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APPARATUS FOR EVAPORATING FROTHING LIQUIDS.

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1,182,220.

Patented May 9, 1916.

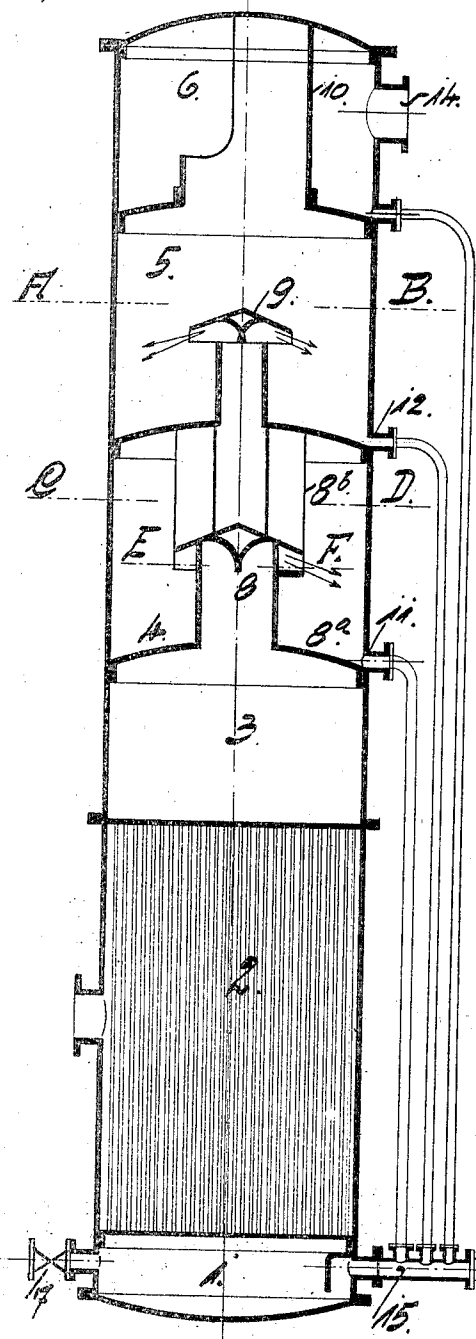


Fig. 1.

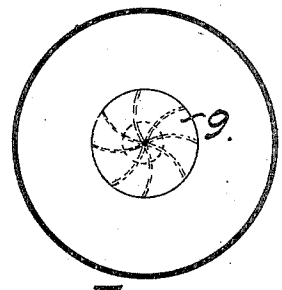


Fig. 4.

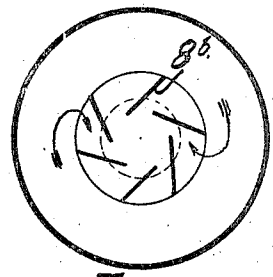


Fig. 3.



Fig. 2.

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APPARATUS FOR EVAPORATING FROTHING LIQUIDS.

1,182,220. Specification of Letters Patent. Patented May 9, 1916.

Application filed April 24, 1914. Serial No. 834,265.

To all whom it may concern:

Be it known that I, FRIEDRICH SEEGER, engineer and factory director, a subject of the Emperor of Germany, of 11 Königgrätzerstrasse, Magdeburg, Germany, have invented certain new and useful Improvements in Apparatus for Evaporating Frothing Liquids, of which the following is a specification.

The evaporation of certain mixtures of liquids having the tendency to froth very freely has hitherto, owing to lack of a suitable evaporating apparatus, been so difficult to accomplish that it has generally been abandoned in practice, although considerable economical advantages could be derived therefrom. Examples of such mixtures of liquids are solutions containing albumen, dextrin, oil and other substances which at boiling point are immediately converted into froth. One liquid of this kind is the sulfite liquor obtained in wood cellulose factories, especially in factories dealing with pine wood. As soon as this liquid exceeds a temperature of approximately 110° C. it has hitherto been found impossible to prevent it from frothing over. Moreover, with all the known types of apparatus it is necessary to work very slowly and to keep the density of the thinnest liquor above 11 to 12° Baumé, otherwise the ebullition is so violent that it is impossible to prevent bubbling over, and even the greatest care bestowed by the operatives fails to prevent froth from reaching the adjacent heating chambers. This results in a continual loss of the valuable liquor constituents and interferes with the normal working of the heating chambers, so that the cost for repairs is very considerable. These drawbacks have resulted in the complete abandonment at certain places of evaporation, the apparatus at the present day only being used at a few places where absolutely necessary.

Both the use of unreliable evaporators, and the method of working without evaporation, considerably increase the cost of the product, owing in the first case to the inadequate return on capital expenditure, and to the expense for repairs, and in the second case to the inefficiency of the whole process and great expense for coal in regenerating the waste liquor.

