Dec. 22 1925. 1,566,778

N. STATHAM

DRY DISTILLATION APPARATUS

Filed Dec. 12, 1921

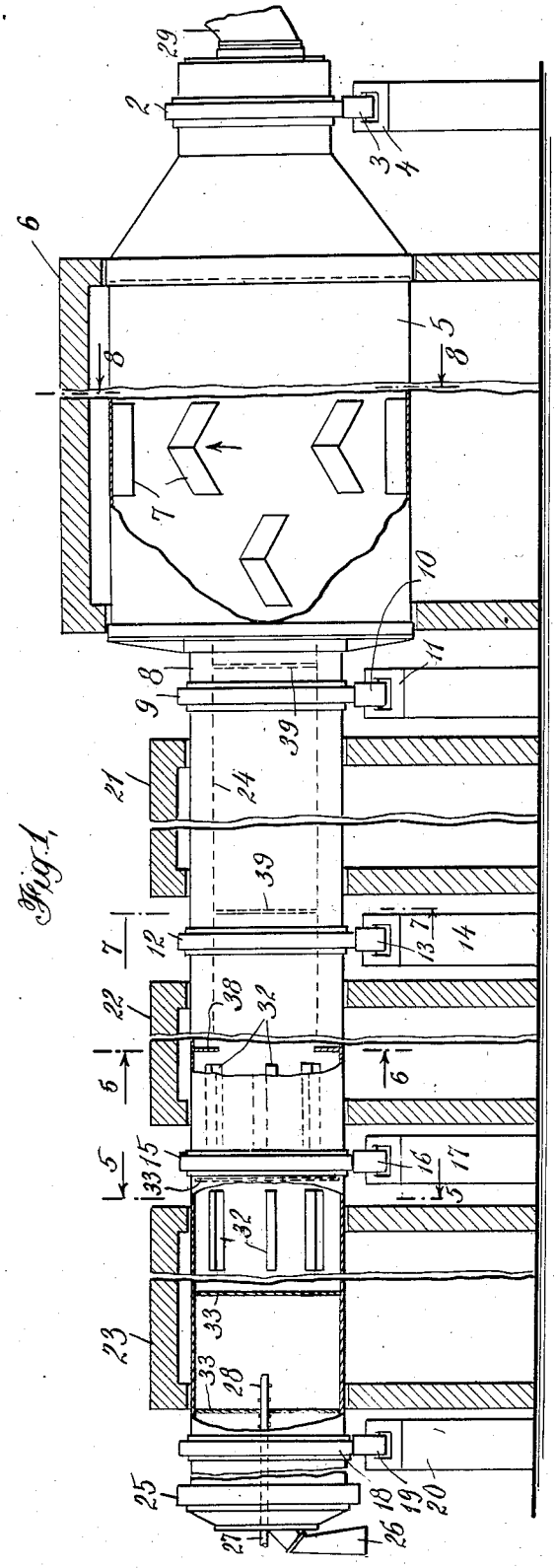


Fig. 1.

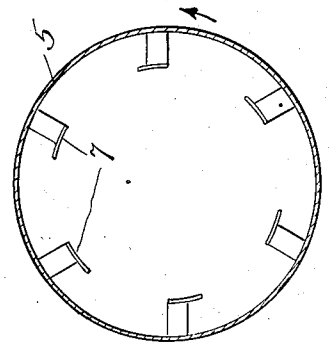


Fig. 8.

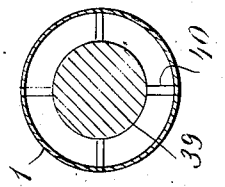


Fig. 7.

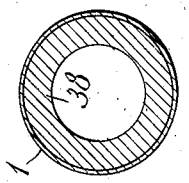


Fig. 6.

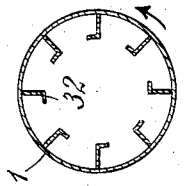


Fig. 5.

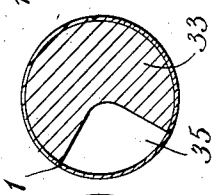


Fig. 4.

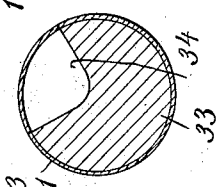


Fig. 3.

