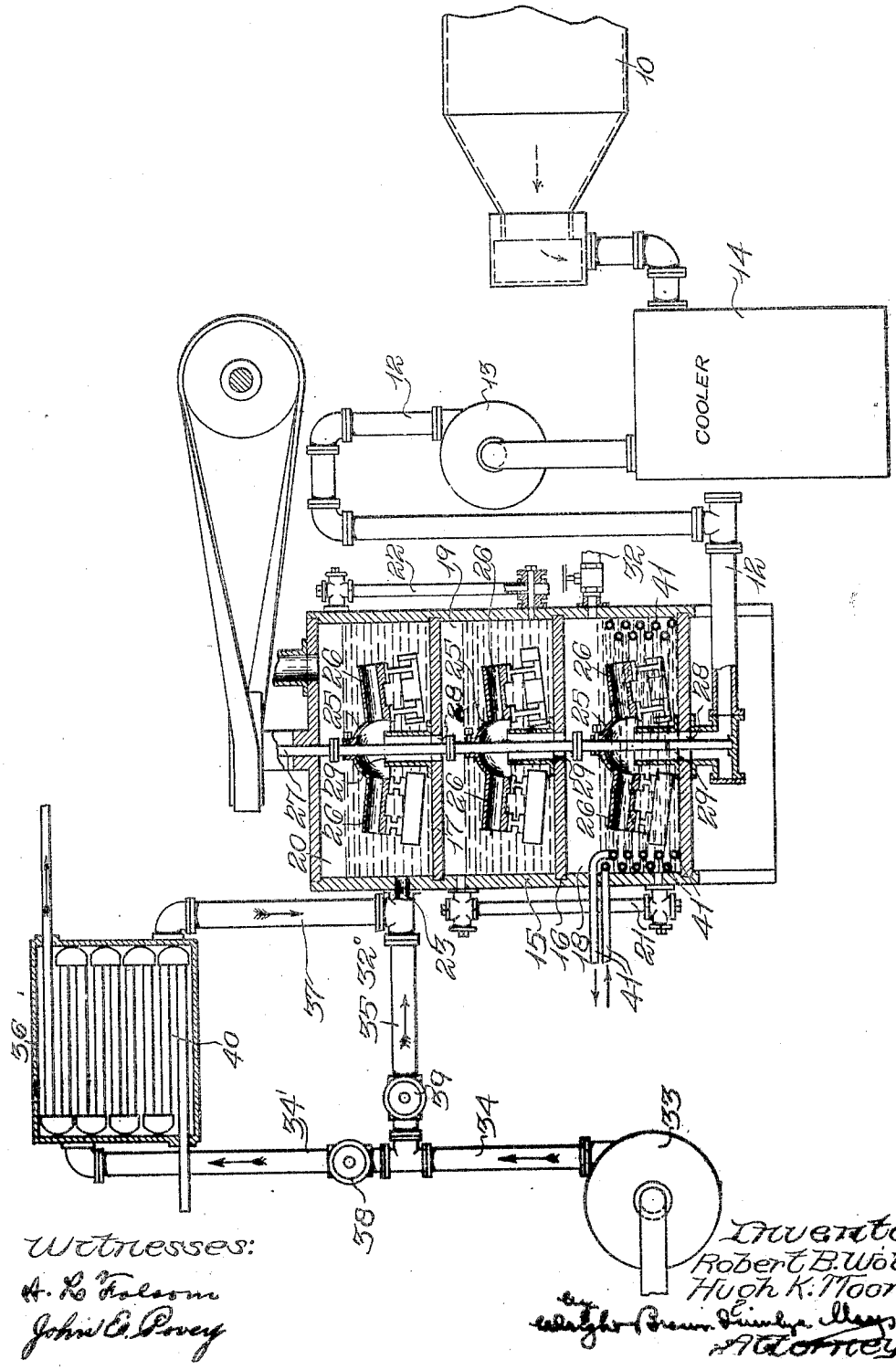
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METHOD OF MAKING SULFITE LIQUOR.

APPLICATION FILED DEC. 31, 1913.

1,099,565. Patented June 9, 1914.



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UNITED STATES PATENT OFFICE.

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METHOD OF MAKING SULFITE LIQUOR.

1,099,565. Specification of Letters Patent. Patented June 9, 1914.

Application filed December 31, 1913. Serial No. 809,659.

