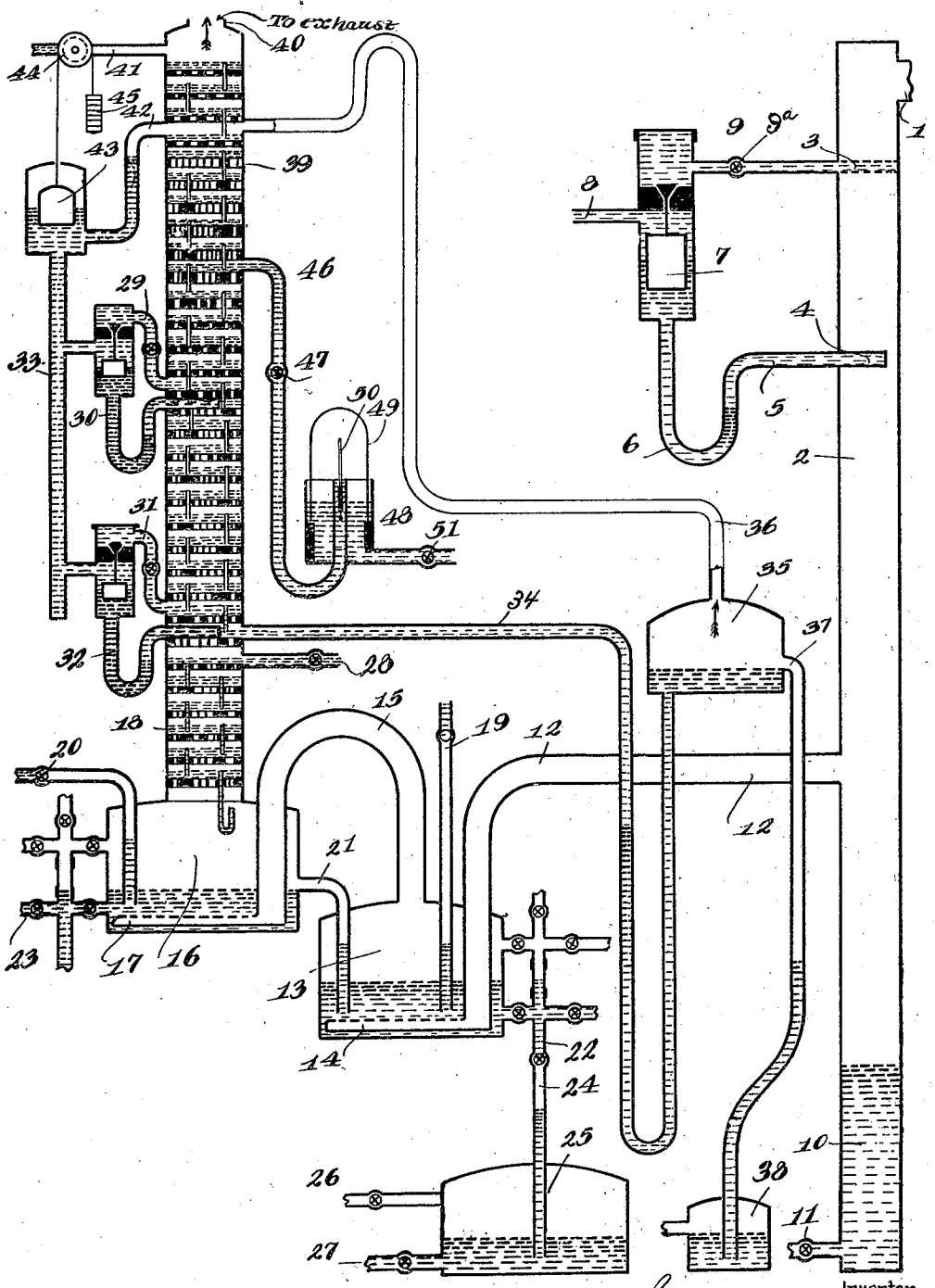
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METHOD AND APPARATUS FOR OBTAINING WOOD PRODUCTS.

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1,426,346. Patented Aug. 22, 1922.



