

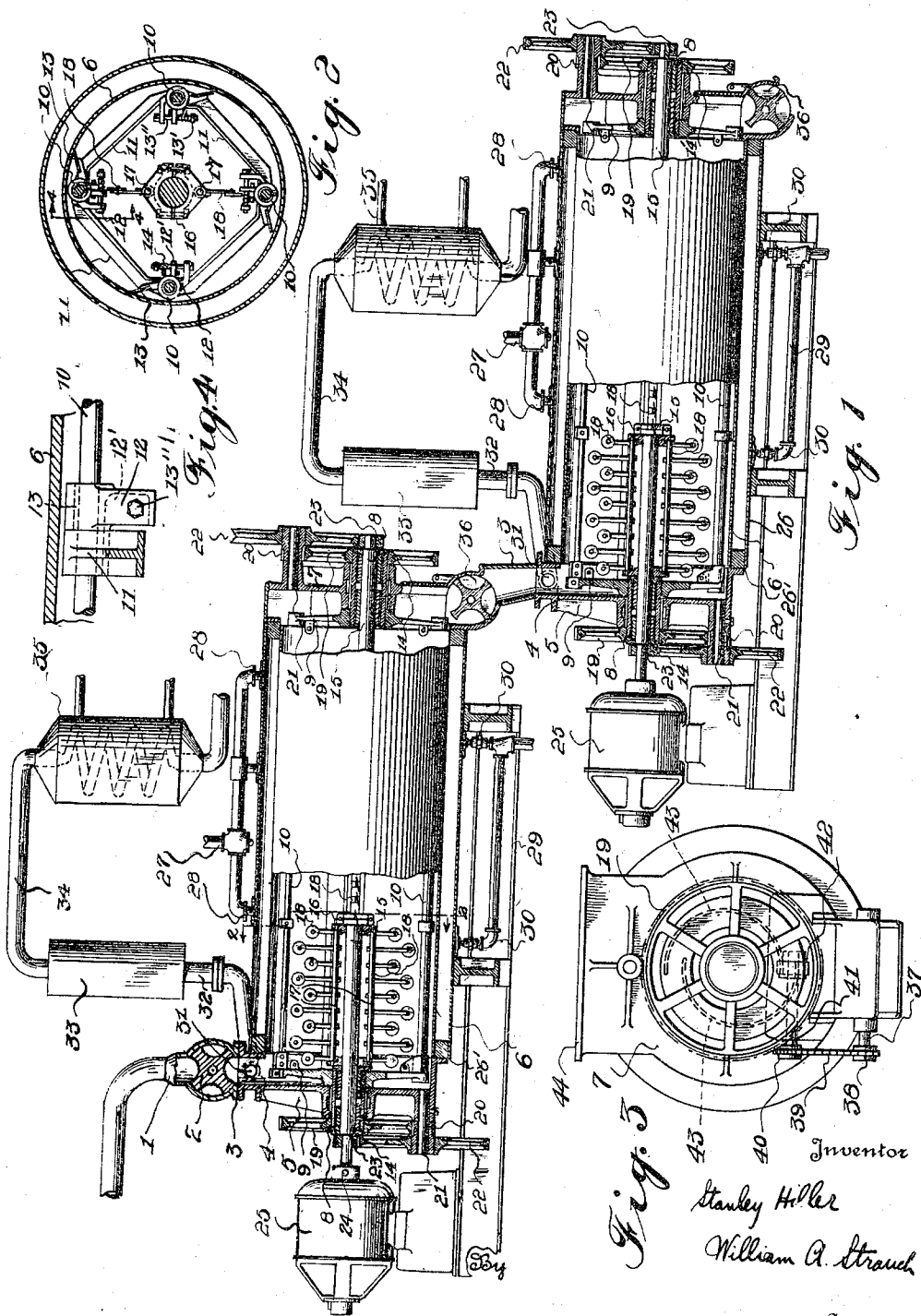
Nov. 12, 1929.