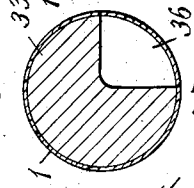


Fig. 2.

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UNITED STATES PATENT OFFICE.

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DRY-DISTILLATION APPARATUS.

Application filed December 12, 1921. Serial No. 521,663.

To all whom it may concern:

Be it known that I, NOEL STATHAM, a subject of the King of Great Britain, and resident of Irvington, county of Westchester, State of New York, have made a certain new and useful Invention Relating to Dry-Distillation Apparatus, of which the following is a specification, taken in connection with the accompanying drawing.

This invention relates especially to dry distillation apparatus comprising a large rotary chamber or retort in which acetone and similar volatile organic solvents may be efficiently produced from wood waste material such as the acetate material referred to in the Statham Patent 1,298,594, and the Drewsen Patent 1,298,480, both of March 25, 1919; the process of distillation being preferably conducted in the general manner described in my copending application Serial No. 273,539, filed January 28, 1919 and Serial No. 520,402 renewed June 30, 1921. This wood acetate material containing large proportions of lime and organic matter may be continuously fed in somewhat moist granular condition into the preliminary roasting or treating chamber of the retort in which it is heated and continuously agitated by the rotation of the retort and by special distributing agitating ribs projecting inward therefrom at suitable temperatures which seems to considerably promote the formation of acetates in this material. Then the heated material passes on into the main distilling chamber of the retort of somewhat smaller opening or diameter along which it is progressively fed by the inclination of the retort at such a rate that it takes a number of hours to pass through the retort which is heated hotter and hotter toward its discharge end so that the organic material is subjected to a dry distillation and carbonizing action. This main section of the retort is preferably formed with a number of gas retarding diaphragms or transverse partitions which reduce or more or less cut down the effective cross section of the retort so that more definite heating conditions can be secured at the different progressively heating sections. This seems particularly advantageous in connection with the use of superheated steam adjacent the carbonizing or discharge end of the retort where a number of jets of steam are admitted to improve the operation.

In the accompanying drawing showing in a somewhat diagrammatic way an illustrative embodiment of this invention—

Fig. 1 is a longitudinal sectional view showing the retort and its mountings.

Figs. 2, 3 and 4 are transverse sectional views showing different retarding diaphragms.

Fig. 5 is a transverse section showing the agitating ribs and taken substantially along the line 5—5 of Fig. 1.

Figs. 6 and 7 are transverse views showing other retarding diaphragms taken along the lines of 6—6 and 7—7 of Fig. 1, and

Fig. 8 is a transverse sectional view through the preliminary roasting chamber of the retort taken substantially along the line 8—8 of Fig. 1.

This retort which may be made of sheet steel plate riveted together may be mounted on suitable bearing rings arranged at intervals along the length of the retort such as 2, 9, 12, 15 and 18. These bearing rings may co-operate with suitable sets of bearing rolls such as 3 mounted in the brackets or supports 4 on a suitable foundation of concrete or the like and some of these bearing rolls such as 10, 13, 16 and 19 may be rotated, or, if desired, a rotating crown gear may be positively rotated if it is desired to more definitely control the speed of rotation and thus regulate the speed with which the material is gradually fed along the slightly inclined retort. A feed head or connection 29 may be arranged at the upper end of the retort through which the raw acetate material may be continuously or otherwise supplied and through which the gases and vapors may be discharged. This substantially airtight feed head communicates with the preliminary roasting chamber 5 of the retort which may be 10 to 15 feet in diameter and 20 to 35 feet long according to the capacity desired. This roasting chamber may be enclosed in the masonry heating chamber 6 so that this retort section may be externally heated to the desired temperature of 450 to 550° F. more or less. The ligneous acetate material is thus dried and simultaneously agitated by the rotation of the retort shell and the internal agitating

ribs or devices which are preferably provided. As indicated in Figs. 1 and 8 these internal ribs or projections 7 may at least in some instances be given a V or angular shape so as to laterally distribute the material which is carried up in these ribs or partially enclosed flights to thus promote the uniform distribution and heating of the material throughout this section of the retort in which the material may be treated for 4 to 8 hours more or less, which seems to promote the formation of acetates in such crude or ligneous acetate material as has been referred to so that the yield of acetone therefrom is considerably increased.