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METHOD AND APPARATUS FOR OBTAINING WOOD PRODUCTS.

1,426,346. Specification of Letters Patent. Patented Aug. 22, 1922.

Application filed December 31, 1919. Serial No. 348,711.

To all whom it may concern:

Be it known that I, EDMOND BERTHELON, engineer, a citizen of the Republic of France, residing at Ax-les-Thermes, Ariege, France, have invented certain new and useful Improvements in Methods and Apparatus for Obtaining Wood Products (for which I have filed an application in France September 6, 1918); and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to the recovery and treatment of volatile products entrained by the gases resulting from the carbonization or distillation of combustible material and more especially as hereinafter described to the gases resulting from the carbonization or destructive distillation of wood with the recovery of anhydrous tar, the production of alkaline and other acetates and rectification of wood spirit.

The accompanying drawing shows diagrammatically a general arrangement of apparatus for carrying out the present invention.

The apparatus indicated in the drawing is constructed and arranged to work normally at a pressure slightly below atmospheric pressure, the partial vacuum being maintained by suction fans or other suitable means.

The gas or gases coming directly from the furnaces or retorts enter into the passage 2 by the pipe 1, the cross section of the passage being as large as possible so as to reduce the speed of circulation of the gases in the said passage thereby facilitating the deposit of material entrained in the gases or such material as is capable of being condensed in the passage 2.

These gases coming directly from the furnaces or retorts are at a high temperature, and as they remain some time in the passage 2 because of their low velocity, a certain decomposition takes place of the products intended to be recovered.

In order to avoid this decomposition the gases are cooled to the temperature required to permit of the series of operations taking place as hereinafter described, the said cooling being effected by the injection of water by an atomizer situated in the passage 2 and formed as a pipe 3 provided with holes of small diameter.

The injection of water is automatically controlled by lowered temperature of the gases by means of an apparatus comprising a tube 4 of which the part in the passage 2 is filled with a highly expansible fluid as at 5 which fluid is always at the same temperature as the gases in the passage 2.

The part of the tube 4 outside the passage 2 is bent into the form of a syphon. The branch of this syphon is filled with mercury as at 6, a sufficient quantity of highly expansible fluid 5 being left so as to prevent the mercury rising into the part 4 of the tube inserted into the passage 2.

The highly expansible fluid is therefore enclosed in the tube and cannot escape.

The mercury partly fills the enlarged upper part of the exterior branch of the tube 4.

The highly expansible fluid 5 acts on the mercury in the exterior branch of the syphon so that the level of the mercury is raised or lowered in the enlarged part of the tube and controls a float 7 rigidly connected with a valve situated adjacent the water inlet tube, 8, the water passing therefrom by the valve to the atomizing tube 3.

The valve is raised or lowered in accordance with the movement of the mercury, and consequently controls the admission of water to the passage 2 during working the admission of water to the passage 2 being dependent on the temperature of the gases in the passage 2.

If the temperature of the gases increases, the highly expansible fluid forces the mercury into the enlarged part of the syphon tube, the valve is raised and water is admitted in greater or less quantity according to the dilatation of the said fluid and consequently according to the temperature of the gases in the passage 2. If the temperature be lowered, the dilatable fluid contracts and the valve becomes more or less closed thereby reducing the quantity of water admitted to the passage 2. The delivery of water to the atomizer 3 can be controlled by a cock 9 so that the feed of water to the passage 2 is independent of the movement of float controlled valve without any modification in the water controlling means above described.

The gases thus partially cooled deposit the greater part of the condensable products, the boiling point of which is above the temperature desired to effect the cooling of the gases.

These condensed products collect at 10 and escape by the cock 11.

The passage 2 may be horizontal, inclined or vertical as desired.

The gases thus deprived in part of the products of high boiling point pass through the pipe 12 to the bottom of a closed vat or receptacle 13 filled to a certain height with liquid containing in solution, or suspension or in admixture therewith substances capable of saturating the acids contained in the gases in order to form therewith the desired soluble salts.

The gases entering at the bottom of the vat or receptacle 13 can only escape thereinto through the perforations 14 provided in the tube of which there may be any number, only one perforated tube being shown in the drawing.

