

UNITED STATES PATENT OFFICE.

ERNEST SOLVAY, OF BRUSSELS, BELGIUM.

IMPROVEMENT IN APPARATUS FOR WASHING AND ABSORBING GAS.

Specification forming part of Letters Patent No. **177,580**, dated May 16, 1876; application filed November 18, 1875.

To all whom it may concern:

Be it known that I, ERNEST SOLVAY, of the city of Brussels, Belgium, have invented a new and Improved Apparatus for Washing and Absorbing Gas, which improvement is fully set forth in the following specification, reference being had to the accompanying drawing, in which—

Figure 1 represents a longitudinal section of my apparatus. Fig. 2 is a cross-section of the same.

Similar letters indicate corresponding parts.

It is a well-known fact that the process of washing and absorbing gas can be successfully performed only by an apparatus in which the liquid used is caused to circulate in a direction contrary to the gas, and this purpose has been hitherto effected by means of a "column" or vertical apparatus, in which the liquid is elevated and then allowed to fall, while the gas ascends. In this apparatus the objection, among others, exists, that a certain amount of power is required for the purpose of elevating the liquid.

My invention consists in an apparatus in which the liquid, as well as the gas, circulates horizontally, and in which the pressure of the gas is utilized for the purpose of causing the liquid to flow in a contrary direction to the gas.

My improved apparatus is constructed of a series of air and water tight chambers, which communicate with each other through the medium of an upper and lower series of bent pipes projecting from opposite sides of the chambers, the diameter of the upper series of pipes being less than that of the lower series, while the former project into the latter in such a manner that if water or other liquid is allowed to run into the chamber situated at one end of the apparatus, and at the same time gas is forced into or generated in the chamber situated at the other end thereof, the gas circulates through the upper series of bent pipes and the chambers, while a suction is created in the lower series of pipes, by the action of which a circulation of the liquid is caused to take place through the lower series of pipes and the chambers in a direction opposite to that of the gas, while the gas commingles with the liquid, and is thereby freed from the im-

purities or absorbed, as the case may be. The chambers, situated at the respective ends of the apparatus, are provided with an inlet and an outlet orifice for the washing or absorbing liquid, and with one or more orifices for the gas. For the purpose of supplying the apparatus with liquid I use a "float-box," which communicates with the chamber situated at one end of the apparatus by a feed-pipe, and by which a constant and uniform supply of liquid is obtained.

In the drawing, the letters $A A^1 A^2 A^3 A^4 A^5$ designate the chambers of my apparatus, and a are the lower series of pipes, while b are the upper series of pipes. The aforesaid chambers are made air and water tight, and I prefer to make the division-walls thereof of sheet-iron. The upper and lower series of pipes $a b$ project inwardly from the opposite sides of the chambers, except from those marked A and A^5 , which are devoid of pipes, the division-walls of the chambers being provided with apertures c at the points where the pipes are attached thereto, so that the chambers are made to communicate with each other through the medium of the pipes. The lower series of pipes, a , are bent upward, while the upper series of pipes, b , are bent downward, as shown; and the pipes b are made of a less diameter than the pipes a , while the former, b , are made to project into the latter, a , in such a manner that a space is created between the pipes. The free ends of the upper series of pipes, b , are provided with notches or serrations.

In the outer walls of the chambers $A A^5$ are formed, respectively, an inlet-orifice, d , and an outlet-orifice, e , for liquid, while in the roofs of such chambers are formed similar orifices $f g$ for gas, the orifice f being intended for the introduction of gas to the apparatus, and the orifice g for its outlet. The gas, however, may be generated in the chamber A , and in such case the inlet-orifice f is dispensed with. From the outlet-orifice e projects a discharge-pipe, C , while to the inlet-orifice d is connected a feed-pipe, D , which extends from a so-called float-box, E . The bottom of this float-box is provided with a hole, y , which contains a conical valve, h , that is suspended by a vertical stem from a float, i . The valve h is surrounded

by a shell, K, which is attached to the bottom of the float-box E, and which is adapted to be connected to a pipe for the introduction of water or other liquid to the box.

