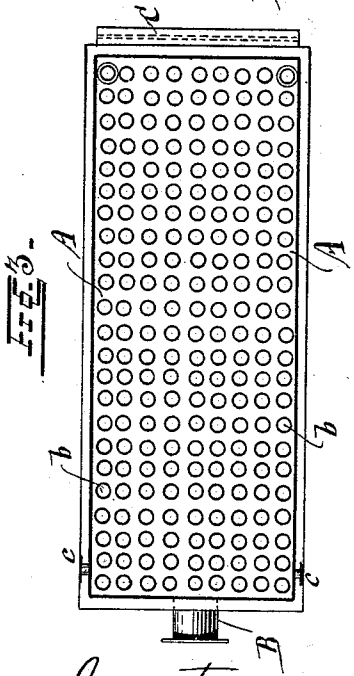

Fig. 3.

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UNITED STATES PATENT OFFICE.

ALBERT MUELLER, OF NIEDER-SCHOEWEIDE, GERMANY.

PROCESS OF AND APPARATUS FOR EXPELLING CARBON DIOXID.

SPECIFICATION forming part of Letters Patent No. 536,642, dated April 2, 1895.

Application filed September 21, 1893. Serial No. 486,130. (No model.)

To all whom it may concern:

Be it known that I, ALBERT MUELLER, a subject of the King of Prussia, and a resident of the village of Nieder-Schoeweide, near Berlin, Prussia, Germany, have invented certain new and useful Improvements in Methods of and Apparatus for Expelling Carbon Dioxid from its Solutions, of which the following is a specification.

The object of my invention is to expel carbon dioxid from liquid holding the same in solution, such, for instance as carbonate of potassa or carbonate of sodium particularly with a view of compressing the carbon dioxid thus expelled.

My invention is described hereinafter, and the features of novelty for which protection is desired are set forth in the claims at the end hereof.

In the accompanying drawings, which form a part of this specification, and wherein like parts are indicated by like letters of reference in the several views, Figure 1 is a longitudinal sectional view of an apparatus embodying my invention and comprising an upper and lower section. Fig. 2 is a transverse section on the line *x x* of Fig. 1. Fig. 3 is a horizontal section on the line *y y* of Fig. 1, and Fig. 4 is a top view of the lower section of the apparatus.

The two sections of the apparatus are connected together by means of an outer flange and the entire apparatus, with the exception of the pipe connections and the overflow pipes, is made of wrought iron.

The several parts of the apparatus may be secured together by screws. The pipe connections and overflow pipes will preferably be made of cast iron.

In the drawings the arrows marked 1 indicate the direction of flow of the carbon dioxid, those marked 2 the direction of the flow of the heating gases and those marked 3 the direction of the flow of the liquid.

Referring to the drawings, A indicates the interior space of the upper section of the apparatus, which is separated from the lower section by the bottom to which are attached the thin cooling tubes *b*.

B is the pipe connection through which the gases of combustion enter, D a corrugated evaporating plate, and C indicates a vacant space underneath the plate D, the said space extending from the boiler E to the pipe connection B and forming a conduit for the gases of combustion. The corrugated plate D which is inclined from the boiler is made of heavy sheet iron with a longitudinal flange on each side conforming to the corrugations, said flanges serving to connect the plate to the side walls of the lower section within which it is located. The flanges may be attached to the side walls by screws or otherwise.

The interior of the boiler is in direct communication with the plate D and is in communication with the upper section A of the apparatus through the tubes *d*.

F indicates the space between the bottom of the upper section A and those parts of the lower section covered by or filled with liquid, said space serving to receive the carbon dioxid developed in the lower section.

G indicates a dome provided with two pipe connections through which the carbon dioxid is discharged from the apparatus and H indicates the connection for the pipe through which crude gases mixed with carbon dioxid find their exit from the apparatus.

The boiler E is rectangular in form and is provided with a series of horizontal tubes *a*. There are altogether forty two of these tubes, twenty one of which communicate with the space beneath plate D and twenty one with the space of which pipe connection H is the outlet. On each side of the upper and lower section of the apparatus there are pipe connections. Those of the upper section are marked *c* and those of the lower section *f*. In Fig. 2 the positions of the pipes B and H are shown in dotted lines.