After this preliminary heating and roasting of the material the organic acetate material automatically passes into the main distilling chamber 1 of the retort which may be 5 to 7 feet in diameter more or less and mounted at a slight inclination of a fraction of an inch per foot so that the rotation of the retort shell gradually feeds the material along the retort towards its discharge end where a discharging device 25 automatically raises the material and distributes it into the stationary chute or conveyor 26. The discharge device 25 may advantageously be of the type illustrated and described in United States patent to Ten Broeck and Weston, No. 1,350,627, patented August 24, 1920. This main section of the retort is heated progressively in any desired number of heating chambers such as 21, 22 and 23 in which gas or other heating devices may be used to heat the retort shell to such temperatures as 650° F. or so in the chamber 21 for example; 700 to 800° F. in the chamber 22 and 900 to 950° F., for instance, in the final heating chamber 23 enclosing the carbonized section of the retort. This main distilling and carbonizing chamber of the retort may be 80 to 120 feet long more or less and may be provided with internally projecting ribs or agitating devices at various points such as the ribs or flights 32 shown as secured to the retort shell 1 in Fig. 5 and projecting inward considerably therefrom. In this way the organic acetate material is raised with the shell and agitated as it is raised and dropped again so as to be quite uniformly distributed and its uniform heating promoted at different parts or sections of the retort chamber. This is also promoted by installing a number of diaphragms at different points along the retort so that the effective or open cross section thereof is considerably reduced. Several such central diaphragms as 39 may be mounted on supports or spacers 40 secured to the retort shell so that the diaphragm may shut off the central part of the retort chamber and considerably retard the movement of gases therein in connection with the ligneous acetate material which, of course, occupies a considerable part of the cross section in the lower and ascending sides of the retort. Between or in connection with such central diaphragms, suitable ring diaphragms of the desired radial extent may be installed and bolted, riveted or otherwise secured to the shell as in the case of the ring diaphragm 38 shown in Figs. 1 and 6. Another type of gas retarding diaphragm which has proved advantageous in this connection is the sector opening diaphragm shown in Figs. 2, 3 and 4. These diaphragms are installed successively so as to have progressively displaced circumferential openings of sector shape or other suitable contour. Such diaphragms may be arranged at intervals of four to eight feet apart or so throughout the main distilling chamber or retort, if desired, and they are particularly advantageous in the hotter parts of this distilling chamber where 8 to 12 or so may be advantageously arranged at suitable intervals, in some cases with agitating ribs 32 between them. As shown in Figs. 2, 3 and 4, the circumferential or sector shape opening 36 which may be a quarter of the area of the diaphragm 33 may be arranged at an angle of about 120° from the opening 34 in the succeeding diaphragm while the opening 35 in the next diaphragm is still further angularly displaced. In this way convection currents of the gases in the retort chamber are controlled or prevented from assuming undesirable proportions so that the temperatures of the different sections can be more effectively controlled. One or more steam distributing or injecting pipes such as 27 may be arranged in or adjacent the discharge end of the retort and may extend 15 to 20 feet up the same with advantage. As shown in Fig. 1 the steam injecting pipe 27 is provided with a number of more or less radial small diameter distributing nozzles or holes 28 which may be located on both sides of the diaphragm 33 so that the superheated steam may be brought forcibly into engagement with the organic material in this part of the retort to effect its final conversion, especially where the steam is very highly heated before it is injected.

This invention has been described in connection with a number of illustrative forms, proportions, parts, arrangements, sizes, materials, temperatures, conditions and methods of use to the details of which disclosure the invention is not, of course, to be limited since—

What is claimed as new and what is desired to be secured by Letters Patent is set forth in the appended claims.

1. In apparatus adapted for treating and distilling ligneous acetate material, a combined rotary treating and distilling chamber formed of sheet metal and comprising an elongated substantially cylindrical distilling chamber, and a communicating enlarged

diameter treating chamber connected to said distilling chamber, a feed device to feed material into said treating chamber, a substantially airtight discharge device communicating with said distilling chamber, graduated heating means cooperating with said distilling and treating chamber and comprising a series of heating compartments and cooperating heating devices to maintain said heating compartments at different predetermined temperatures, means to continuously rotate said treating and distilling chamber to agitate and uniformly heat the acetate material in each part of the chamber and gradually feed such material into a more highly heated portion of said chamber, and a series of transverse diaphragms in said distilling chamber.