To all whom it may concern:

Be it known that we, HUGH K. MOORE and ROBERT B. WOLF, citizens of the United States, and both residents of Berlin, in the county of Coos and State of New Hampshire, have invented certain new and useful Improvements in Methods of Making Sulfite Liquor, of which the following is a specification.

This invention has relation to the manufacture of sulfite fiber in which the raw material is cooked in a digester in an acid liquor having therein more or less free or uncombined sulfurous acid.

The object of the present invention is to provide an acid liquor having a predetermined proportion of free sulfurous acid.

On the accompanying drawings, we have illustrated conventionally an apparatus which embodies the invention and which may be utilized in carrying out our process.

The figure illustrates a mixer, a cooler for the gas, a sulfur burner, a refrigerator for the milk of lime, a gas pump, and the various necessary connections.

It will be understood that the mixing apparatus, which is illustrated upon the drawings, may be substantially like that illustrated in United States Letters Patent No. 649,041, dated May 8, 1900, but that the invention is not limited to the employment of that particular mixer, as any other form may be employed which is capable for the purpose.

At 10 is illustrated conventionally a portion of a sulfur burner for producing sulfur dioxid gas. In the burner is burned either sulfur or any ore containing sulfur. From this burner, the products of combustion are conducted through a cooling apparatus 14 which condenses those gases having a volatilizing point higher than that of the sulfur dioxid, before the remaining products of combustion are delivered to the mixing apparatus where they are mixed with the milk of lime or other solvent. Any suitable or usual form of cooling apparatus or condenser may be used for this purpose, the temperature being so regulated that the gases delivered from the cooler are at a temperature of approximately 70° F. From this cooler, the uncondensed gases may be forced or pumped by a pump 13 through a conduit 12 to the mixer which is indicated as a whole at 15. The mixer which is illustrated comprises in its construction a casing having a plurality of horizontal partitions 16, 17 which divide the interior of the casing into compartments 18, 19 and 20. The lower part of the compartment 18 and the upper part of the compartment 19 are connected by a pipe 21. In a similar manner, the lower part of the compartment 19 and the upper part of the compartment 20 are connected by a pipe 22. The milk of lime or other solvent to be employed in making the acid liquor is introduced into the top compartment 20 through an inlet 23. The solvent thus introduced overflows from one compartment into the compartment immediately therebelow and is finally delivered through a valved discharge pipe 32 leading from the lowest compartment.

The gases from the cooler are thoroughly mixed with the solvent by suitable agitating devices. These are identical in form and operation, and each comprises a bell-shaped casing 25 provided with radiating hollow arms 26 for the emission of the gas into the body of the liquid. The several devices are affixed to a shaft 27 which extends through the top of the casing, and is provided at its upper end with a pulley by means of which it may be driven by power-transmitting mechanism from a convenient power shaft. The shaft projects through the bottom of the casing into the pipe 12 and is stepped in a bearing therein. Through the partitions are openings to receive the shaft, there being at each opening a short piece of pipe 29 to conduct the gas into the bell-shaped casing thereabove. The gas is thus conducted in series to the several compartments and is distributed through and mixed with the liquid. Such gas, as is not absorbed in the liquid in the lower compartment, passes therefrom into the compartment next above and is mixed with the liquid therein. Any unmixed gas passes therefrom into the higher compartment and is mixed with the body of solvent therein. The other gases escape through a conduit leading from the upper compartment.

The solvent is forced into the compartment 20 by a pump 33 which is connected to the inlet 23 by pipes 34, 35. If the initial temperature of the solvent, on account of atmospheric conditions, is in the vicinity of 32° F., the solvent may pass directly from the pump to the compartment 20. If, on the other hand, the initial temperature of the solvent is materially above 32° F., it is

caused to pass through a refrigerating apparatus prior to its admission to the mixer. At 36 a refrigerating apparatus is indicated which may be formed in any suitable manner. As shown, it consists of a casing through which the solvent passes and which contains a coil of pipe through which a refrigerated brine or other refrigerant is circulated. In cold weather, this cooler may be located out of doors and may be chilled or refrigerated by the normal out-of-door temperature. As shown, the solvent is conducted to the refrigerator by a pipe 34′ and is conducted thence to the mixer by a pipe 37. The coil for the refrigerant is indicated conventionally at 40. Suitable valves 38 and 39 may be provided to direct the solvent from the pump either to the mixer or through the refrigerator. The solvent is caused to enter the mixer preferably at approximately 32° F. On account of the sensible heat of the gases entering the solvent and on account of the heat liberated by the reactions taking place in the several compartments, the temperature of the mixture emitted from the lower compartment, unless the same is further refrigerated, will be approximately 50° F. The temperature of the solvent, as it passes through the mixture, gradually rises and its absorption capacity gradually decreases. Hence we may also provide means for refrigerating the mixture to compensate, to some extent at least, for the rise in temperature due to the chemical reactions and to the sensible heat of the incoming gases, thereby insuring the production of an acid liquor having a maximum predetermined proportion of free sulfurous acid.