The position of the valve *h* is dependent on that of the float *i*, which is buoyed up by the liquid in the box, and when the level of the liquid falls the valve *h* is automatically opened, so as to let in a fresh supply of liquid, while, when the liquid reaches the proper level, the valve *h* is shut. The level of the liquid in the float-box E is thus kept always uniform.

The operation of my apparatus is based on the fact that if a current of gas is made to pass through a vertical pipe, and liquid is introduced to its lower part, the latter is elevated by the gas, the operation, however, being successful only if the pressure of the gas is sufficiently great compared with the quantity of the liquid, or, in other words, the pressure of the gas must be proportionate to the height and quantity of the liquid to be elevated. If the said current of gas is made to pass successively through a series of pipes, which are situated in chambers containing liquid, the liquid is made to pass from one chamber to another, and to circulate horizontally. This will be readily understood from the following description of the operation of my apparatus:

I first allow the liquid from the float-box E to pass into the chamber A⁵, which is situated at one end of the apparatus, when the lower pipe *a* of the next or succeeding chamber A⁴ is at once filled by the liquid to the level of that in the chamber A⁵ and in the float-box. I then force a current of gas into the chamber A at the other end of the apparatus, or in lieu thereof a gas or vapor may be generated in such chamber. The current of gas passes from the chamber A through the upper pipe *b* of the chamber A¹, next to it, and emanates in the lower pipe *a* of this chamber, when it takes an upward course, as indicated by arrows, in the space between the upper and lower pipes. The gas is thus conducted into the chamber A¹, and thence it passes through the rest of the upper series of pipes *b*, and through the chambers A² A³ A⁴ A⁵. By the action of the gas as it passes upward from the lower series of pipes *a*, a suction is created in the said lower series of pipes, whereby when the gas reaches the pipe in the chamber A⁴, which contains a quantity of liquid, as before

stated, the level of the liquid is first lowered to below the lower end of the upper pipe, when it is elevated and caused to overflow into the chamber A⁴, then in a similar manner to overflow into the chamber A³, and so on into the several chambers. The liquid is thus caused to circulate through the series of chambers A to A⁵ inclusive, in a direction opposite to that of the gas, and after having traversed the chambers it escapes by the outlet-orifice *e*. As the gas issues from the lower series of pipes *a*, it commingles with the liquid overflowing therefrom, and thereby the gas is washed or absorbed according to its nature, while, when the gas reaches the chamber A⁵, it escapes by the orifice *g*, and thence may be conducted to a gas-receiver.

It will be seen that by the above apparatus a material saving in power and labor is effected, while the apparatus is adapted to work continuously.

If desired, the chambers of my apparatus may be heated by placing the whole over a furnace, and the apparatus can also be used for distilling.

What I claim as new, and desire to secure by Letters Patent, is—

1. The process herein described, of washing and absorbing the impurities from gas, the same consisting in causing the washing and absorbing liquid and the gas to circulate horizontally, and utilizing the pressure of the gas, to cause the washing-liquid to flow in a direction the reverse of the gas, as and for the object specified.

2. An apparatus constructed of a series of chambers, A A¹ A² A³ A⁴ A⁵, and having orifices *d e* for the inlet and outlet of liquid, and gas-orifices *f g*, one or more, in combination with bent pipes *a b*, the whole being adapted to operate substantially as described.

3. In combination with the chambers A A¹ A² A³ A⁴ A⁵ and the bent pipes *a b*, the float-box E, substantially as described, and for the object specified.

In testimony that I claim the foregoing I have hereunto set my hand this 14th day of September, 1875.

E. SOLVAY.

Witnesses:

G. CAUDERLIER,
BROIBANT.