2. In apparatus adapted for treating and distilling ligneous acetate material, a combined rotary treating and distilling chamber formed of sheet metal and comprising an elongated distilling chamber having a series of transverse gas retarding devices and a treating chamber connected to said distilling chamber and having a greatly increased diameter, and graduated heating means cooperating with said distilling and treating chamber, means to rotate said treating and distilling chamber to agitate and uniformly heat the acetate material in each part of the chamber and gradually feed such material into a more highly heated portion of said chamber.

3. In apparatus adapted for treating and distilling ligneous acetate material, an elongated substantially cylindrical rotary distilling chamber, and a communicating large capacity treating chamber, a feed device to feed material into said treating chamber, a substantially airtight discharge device communicating with said distilling chamber, a steam injecting pipe extending through said discharge device, graduated heating means cooperating with said distilling and treating chamber, and a series of transverse gas retarding diaphragms mounted in said distilling chamber and comprising a series of eccentric opening diaphragms in which the opening is angularly displaced in adjacent diaphragms.

4. In apparatus adapted for treating and distilling ligneous acetate material, an elongated substantially cylindrical rotary distilling chamber, and a communicating enlarged diameter treating chamber, a feed device to feed material into said treating chamber, a substantially airtight discharge device communicating with said distilling chamber, graduated heating means cooperating with said distilling and treating chamber and comprising a series of heating compartments and cooperating heating devices to maintain said heating compartments at different predetermined temperatures, and a series of transverse gas retarding diaphragms mounted in the hotter part of said distilling chamber and comprising a series of sector opening diaphragms in which the opening is progressively angularly displaced.

5. In apparatus adapted for treating and distilling ligneous acetate material, an elongated substantially cylindrical rotary distilling chamber, and a communicating treating chamber of greater diameter, a feed device to feed material into said treating chamber, graduated heating means co-operating with said distilling and treating chamber and comprising a series of heating compartments and cooperating heating devices to maintain said heating compartments at different predetermined temperatures, and a series of transverse gas retarding diaphragms mounted in the hotter part of said distilling chamber and comprising a series of sector opening diaphragms in which the opening is progressively angularly displaced.

6. In apparatus adapted for treating and distilling ligneous acetate material, an elongated substantially cylindrical rotary distilling chamber, and a communicating large capacity treating chamber, a feed device to feed material into said treating chamber, a substantially airtight discharge device communicating with said distilling chamber, a steam injecting pipe extending through said discharge device, graduated heating means cooperating with said distilling and treating chamber, and a series of transverse gas retarding diaphragms mounted in said distilling chamber and comprising eccentric opening diaphragms.

7. In apparatus adapted for treating and distilling ligneous acetate material, an elongated distilling chamber having a length of over 100 feet, means to feed material into said chamber, graduated heating means cooperating with said chamber, means to rotate said chamber to agitate and uniformly heat the acetate material in each part of the chamber and gradually feed such material into a more highly heated portion of said chamber and a series of transverse gas retarding diaphragms mounted in the hotter part of said distilling chamber and comprising a series of sector opening diaphragms in which the opening is angularly displaced, and a steam injection pipe extending axially into the discharge end of said distilling chamber and having substantially transverse steam injecting openings on both sides of one of said sector opening diaphragms to supply superheated steam to the material.

8. In apparatus adapted for treating and distilling ligneous acetate material, a rotary distilling chamber and a communicating enlarged diameter preliminary treating chamber, a stationary feed device having an annular joint with said treating chamber, a

series of V-shaped agitating ribs projecting inward from the shell of said treating chamber to agitate the material and simultaneously distribute the same longitudinally of the chamber and graduated heating means cooperating with distilling and treating chambers to progressively heat the same to different predetermined temperatures.

9. In apparatus adapted for treating ligneous acetate material, a slightly inclined rotary distilling chamber formed of sheet metal, provided with a plurality of heating compartments, means for maintaining different temperature conditions in each compartment including independent external heating means associated with each compartment and diaphragms adapted to minimize the convection currents between said compartments while permitting the material to pass gradually from compartment to compartment through apertures in said diaphragms said apertures being eccentrically disposed in each diaphragm and angularly disposed relative to each other and means for rotating said distilling chamber to cause the material under treatment to pass gradually through the series of compartments.

NOEL STATHAM.