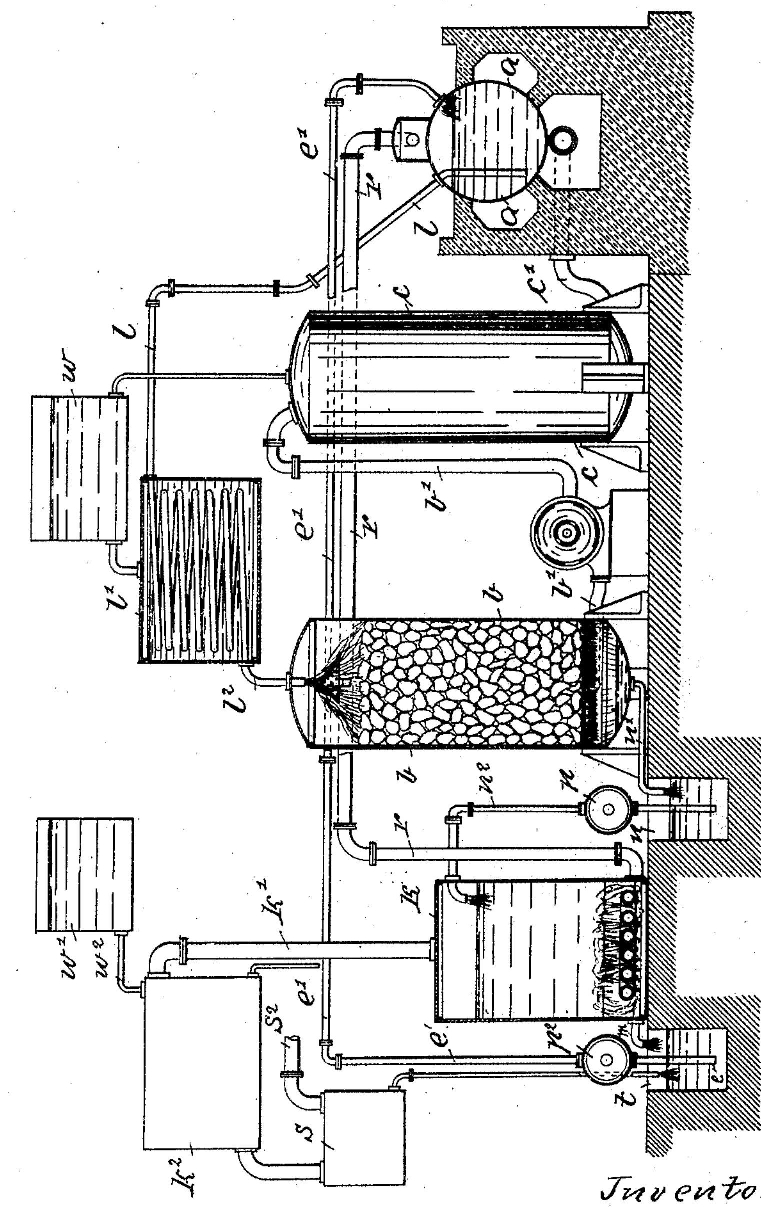
(No Model.)

E. LUHMANN.

PROCESS OF MAKING CARBONIC ACID.

No. 503,286. Patented Aug. 15, 1893.



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UNITED STATES PATENT OFFICE.

EDUARD LUHMANN, OF ANDERNACH, GERMANY.

PROCESS OF MAKING CARBONIC ACID.

SPECIFICATION forming part of Letters Patent No. 503,286, dated August 15, 1893.

Application filed July 11, 1891. Serial No. 399,251. (No specimens.)

To all whom it may concern:

Be it known that I, EDUARD LUHMANN, a subject of the King of Prussia, German Emperor, and a resident of Andernach, in the Province of the Rhine, Kingdom of Prussia, Empire of Germany, have invented certain new and useful Improvements in Processes for the Production of Carbonic Acid, of which the following is a full, clear, and exact specification, reference being had to the accompanying drawing, which forms a part of this specification.

My invention relates to a method of producing carbonic acid from bicarbonate of alkalies in a continuous way by decomposing and regenerating the latter, and is an improvement of the process of extraction of gases from fluids, as described in my application filed July 11, 1891, Serial No. 399,250.

The improvement consists in utilizing for the regeneration of the lye the gases employed for heating the same in a boiler.

Before describing the improved process I will give a short description of the apparatus which I employ for the same.

The accompanying drawing is a longitudinal sectional elevation of the said apparatus.

The closed boiler *a* is placed within a furnace of any suitable construction, from which the gases of combustion are conducted by means of a pipe *c'* into a washing and cooling apparatus *c*. A pipe *l* is passed through a suitable hole in the shell of the boiler, near the top of the same, and reaches down almost to the bottom of the same. The pipe *l* leads into a cooling tank or cooler *l'*, in which it forms a coil, and leaves the same by means of the pipe l^2, which is connected with the absorption tower *b* and provided at its extremity, in the upper part of the said tower *b*, with a rose of any suitable construction. This absorption tower *b* is filled in its greater part with pieces of a material affording a large surface, said material resting on a perforated metal plate provided a short distance above the bottom of the absorption tower *b*. A pipe *n'* leads from the bottom of the mentioned absorption tower *b* to the collecting vessel or tank *n*. Immediately below the above mentioned perforated plate on which rest the pieces of material presenting a large surface, I provide another pipe *b'* which communicates with the top of the washing and cooling apparatus *c*, and in which I insert a fan or blower. Above the said washing and cooling apparatus *c* and the cooler *l'*, I place a reservoir *w*, from the lower part of which one pipe leads into the cooler *l'*, and another pipe into the washing and cooling apparatus *c*. Both the absorption tower *b* and the cooling apparatus *c* are hermetically closed. Above the collecting tank *n* there is provided a forcing pump *p*, from which a pipe descends into said tank *n*, while another pipe n^2 leads up from the pump *p* into the upper part of a boiling vat *k*. In the lower part of the latter I arrange several perforated tubes, which are all in communication with the pipe *r* coming from the dome at the top of boiler *a*.

