THE MANUFACTURE OF SODA.

Soda is now universally manufactured from chloride of sodium (common salt), which is first converted into sulphate of sodium, and is then treated with powdered chalk and coal. Leblanc has introduced the following proportions for this mixture: 100 parts sulphate of sodium, 104 parts of carbonate of calcium, and 39 parts of coals.

If in solution, the sulphide of calcium and the carbonate of sodium can remain without acting upon each other. The results of the operation are variable mixtures of carbonate of sodium, caustic soda, sulphate of calcium, and lime. As the proportions of the carbonate of calcium are varied, the results obtained vary more or less likewise, but generally the quantity of lime used is greater than the quantity given in the theoretical formulæ.

The process of making soda may be divided into four distinct successive stages:

1. The reduction of the sulphate of sodium into a sulphide $Na_2SO_4+2C=Na_2S+2CO_2$.

2. The double decomposition of the sulphide of sodium and the carbonate of calcium: $Na_2S+CaCO_3=Na_2CO_3+CaS$.

3. The production of oxide of sodium, due to the partial reduction of the excess of carbonate of calcium, by the coals: $2CaCO_3+2C=2CaO+4CO$. (The quicklime acts upon the carbonate of sodium during the lixiviation.)

4. The production of oxide of sodium, in case an excess of carbonate of calcium is not used, due to the action of the coal on the carbonate of sodium: $CO_3Na_2+C=2CO+Na_2O$.

It is evident that by varying the proportions of the coals and lime, more or less caustic salts and caustic soda may be obtained. The latter branch of industry has been greatly developed in England, particularly since the adoption of the rotating soda furnaces. In France, where the latter are used but very sparingly, the soda salts contain only from 2 to 10 per cent of caustic soda. The first rotating furnace was built in 1853, by Messrs. Elliot & Russel, and has since been considerably perfected by Messrs. Stevenson, Williamson & MacTear.

The furnace as it is generally constructed and as exhibited at the Universal Exhibition of 1878, in Paris, consists of an enormous cast iron cylinder lined with fire brick, and arranged to rotate on the longitudinal horizontal axis, as shown in Fig. 1 of the annexed engravings, which we have taken from *La Nature.* The flames of an adjoining furnace pass into the cylinder at one end and escape at the other, passing through and heating the mass contained in the same. The cylinder is provided with several openings for filling and discharging it. These openings are closed by means of cast plates furnished with locking devices. The revolving furnace does not require any stirring and mixing of the mass as is necessary in the reverberatory or ordinary soda furnace, and it permits of operating much more rapidly.

Both in the reverberatory and revolving furnaces the raw soda forms hard lumps, if the proportions of Leblanc, as given above, are adhered to, and these lumps can only be lixiviated with the greatest difficulty. Mr. MacTear avoided this difficulty by adding about five per cent of quicklime to the mass, thereby obtaining a product that could be very easily lixiviated, for the lime expands as it comes in contact with the water and breaks the lumps into small pieces. A factory in Glasgow, using MacTear's improved revolving furnace and the above improvements in the process, produces fifty tons of soda in twenty-four hours.

The lixiviation is carried on in the apparatus and according to the continuous method of James Shank, as shown in Fig. 2 of the annexed engravings. A and B are vats or tanks containing the lumps of raw soda, and are provided with perforated false bottoms; CC are pipes which convey the lye from one tank to the other; by this means it is gradually concentrated and the soda is gradually and thoroughly lixiviated. The lye is evaporated in furnaces, heated by a separate fire or by the waste heat of the soda furnace, until it has the consistency of sirup, which mass is then placed in large crystallizing vessels, subdivided by perforated plates, like sieves. The carbonate of sodium settles on the sieve plates, whereas the impurities are contained in the concentrated lye. In order to obtain the commercial product the carbonate of sodium must be calcined. Mr. Thelen has constructed an apparatus in which the lye is evaporated and the crystals are collected mechanically as rapidly as they are formed.

