G. H. TOMLINSON.

PROCESS OF TREATING LIGNO CELLULOSE FOR RECOVERING TURPENTINE AND SUGAR.

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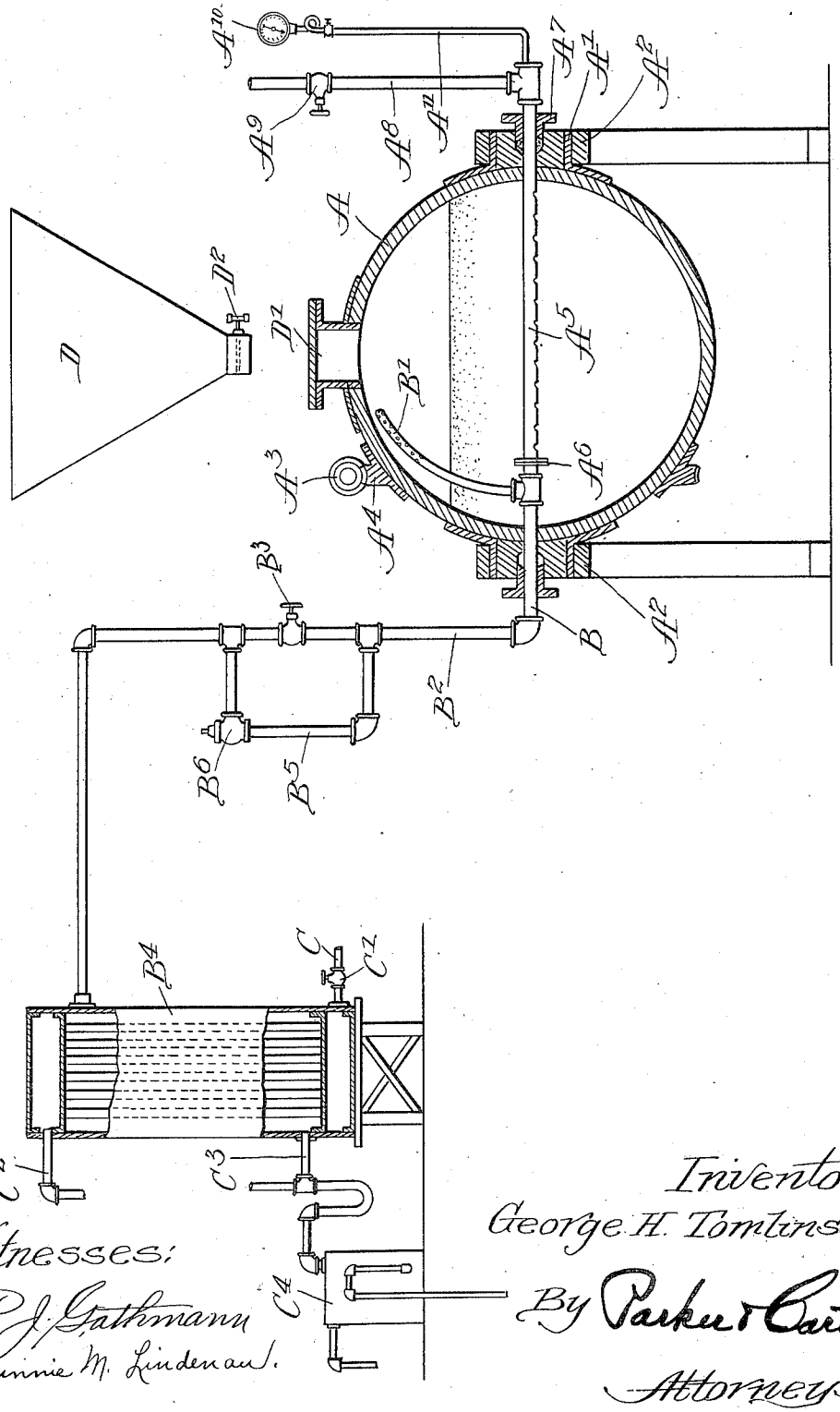

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PROCESS OF TREATING LIGNOCELLULOSE FOR RECOVERING TURPENTINE AND SUGAR.

1,032,443. Specification of Letters Patent. Patented July 16, 1912.

Application filed December 20, 1910. Serial No. 598,298.

To all whom it may concern:

Be it known that I, GEORGE H. TOMLINSON, a subject of the King of England, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in the Process of Treating Lignocellulose for Recovering Turpentine and Sugar, of which the following is a specification.

My invention relates to a process for recovering volatile hydrocarbons and fermentable sugar from turpentine bearing ligno cellulose.

One apparatus for converting the sugar and recovering the hydrocarbon is illustrated in the accompanying drawing but it is to be taken as simply illustrative or diagrammatical.

The digester A which is rotatably mounted on the trunnions A^1 in the bearings A^2, is driven by the worm A^3 and wheel A^4 and contains the axially located perforated pipe A^5 which is closed at one end by the blind flange A^6, passes out of the digester through the stuffing box A^7 and communicates by means of the pipe A^8 and supply valve A^9 with any suitable source of steam supply not shown. The pressure gage A^{10} is connected by means of the pipe A^{11} with the pipe A^5. The pipe B which is closed at one end by the blind flange A^6 has the upwardly extending perforated branch B^1 within the digester and connects at its outer end with the pipe B^2 which is controlled by the exhaust valve B^3 and leads to the condenser B^4. The by-pass B^5 controlled by the safety pop valve B^6 leads from the pipe B^2 on one side of the valve B^3 back to the pipe on the other side. Water is supplied to the condenser by the pipe C controlled by the valve C^1 and discharged therefrom by the pipe C^2. The condensation products are discharged from the condenser through the pipe C^3 to the separator C^4 which extracts the turpentine. The sawdust or ligno-cellulose which is to be used is stored in the bin or hopper D and discharged therefrom into the digester through the man-hole D^1, being controlled by the valve D^2.