The apparatus operates continuously as follows: The saturated liquid which passes out from an absorbing apparatus is forced by means of a pump, and pipes attached to the two connections *c c*, into the cooling compartment A of the apparatus and fills the same to the upper edges of the overflow pipes *d* and drops through the same to the bottom of tubular boiler E, filling the latter to its top *e*, and from thence the liquid passes onto the corrugated plate D, flowing from each depression of the same over the adjoining elevation until it finally leaves the last depressions through pipe connections *f f*, of the lower section of

the apparatus to be reintroduced into the absorbing apparatus after having first circulated through a cooler. As soon as the flow of liquid through the pipes attached to the connections *f f* indicates that all the parts of the apparatus which are to receive the liquid have been filled, the gases containing the carbonic acid produced by processes of combustion or of roasting are conducted from the generator through a pipe connected to pipe connection B into the space underneath the evaporating plate D from which they pass through the upper series of tubes *a*, thence through the lower series of said tubes into chamber C and finally into the discharge pipe attached to pipe connection H which communicates with a purifying apparatus. The thin body of liquid distributed over the evaporating plate D is by the action of the hot gases readily raised to the boiling point. The carbon dioxid which is expelled at as low a temperature as 80° centigrade now begins while passing through the thin vertical tubes *b* of the cooling apparatus to give up its heat to the liquid surrounding the same, the cooler thus serving as a preliminary heater.

In this apparatus the liquid, even when the temperature of the heating gases is comparatively low, reaches a temperature of more than 80° centigrade, and when this temperature is reached the carbon dioxid begins to be set free.

The temperature of the liquid is increased according to the distance which it is compelled to travel and in proportion as the carbon dioxid in the liquid is reduced and requires for its expulsion a higher temperature. The carbon dioxid thus set free leaves the apparatus through the pipe connections of the dome G the latter being a continuation of the dome formed by the upper part of casing A over tubes *b* which communicate with suitable conduits.

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

1. The method of expelling carbonic acid from its solutions, which consists in subjecting such solutions to successive and progressive heating operations and conducting the heated carbonic acid expelled by one of such heating operations along surfaces of suitable heating passages while conducting the cooler solution along the opposite surfaces of such heating passages thus producing expulsion of carbonic acid gas therefrom during a preliminary heating operation, and uniting the two bodies of carbonic acid gases after each has been so expelled from its solution, substantially as set forth.

2. In an apparatus for expelling carbon-dioxid from liquids, the combination with a preliminary heater for the liquids, of a second compartment adapted to be heated by gases of combustion, and through which latter compartment the liquids circulate and are further heated, and a dome extending over the preliminary heater and over the outlets of the passages conducting the gases from the second compartment, substantially as set forth.

3. In an apparatus for the purpose described, the combination with an upper compartment provided with a series of vertical tubes in the bottom, and with a dome above said tubes, and in which compartment the liquid is first admitted, of a lower compartment in communication with such dome through said vertical tubes and by an overflow pipe or pipes, and a heating apparatus within said lower compartment, substantially as set forth.

4. In an apparatus for the purpose described, the combination with an upper compartment provided with a series of vertical tubes in the bottom, and with a dome above said tubes, and in which compartment the liquid is preliminarily heated, of a lower compartment in communication with such dome through said vertical tubes and by an overflow pipe or pipes, a heating apparatus within the lower compartment provided with horizontal heating tubes and pipe connections for admission and discharge of heating gases which circulate through said heating apparatus, substantially as set forth.

5. In an apparatus for the purpose described, the combination with an upper compartment provided with a series of vertical tubes in its bottom, of a lower compartment in communication with the upper compartment through said vertical tubes and by an overflow pipe or pipes, a heating apparatus in said lower compartment through which gases of combustion are adapted to circulate, and an evaporating plate extending from the top of the heating apparatus to the point of entrance of the heating gases, substantially as set forth.

6. In an apparatus for the purpose herein described, the combination with an upper compartment provided with a series of vertical tubes in its bottom, of a lower compartment in communication with the upper compartment through said vertical tubes, a heating apparatus in the lower compartment in communication with the upper compartment by an overflow pipe or pipes, and a corrugated evaporating plate connected with the heating apparatus at its top and inclined to the point of entrance of the heating gases, the depressions in the corrugated plate forming receptacles from which the liquid after filling the same successively passes out at the point of highest temperature, substantially as set forth.

7. The combination with the upper compartment A provided with a series of vertical tubes in its bottom and with a dome through which the liberated carbonic acid escapes, and also with an inlet for the solution containing the carbonic acid, of a lower compartment comprising three chambers, as F, C, C′, and having an inlet into chamber C for the gases of combustion and an outlet for said gases from chamber C′, a boiler within said lower compartment in communication with the up-

per compartment by an overflow pipe or pipes and having a series of horizontal tubes through which the gases of combustion circulate, and an evaporating plate connected with the top of the heating apparatus and inclined to the point of entrance of the gases of combustion, substantially as set forth.

In witness whereof I have hereunto set my hand in presence of two witnesses.

ALBERT MUELLER.

Witnesses:
R. HESS,
EMIL GRASSMANN.