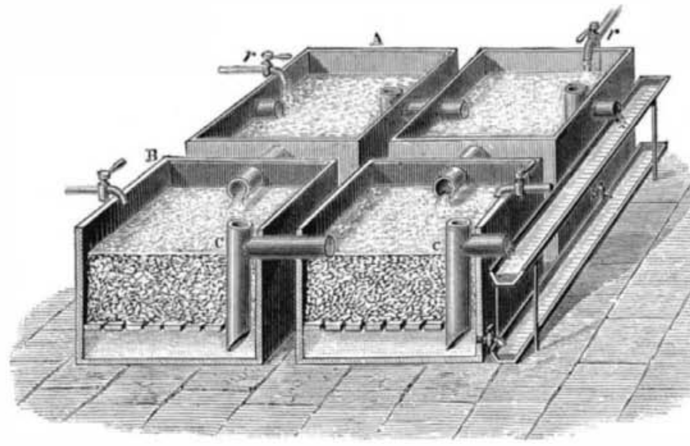


FIG. 2.—APPARATUS FOR LIXIVIATING SODA.

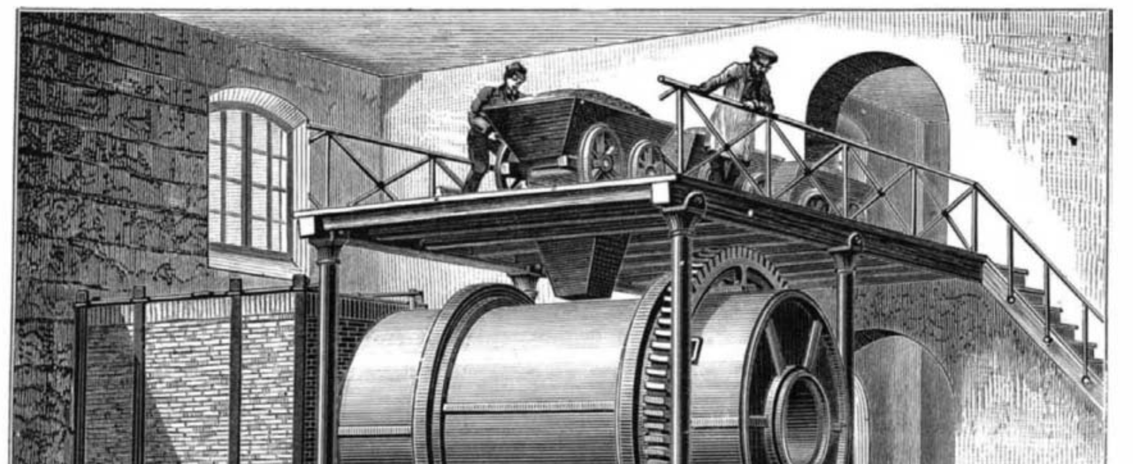
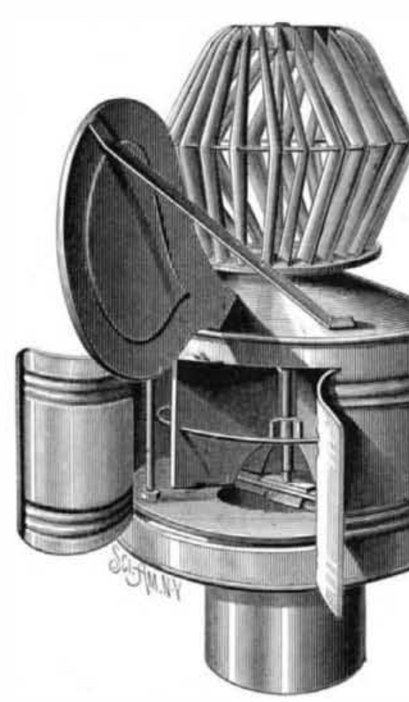


FIG. 1.—REVOLVING FURNACE FOR THE MANUFACTURE OF SODA.

A NEW VENTILATOR.

In comparing the various methods of ventilation, Surgeon General John S. Billings, U. S. Army, who has made ventilation a life study, and other eminent authorities, agree as to the power, capacity, and cheapness of the exhaust fan for the purpose of ventilation. Tall chimneys are useless for the purpose of ventilation without heat when the difference between the internal temperature of the house and the temperature of the external air is insufficient to produce a current, and when they are doing their average duty they are far more inefficient than is generally supposed.



THE WING VENTILATOR.