According to the present invention all these disadvantages are obviated by causing the froth or foam, with which the vapor is heavily charged when it leaves the heating chamber or generator, to be broken down by passing the vapor out of a froth or foam chamber through a nozzle device, preferably tapered, in which the vapor attains a very high velocity, the froth bubbles being broken down by friction with the nozzle walls. The velocity required for this purpose depends of course on the nature of the foam. With sulfite liquor a velocity of about 100 or 150 m. per second is generally suitable. The following advantages are thus obtained: 1. Small heating surfaces, and consequent saving of space and reduction of cost for plant. 2. Elimination of loss of liquor, owing to the absence of frothing. 3. Elimination of disturbance in the working of the heating chambers, by froth passing over. 4. The possibility of raising the pressure of the vapor sufficiently to allow it to be used at other parts of the plant, for instance for heating the drying chambers in sufite cellulose factories. 5. More regular working, as it is much less dependent on the attention of the operatives. 6. In sulfite cellulose factories, thinner liquors and wet wood or wet wood waste can be used, and the yield of cellulose is increased.

The invention is illustrated in the accompanying drawing, in which—

Figure 1 is a vertical section of the evaporator, and Figs. 2, 3 and 4 are cross sections of Fig. 1 on the lines E—F, C—D, and A—B respectively.

The evaporator comprises essentially the lower liquor chamber 1, the heating chamber 2 provided with vertical externally heated tubes, the froth chamber 3, the first separating chamber 4, with a separator 8, the second separating chamber 5, with an impact separator or baffle plate 9, and the third separating chamber 6 with a vapor pipe 10.

The thin liquor is introduced into the lower lye chamber 1 through the valve 7, and rises inside the heating tubes of the heating chamber 2, in which it is thickened. The vapor generated rises with the liquor almost entirely in the form of froth and passes as a mixture into the froth chamber 3, whence it passes at a very high speed through the separator 8 and at 8^a into the separating chamber 4. The speed at which the mixtures leave at 8^a is several times as great as the speed at which it previously

passed out of the heating tubes. After passing out at 8^a the speed of the vapor falls considerably. In order to force the mixture through the narrow cross section at 8^a, a much higher pressure must exist in the chamber 3 than in the separating chamber 4. The liquor bubbles, not broken up in passing through at 8^a, burst after entering the chamber 4, by the sudden expansion of the gas which they contain. The channels of the separator 8 project out tangentially at 8^a so that a rapid circulation of the vapor is produced and particles of liquor are driven outward, swept against the wall, and collect at the bottom, whence they issue at 11. Owing to the position of the blades 8^b the direction of travel of the vapor is completely changed, and the vapor flows toward the center and then into the separating chamber 5. With the vigorous froth eliminating action in the separating chamber 4 it is impossible to prevent the retention in the vapor of minute drops of liquid, especially in the case of liquor containing oil. These very minute drops are thrown with great force against the impact plate 9 by the stream of the vapor, which in the narrow delivery pipe of the impact separator 9 again attains a speed as high as, or higher speed than, the speed it had at the outlet 8^a. The shape of the impact plate is such that the drops of liquid are thrown downward at an angle and a circular movement is again imparted to the vapor by tangential blades or ribs. The arrangement is such that the speed of the vapor passing out of the impact separator 9 is so reduced that the downwardly thrown particles of liquid are not again carried away by the vapor. The particles which may be formed by internal condensation are swept off on the walls by the circular movement, and flow away at 12 with the other liquid. The vapor rises at a much reduced speed in the pipe 10, in which its speed is again slightly increased, and it then sweeps through the separating chamber 6 to the outlet 14. The pipe 10 extends to the top of the chamber 6, but is cut away, or open, at the side remote from the outlet 14. The differences of pressure in the chamber 3, 4, 5 and 6 render it necessary that the discharge pipes 11, 12 and 13 are separately joined to the return pipe 15 leading to chamber 1. The pipe 15 allows part of the liquor to enter the chamber 1, the remainder flowing away through the valve 16, through which only thickened liquor escapes.

What I claim as my invention and desire to secure by Letters Patent of the United States is:

1. In an evaporating apparatus, the combination with a vapor generator, of a froth chamber communicating with said generator, an outlet for said chamber, and means for imparting a high velocity to froth issuing from said chamber, said means comprising a discharge tube and a plurality of tangentially directed nozzles on said tube.

2. In evaporating apparatus the combination of a vapor generator, a froth chamber communicating with said generator, and a constricted discharge nozzle device on said froth chamber, whereby a high velocity and friction are imparted to froth issuing from said chamber, said nozzle device consisting of a tube and a plurality of tangentially directed nozzles on said tube.

3. In evaporating apparatus the combination of a vapor generator, a froth chamber communicating with said generator, a second chamber, having an outlet, a constricted discharge nozzle affording passage from said froth chamber to said second chamber, whereby a high velocity and friction are imparted to froth issuing from said froth chamber into said second chamber, and a baffle plate over the outlet of said second chamber.

4. In evaporating apparatus the combination of a vapor generator, a froth chamber communicating with said generator, a second chamber, having an outlet, a constricted nozzle device giving passage from said froth chamber to said second chamber, said nozzle device consisting of a tube and a plurality of tangentially directed nozzles, and guide blades between said nozzle device and said outlet, whereby the direction of the streams of vapor issuing from said nozzles is reversed.

Signed at Magdeburg, 15 this April day of 1914.

FRIEDRICH SEEGER.

Witnesses.
HOENR EYCH,
L. OEHLMANN.