Since the gases pass through the liquid covering the perforated tubes 14, the acids become saturated and the gases completely or almost completely deprived of acids pass through the pipe 15 to the bottom of a closed vat or receptacle 16 situated above the level of the vat or receptacle 13.

The vat or receptacle 16 contains liquids analogous to those contained in the vat or receptacle 13 and cover also perforated tubes 17, of which only one is shown in the drawing.

The gases escaping from the tubes 17 pass through the liquid which covers them and therein become completely deprived of the last traces of entrained acids.

From the vat or receptacle 16 the gases ascend the column 18, the mode of procedure therein being hereinafter described.

The materials intended to effect saturation of the acids are fed into the vats or receptacles 13 and 16 by tubes 19 and 20 provided with suitable stop cocks.

The vat or receptacle 16 is provided with an overflow tube 21 which delivers the excess liquid therefrom into the vat or receptacle 13.

Each of the vats or receptacles 13, 16, is provided with an arrangement of tubes or pipes and cocks 22, 23 for correcting the level of the liquid in the respective vats or receptacles.

The cocks from these levelling tubes, analogous to those in use in boilers serve as a means for withdrawing samples of the materials contained in the respective vats or receptacles 13, 16.

When the liquid in the first vat or receptacle 13 becomes concentrated or saturated and neutralization is desired, either wholly or in part or slightly acid in order to decompose the compounds which may be produced with the phenols or cresols entrained in the gases, the contents of the said vat or receptacle are wholly or in part evacuated through the tube 24 branched from the cock at the level 22 and debouching into the bottom of a vat or receptacle 25 situated at a lower level and containing a certain quantity of liquid so as to obviate the entry of air into the vat or receptacle 13 at the moment of opening the cock although the pressure in the vat or receptacle 13 is below atmospheric pressure.

The cock is closed at the end of the evacuation period and the liquid from the vat or receptacle 25 can be evacuated by opening the cocks 26 and 27.

The vat or receptacle 13 is refilled to desired level by opening the cock 20 on the vat or receptacle 16 until the overflow from the vat or receptacle 16 fills the vat or receptacle 13 to the desired level.

The liquids containing the salts which are produced by the action of the acids from the first vat or receptacle 13 are thus fed into the latter and the vat or receptacle 16 being always full of neutralizing materials retain all the acidic vapours collecting therein.

The solution evacuated into the vat or receptacle 25 contains oils and tars and cannot be treated by direct evaporation.

The decantation and filtration may be effected by the usual methods or preferably by means of a centrifugal separator described in an application for a French patent of even date herewith.

This apparatus permits the immediate decantation while hot, so that the maximum concentration of the liquid in the vat or receptacle 13 can thus be effected.

On their discharge from the second vat or receptacle 16 the gases deprived of acids pass into the column 18 serving for the condensation and rectification of wood spirit and other volatile materials.

All the trays provided in the column 18 other than that indicated by the reference numeral 39 are formed of plates having small holes and each tray is provided with an overflow pipe extending some millimeters above the upper surface of the tray and extending downwardly from the tray and engaging a recess or depression in the adjacent lower tray. In some cases the overflow tube is omitted and the liquid is there evacuated to the exterior of the column.

The trays are maintained at the desired distance apart by wedging or keying or by means of washers or catches as in ordinary rectification columns.

The trays are covered with liquid to the level of the overflow tube, the excess of liquid escaping to the lower tray.

The liquids are maintained on the trays

by the difference of pressure existing between the upper and lower surfaces.

In case of stoppage, the liquids descend through the various trays to the vat or receptacle 16 and thence into the vat or receptacle 13 which may be of such size as to contain all the contents of the column 18.

The gases entering the column 18 from the vat or receptacle 16 pass through the first few trays to which water is delivered by the tube 28 and are thus washed and deprived of any particles of materials entrained therein.

The quantity of water thus introduced passes from tray to tray and finally enters the vat or receptacle 16 and may be there reduced.

After having been thus washed, the gases pass to the upper trays contained in the column between the trays immediately above the water inlet 28 and the water inlet 29.