On the drawing it will be observed that we have located in the lower compartment 18 a refrigerating coil indicated at 41. Through this coil is passed any suitable refrigerant, such as an expanding gas or a refrigerated brine. By this means, we are able to lower the temperature of the body of solvent materially to increase its absorption capacity and thus provide for the delivery of the solvent at a predetermined temperature, say at a temperature of 45° F. or even lower, and containing a greater proportion of free sulfurous acid than would otherwise be possible. The solvent, which has been preliminarily refrigerated to a predetermined temperature, is circulated through the mixer, and the gas is introduced into the mixer so as to pass in a direction opposite to the flow of the solvent. The undissolved sulfur dioxid entering the upper chamber meets the coldest body of solvent, and is practically all absorbed thereby. The temperature of the solvent is raised, and it flows into the next lower compartment where its temperature is still further increased by the heat of the gases and the heat of the reactions. Hence still more gas is absorbed, though the capacity of absorption is diminished. The solvent flows from the second compartment to the third or lowest compartment where the incoming body of gas is initially delivered, and where the sensible heat of the gas is greatest. In this compartment, however, the solvent is refrigerated, and its absorption capacity, due to its rise in temperature, is more or less restored, with the result that the proportion of free sulfurous acid contained in the effluent is increased.

We would not consider it a departure from the invention if each compartment in the mixer contained a coil for a refrigerant, so that each body of solvent could be refrigerated to compensate for its rise in temperature due to the heat imparted thereto by the gas.

It is apparent that the present invention is not limited to the form of refrigerating apparatus illustrated, and that said apparatus may be varied according to prevailing conditions and facilities as occasion requires to effect the desired refrigeration of the solvent.

So far as any generic features of the process are concerned, this application is a continuation of our application Serial No. 541,244, filed February 1, 1910.

What we claim is:

1. The herein described process of producing calcium bisulfite having a predetermined proportion of free sulfurous acid, which consists in refrigerating milk of lime to a constant predetermined temperature, and passing sulfur dioxid through said refrigerated milk of lime.

2. The herein described process of producing calcium bisulfite having a constant predetermined proportion of free sulfurous acid, which consists in preliminarily refrigerating milk of lime to approximately 32° F., and passing sulfur dioxid through said refrigerated milk of lime.

3. The herein described process which consists in the following steps, to wit: burning a sulfur-bearing substance, cooling the products of combustion to condense those having a higher volatilizing point than sulfur dioxid, refrigerating milk of lime to a constant predetermined temperature, continuously supplying the refrigerated milk of lime to and mixing the sulfur dioxid with the refrigerated milk of lime in a suitable mixer, and continuously withdrawing from said mixer calcium bisulfite having a constant predetermined proportion of free sulfurous acid.

4. The herein described process of producing calcium bisulfite having a constant predetermined proportion of free sulfurous acid, which consists in refrigerating milk of lime to a predetermined temperature,

mixing sulfur dioxid therewith, and refrigerating the mixture to a constant predetermined temperature.

5. The herein described process of producing calcium bisulfite having a constant predetermined proportion of free sulfurous acid, which consists in preliminarily refrigerating milk of lime to a predetermined temperature, passing said milk of lime through a mixer, passing sulfur dioxid, in the opposite direction into and mixing the same with the milk of lime in the mixer, and refrigerating the mixture to a constant predetermined temperature to compensate for the increase in the heat of the solvent due to the admixture of the gas with the solvent, whereby the desired constant proportion of free sulfurous acid in the mixture is secured.

6. The herein described continuous process which consists in introducing milk of lime and sulfur dioxid into a mixer, mixing the same therein, refrigerating the mixture in said mixer to a predetermined temperature, and withdrawing from said mixer calcium bisulfite having a constant predetermined proportion of free sulfurous acid.

In testimony whereof we have affixed our signatures, in presence of two witnesses.

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ROBERT B. WOLF.

Witnesses to Moore:
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