From the reports on ventilation in the Barnes Hospital Washington, D. C., for 1876, the chimneys there used showed an average current of less than 200 feet per minute when the fan was not in use. The current is usually much less than this. In the record of ventilation of the Boston City Hospital, December, 1877, and January, 1878, the average velocity of the air passing through ventilators was about 100 feet per minute. In the Brooklyn school buildings—generally supposed to be well ventilated—it is found upon examination that many of the ventilating shafts are absolutely without currents, while some of the buildings, provided with what have been considered efficient ventilators, show a current ranging from 30 to 170 feet per minute, with the rooms heated, and in many of the churches and public buildings in this and other cities it is found that the ventilating flues are, in the majority of cases, either entirely dead or with a downward draught, sometimes being found entirely sealed to stop a downward draught of cold air. This array of facts indicates that the question of ventilation has been hitherto unsatisfactorily dealt with. The ventilator represented in the accompanying engraving is constructed on scientific principles, and is well calculated to fulfill the requirements of an efficient ventilator.

The ventilator shaft used in connection with this device is enlarged as it extends upward, so that each successive story of a building may discharge into it without interfering with the proper ventilation of the lower stories. The cowl into which the ventilating shaft discharges is large and nicely pivoted, so that it turns easily with the wind. Its flaring mouth gives it peculiar advantages over the ordinary form of cowl, so that this of itself is a very efficient ventilator; but the chief merit of this device lies in the arrangement of the fan and its propelling wind wheel seen at the top of the cowl.

All the parts are made to work very freely and with but little friction. The fans are arranged so as to swing around the inner periphery of the casing, leaving an undisturbed central core, while the enlarged hood and vertical position of the fans offer no resistance whatever to the upward current of air in case the fan should not be in motion. In motion they force the air out through the lateral opening, thus producing a vacuum, aiding the natural draught or creating one where there was none.

With the Wing fan ventilator it is found after many tests that when the wind is not strong enough to run the fan, the peculiar form of the cowl, its enlarged size, and prompt action in shifting itself to windward, will give a regular current of from 100 to 200 feet per minute; while with a fair to brisk wind to run the fan the velocity will go up to 300 and 400 feet, while with a strong wind it often records over 500 feet, and has in several cases reached over 600 feet per minute. Six tests made November 20, 1879, at St. Denis Hotel, where there is a 24 inch shaft capped with a Wing ventilator, showed an average of 438 feet, being an actual exhaust of fully 100,000 cubic feet of foul air per hour. December 22, 1879, in public school branch of 15, Brooklyn, six tests showed a current of from 225 to 357 feet per minute, with 8 12-inch pipes leading into two large pipes of 24 inches each, showing an exhaust of over 146,000 cubic feet per hour, with only a light wind and no fires. Later same day the one in Brooklyn *Eagle* building showed a current from 230 to 270 feet per minute. November 20, 1879, the Irving House, where there are two of these ventilators, one over each tier of water closets, gave a current of 525 feet, there being a good breeze.

The inventor gives us an instance in which eggs put last summer in a cold storage house provided with his ventilators had kept until winter perfectly, while those in similar houses without the ventilators had failed to keep in good condition, showing clearly the need of fresh dry air, even in the preservation of eggs. For smoky chimneys or to prevent down draught this ventilator is particularly adapted.

Mr. Wing furnishes us with the names of a large number of persons using his ventilator, and has shown us some very flattering testimonials in regard to its efficiency.

For further information address Mr. L. J. Wing, or the Simonds Manufacturing Company, 50 Cliff street, New York city.

MISCELLANEOUS INVENTIONS.

An improvement in apparatus for drawing and preserving malt liquors, patented by Mr. John Neumann, of New York city, is designed for the purpose of drawing malt and other liquors from a barrel or other vessel, without the admission of air or gas thereto, so that the liquor remaining at any time in the barrel will be prevented from becoming stale.

An improvement in snap hooks has been patented by Mr. John B. Hampton, of Pomeroy, Ohio. This invention relates to an improvement in fastening buckles, loops, and hooks to harness, bridles, etc., and the object thereof is to enable the connection to be made without stitching or riveting.

An improvement in swivels for bridle rein loops, patented