The admission of water by the tube 29 is automatically controlled by an arrangement 30 identical with that previously described in respect of the delivery of water to the atomizer 3.

The dilatable liquid is contained in a tube situated on the tray and is constantly at the same temperature as the interior of the column at this point; it thus controls the admission of water from 33 through the inlet pipe 29 in order that the temperature of the gases may be of the desired value. The water admitted by the tube 29 may be controlled by means of a cock.

Water is delivered from a tube 31 to one of the lower trays above the water inlet tube 28 supplied through the tube 33 the feed therefrom being controlled in a manner identical to that of the tube 29 by a similar apparatus but so controlled that the temperature of the liquid on the tray immediately above that on which water is delivered by the tube 28 may approach as near as possible the boiling point of water at the pressure therein.

The overflow from this tray does not escape to the lower adjacent tray and consequently the overflow tube is omitted and discharge is effected to the outside of the column by a tube 34.

This water being at or near the boiling point contains no wood spirit or only a very small quantity of wood spirit or other products of lower boiling point than the water.

The liquors before being rejected and in order to extract therefrom the last traces of wood spirit are led by the tube 34 in a closed vat or receptacle 35 wherein is maintained a reduced pressure by placing the receptacle 35 in communication by a tube 36 with the upper part of the column containing no liquors and before the last few trays. The pressure therein is lower than that at the tray from which the water is evacuated.

The last traces of wood spirit or products of a lower boiling point than that of water are thus entrained and condense in the last few upper trays in the column 18. The overflow from the vat or receptacle 35 escapes by the tube 37 into the vat or receptacle 38 from whence it is discharged into the atmosphere.

The arrangement of the tubes 34, 36 and 37 and of the tanks 35 and 38 is sufficiently clear in the drawing to show that the reentry of air into the apparatus cannot take place because of the reduced pressure therein, and there is no escape of the liquors from the column 18 into the vat or receptacle 35 by the tube 36.

The gases flowing from the column 18 above the water inlet 29 circulate in the upper trays, no water being delivered to the trays compressed between the water inlet 29 and the first of the trays 39 hereinafter described, the latter set of trays being shown of considerably less thickness than the ordinary trays.

The trays situated between the water inlet 29 and the first of the trays 39 only receive all or part of the wood spirit condensed in the upper regions and which redescends towards the lower trays, then becomes vapourized, and again condensed and finally the vapours flow into the upper regions containing only small quantities of water, the major part of the rectification of the wood spirit being effected in this region. The gases then flow into the trays 39.

These trays receive no water and are of identically the same construction as the honeycomb radiators used for cooling the motors of automobiles. The cooling water circulates in the interior thereof.

The construction of the honeycomb radiator apparatus is not illustrated in detail in the drawing.

The gases flow through the holes of these radiators and become cooled by their contact with the walls to the temperature of the supernatant liquid, which escapes by an overflow tube which extends for some millimeters above the radiator or tray and debouches on the upper part of the lower tray into a recess or groove provided for the purpose.

Several of the superposed trays cool the gases and condense a part of the wood spirit and other products.

Before flowing to the exhausting apparatus through the pipe 40, the gases escaping from the last tray 39 give up the volatile products and the wood spirit entrained while passing through the trays which receive the water from the tube 41 and escape by the overflow pipe at the level 42 through which they pass into the reservoir 33. Consequently this water cannot escape from the tray 39 and does not mix with the wood spirit.

The level of the liquid in the reservoir 33 which feeds the tubes 29 and 31 is maintained constant by means of a float 43 controlling the water inlet 41, the float is suspended by a rope passing round a pulley, the other end of the rope carrying a counterweight or sectional counterweight. The pulley on rotating is adapted to actuate and control a cock 44.

The counterweight tends to close the cock 44, while movement in the opposite direction acts to open the cock.

All the vapours condensed by the passage of the gases through the cooling water reenter the column 18 and the gases are deprived as far as possible of vapours capable of being recovered.