At the top of the boiling vat *k* I provide a pipe *k'* communicating with a cooler k^2, which is supplied with water from a reservoir *w'* by means of a pipe w^2. The pipe on the right at the bottom of cooler k^2 serves for draining off the water by opening a suitable cock, not shown on the drawing, and the pipe leaving said cooler at the bottom on the left leads into the collecting vessel *s*. From the top of the latter a pipe s^2 leads to the gasometer, not shown on the drawing, while the pipe at the bottom of said collecting vessel *s* ends in the tank *t*. Into the latter are also led the pipes *m* and *e*, the former being in communication with the lower part of the boiling vat *k*, and the latter with a forcing pump p^2, from which a pipe *e'* leads into the boiler *a*.

I will now describe my improved process as applied to the production of carbonic acid from bicarbonate of soda. The boiling vat *k* is filled with a bicarbonate of soda solution of 10° Baumé. The reservoirs *w* and *w'* and coolers *l'* and k^2 are filled with water. Boiler *a* is likewise partly filled with water or with a weak lye of carbonate of soda. This solution is heated at a medium pressure till it boils thoroughly and the steam evolved escapes through the pipe *r* into the boiling vat *k*. The liquid itself—I will assume that a weak lye is employed—rises in pipe *l* and flows through the serpentine coil placed in the cooler *l'*, where it is brought to the temperature which will enable it to absorb the maximum amount of carbonic acid. Hereafter the lye proceeds through the connecting

pipe l^2 to the absorption tower b and issues in the top of the same through the rose provided at the end of the pipe. At the same time the combustion gases from the coke furnace heating the boiler a, which gases contain of course carbonic acid, enter the washing cylinder c at the lower part of the same by the pipe c'. The fragments of marble with which this cylinder is filled are continuously kept moist by a fine shower of water coming from the reservoir w. The carbonic acid rising in the washing cylinder c is thus freed of any impurities which may be admixed with it and then enters the absorption tower b at the bottom by the pipe b' and moves in this tower in the opposite direction to the lye, which travels downward. In consequence thereof, the lye absorbs a great quantity of carbonic acid and is thus converted into a solution of bicarbonate or at least sesquicarbonate of soda. This liquid leaves the absorption tower by the pipe n' and flows into the collecting vessel or tank n, whence it is conveyed into the boiling vat k by means of the pump p and through the pipe n^2. The boiling vat k is heated by means of the steam emanating from the boiler a and entering the same through the perforated pipes located at the bottom. The steam then heats and decomposes the brine to such an extent that it gives off most of the carbonic acid which it contains, which becomes mixed with that carried away with the steam from boiler a. The carbonic acid which is thus freed passes through pipe k' into the cooler k^2 supplied with water from reservoir w', and thence into the collecting vessel s, where the condensed water is collected, while the carbonic acid is conducted by means of pipe s^2 to the gasometer. The water proceeding from condensation in vessel s is allowed to run into tank t so as to maintain a uniform concentration of the lye. This is absolutely necessary, as otherwise the lye would become so dense, as to be unable to retain the salt in solution but would throw it off and clog the pipes. The hot brine coming from the boiling vat k which runs out of same into the vessel t through the pipe m is not yet freed of all the bicarbonate (or sesquicarbonate) salts which it holds in solution. It is still to a certain extent undecomposed and would not only, if used again in that state, hamper the production of carbonic gas to a great extent, but it would be very difficult to regenerate this lye into bicarbonate (or sesquicarbonate) that is to say, the small absorbent power of this lye would greatly impede the further processes. To avoid this the lye is taken up by the pump p^2 by means of pipes e e' and pumped into boiler a. It will be understood that the process is a continuous one, and therefore may be kept up for any length of time, but it is preferable for practical reasons that the boiling should be continued for one hour at least.

The chief advantage of the described process is that it permits of a complete and thorough utilization of the heat generated, while facilitating the processes throughout. The same process may be employed for producing carbonic acid from bicarbonate of potash, and the most advantageous strength of the solution will be 17° Baumé.

Having thus fully described the nature of this invention, what I desire to secure by Letters Patent of the United States is—

The method of producing carbonic acid consisting in boiling a solution of alkaline carbonate and bicarbonate, thereby partly evaporating the solution, expelling carbonic acid, and converting the solution into normal carbonate, leading the mixture of steam and carbonic acid to another vessel containing a solution of an alkaline carbonate saturated with carbonic acid, and thence through a condenser, from which the carbonic acid is conducted into a gasometer, then cooling the solution of normal carbonate obtained and intimately mixing it with the products of combustion until saturated with carbonic acid, as described.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

EDUARD LUHMANN.

Witnesses:
OTTO BRAEYER,
WILLIAM OELRICHS.