It will be evident that while I have shown in my drawing an operative device still many changes might be made in size, shape and arrangement of the parts without departing materially from the spirit of my invention, and I wish, therefore, that my drawing be regarded as in a sense diagrammatic.

The process which may thus be carried out consists broadly stated in utilizing the same heat which causes the conversion of the sugar to vaporize and cause the carrying off of the volatile hydrocarbons..

A more particular form of the process is that wherein steam is employed to heat the ligno-cellulose and bring about the conversion of the sugar and to vaporize the hydrocarbon and carry it off.

The preferred materials employed are comminuted ligno-cellulose of a turpentine bearing nature such particularly as the sawdust of coniferous woods, the preferred acid which is employed for assisting and bringing about the conversion of the sugar is a nonvolatilizing acid and preferably sulfuric acid. In this case the turpentine may undergo partial or complete conversion to cymene or analogous hydrocarbons. A nonvolatilizing acid is preferable because if any other is used, its volatilization by the heat would interfere with the conversion and it will tend to be carried off with the turpentine. The preferred method of heating is by the introduction of steam. The conditions of operation which are preferred are those wherein the steam is first employed to raise the temperature of the mass while volatilizing and discharging the hydrocarbon, and this process is continued until the temperature of conversion is reached, whereupon thereafter the preferred method of carrying on the process is to discontinue the recovery of the hydrocarbon, but to confine the process thereafter to the conversion of the sugar at a relatively fixed temperature. The recovery of the hydrocarbon is preferably carried on by means of some condenser and the recovery of the sugar from the digested comminuted ligno-cellulose by some form of diffusion battery. The preferred apparatus is one in which a mass of material is contained, but a space in the top thereof is left for the accumulation of gases and vapors. This discharge way for the hydrocarbon vapors connects with this space in the upper part of the digester, while the steam is preferably introduced into the body of the material within the digester.

To illustrate the carrying out of my process I may take about 4000 lbs. of sawdust

of coniferous wood, containing about 30% of moisture and introduce this into the digester. At the same time and along with it and thoroughly mixed with the sawdust, I introduce about 50 lbs. or somewhat less of 60 degree sulfuric acid, preferably diluted with about 200 lbs. of water. The total moisture-content of the mass prepared for conversion should in all cases be less than is required to saturate the sawdust, whereby the mass is in an unsaturated and permeable condition favorable to the rapid and complete elimination of the hydrocarbons. I may then close the digester and turn on steam at about 100 lbs. pressure, turning the digester. I may then continue this process, the hydrocarbon vapor being carried over as rapidly as it is being formed and the operation being continued as slowly or rapidly as experience may determine. When the temperature has reached the point where the formation of the sugar takes place, which will be somewhere between 275 and 325 degrees Fahr. or say approximately 300 degrees, the steam supply may be cut off and the connection with the condenser cut off. The pop valve properly set will then serve to keep the pressure uniform. The material may then be kept at such temperature for about 30 minutes whereupon the contents of the digester may be discharged into the diffusion batteries so that the fermentable sugar may be recovered therefrom. In the meantime the vapors of the hydrocarbon are carried over with the steam which condenses and the hydrocarbon is ultimately recovered.

I am the first to thus recover by continuous process from turpentine bearing ligno-cellulose both fermentable sugar and turpentine or other volatile hydrocarbon, and I wish my descriptions of the process and apparatus to be taken in their broadest sense.

I claim:

1. The process of producing fermentable sugars from ligno-cellulose of resinous woods, which consists in digesting the material in an unsaturated and permeable condition by direct action of steam, withdrawing and condensing the volatile hydrocarbons liberated during the initial stages of the digestion, and continuing the digestion, in presence of a suitable hydrolyzing agent, until the fermentable sugars are formed.

2. The process of producing fermentable sugars from ligno-cellulose of resinous woods, which consists in digesting the material in an unsaturated and permeable condition by direct action of steam and in presence of a suitable hydrolyzing agent, withdrawing and condensing the volatile hydrocarbons liberated during the initial stages of the digestion, and continuing the digestion until the fermentable sugars are formed.

3. The process of producing fermentable sugars from ligno-cellulose of resinous woods, which consists in heating the charge in an unsaturated and permeable condition by direct action of steam to a temperature suitable for the production of fermentable sugars, withdrawing and condensing the hydrocarbon vapors evolved during the heating, and continuing the heating, at relatively fixed temperatures, under pressure of steam and in presence of a suitable hydrolyzing agent, for the production of such fermentable sugars, the temperature and duration of the initial heating being adequate for the substantial recovery of the available hydrocarbons.

4. In a process of producing fermentable sugars from ligno-cellulose or other cellulosic raw materials, the step which consists in heating the material in an unsaturated and permeable condition and in a state of motion, by direct application of steam, and simultaneously withdrawing vapors from the moving mass.

5. In a process of producing fermentable sugars from ligno-cellulose or other cellulosic raw materials, the step which consists in heating the material in an unsaturated and permeable condition and in a state of motion, by direct application of steam and in presence of a suitable hydrolyzing agent, and simultaneously withdrawing vapors from the moving mass.

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