During working, the condensable products being mixed with large quantities of gas cannot remain on the honeycomb radiators 39 and are entrained upwards, but stopped by the upper washing trays between the inlet 41 and the outlet 42 of the cooling water which condenses and delivers them into the intermediate part of the column 18 through the reservoir 33 supplying the tubes 29 and 31 with feed water.

The products thus accumulate in the column 18 until their proportion relative to the gas coming from the furnace or retort is such that a part can be condensed by the honeycomb radiator trays 39, the excess which escapes condensation being stopped by the last few washing trays.

From the honeycomb radiator trays the overflow escapes on to the lower trays, and is again vaporized, then recondensed and finally the product which collects on the trays is then brought to the desired alcoholic condition.

At this stage a part can be withdrawn from the column 18 by means of the tube 46 branched above the lower honeycomb radiator trays and which is closed by the cock 47. The tube 46 is bent into the form of a syphon and is placed at a suitable distance below in order to avoid a re-entry of air to the opening of the cock 47. The branch of the syphon which is not rigid with the column is enclosed in a hole 48 of larger diameter, the bore of the lower part being reduced and adapted to support a glass gas bell 49.

An alcoholmetre 50 is placed in the tube 46 which is full of liquid from the trays, the said alcoholmetre permitting of testing a sample withdrawn from the glass bell.

The tube 46 overflows into the tube 48 and escapes through the tube 50. At the end of a certain time the cock 47 may be left permanently open to allow only a small quantity of liquid to escape the quantity escaping corresponding to the distillation, whilst there remains in the column a quantity sufficient to ensure working as above described.

The fractions of liquid withdrawn and incompletely rectified can be reintroduced into the column for final rectification.

The oils or hydrocarbons condensing in the lower trays can be withdrawn by cocks provided in the column at any desired height of the liquid on each tray and by withdrawing a part of the liquid at that particular place.

The liquors diluted with cold water may be allowed to stand to permit the oils and residual matters separating out and may be returned to the column 18.

The working of the apparatus may therefore be thus rendered permanent.

What I claim is:—

1. The method of recovering by-products from the gas arising from the destructive distillation of combustible material, consisting in discharging such gases at high temperature into a receiver from which air is extracted, cooling such gases in said receiver by injecting water therein to cause the condensable products to collect in the bottom of said receiver; passing such gases into another receiver containing substances capable of saturating the acids contained in such gases to form therewith soluble salts; passing such gas upwardly through a column, and washing such gases with water during such passage.

2. In apparatus of the class described, the combination of a receiver for the gases arising from the destructive distillation of combustible material, a second receiver into which the gases are discharged from the first-named receiver, means to inject water into the first-named receiver, and controlling means for said injecting means and including a regulating element responsive to variations in temperature in said first-named receiver.

3. The method of recovering by-products from the gas arising from the destructive distillation of combustible material, consisting in discharging such gases at high temperature into a receiver from which air is extracted, cooling such gases in said receiver to cause the condensable products to collect in the bottom of said receiver; passing such gases into another receiver containing substances capable of saturating the acids contained in such gases to form therewith soluble salts; passing such gas upwardly through a column, washing such gases with water during such passage, and reducing pressure in the upper portion of said column.

4. The method of recovering by-products from the gas arising from the destructive distillation of combustible material, consisting in discharging such gases at high temperature into a receiver from which air is extracted, cooling such gases in said receiver to cause the condensable products to collect in the bottom of said receiver; passing such gases into another receiver containing sub-

stances capable of saturating the acids contained in such gases to form therewith soluble salts; passing such gas upwardly through a column, washing such gases with water during such passage, withdrawing heated, gas-washing water from the lower portion of said column to a closed vessel to reduce pressure and establishing gas communication between the upper portion of said closed vessel and the upper portion of said column.

5. A receiver for the gases arising from the destructive distillation of combustible material, a column rising from said receiver, gas-washing means in the lower portion of said column, gas cooling means in the upper portion of said column, means to withdraw heated water from the lower portion of said column and reduce the pressure thereof, and means to convey gas from said pressure reducing means to the upper portion of said column.

In testimony whereof I affix my signature in presence of two witnesses.

EDMOND BERTHELON.

Witnesses:

GERMAINE CHAINE,

RENI FOMBORME.