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1,735,394

PROCESS FOR DISTILLING SOLID CARBONACEOUS MATERIAL

Original Filed Aug. 9, 1924



UNITED STATES PATENT OFFICE

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PROCESS FOR DISTILLING SOLID CARBONACEOUS MATERIAL

Original application filed August 9, 1924, Serial No. 731,146. Divided and this application filed May 26, 1925. Serial No. 32,948.

The present invention relates to distilling processes.

More particularly the invention relates to processes and apparatus for distilling materials such as coal, shale, crude oil, sawdust, wood and wood refuse, straw, organic matter; distilling solvents from lard, greases and like materials; for fractional distillation of hydrocarbons in the production of absolute alcohol and in general to the distillation of any material solid or liquid up to temperatures which may be withstood by a metallic cylindrical shell, and which may be subjected to impacting beating, striking and mixing, or to mechanical subdivision, and to the simultaneous action of heat.

The preferred form of apparatus for carrying out my invention comprises one or more fixed heated cylinders in which beaters or hammers revolving at high speeds strike and shatter the material, and dash it against the cylinder, spreading it in thin layers around the interior, while a set of slow speed revolving scrapers, wipers or lifters immediately remove the material from the heated surface, to be again struck, shattered, and impacted against the cylinder by the beaters or hammers. The scraping, wiping, or lifting and throwing, dashing and impacting actions are repeated many times a minute, the material being started at the feed end of the cylinder and progressively advanced toward the discharge end as the drying proceeds, until the desired degree of evaporation of volatile constituents or distillation has been attained, when the material is discharged from the cylinder. A thin continually changing and thoroughly mixed layer of material is maintained in contact with the heated surfaces and effective rapid distillation occurs.

The invention makes possible continuous and economical low temperature distillation of products, such as sawdust, wood chips, straws, stalks, weeds and the like, and all

carbonaceous matter. The by-products may be recovered from the gases and the powdered residue used as charcoal or used for fuel. These fuels are utilized in a manner to cause complete combustion and the waste due to ash, clinkers, and inefficient burning is eliminated, causing an enormous saving in fuel. The temperatures of drying and distillation may be maintained so low that the combustible contents which volatilize at high temperatures remain in the fuel adding to the thermal or calorific value thereof, while dangers from explosions are reduced to a minimum due to low temperatures and exclusion of the atmosphere. The low temperatures of distillation result in the recovery of improved by-products.

A preferred form of apparatus for carrying out my invention is disclosed in the accompanying drawings of which

Figure 1 is a side elevation partially in section showing the preferred form of apparatus embodying two units in cascade.

Figure 2 is a section taken along line 2—2 of Figure 1.

Figure 3 is an end view of the discharge end of the apparatus.

Figure 4 is a partial sectional view on line 4—4 of Fig. 2.

The materials to be distilled are fed through hopper 1 by pumping or by conveyors in accordance with the nature thereof, to a valve 2 which is driven continuously in any suitable manner to deliver the materials at a predetermined and controlled rate through feed passage 3. From passage 3 the material drops through a passage 4 into the feed end casting or head 5 of the apparatus. A cylinder 6 is supported at one end in and communicates with head or casting 5, and at its other end the cylinder 6 is supported in and communicates with a discharge head or casting 7. Journaled in the heads 5 and 7 are drive sleeves 8 which are secured to the lifter supporting spiders 9. Supported in

and connecting the spiders 9 into a rigid cage or structure are rods 10 which extend through the cylinder 6 and are spaced apart and strengthened by members 11. Supported and journaled at spaced points along the rods 10 adjacent the strengthening members 11 are spider supporting members 12 on which are supported the scraping, wiping, or lifting bars 13. Springs 14 seated between extensions or shoulders 12' of members 11 and nuts 13' on bolts 13 are arranged to force the members 12 about the rods 10 until the wipers or lifters 13 engage the interior surface of cylinder 6. Sets of bushings 14' are provided inside of the sleeves 8, and journaled for rotation in these bushings is a high speed beater or hammer shaft 15 extending through the cylinder 6. Supported within the cylinder 6 on the shaft 15 by means of split collars 16 and the diametrically spaced rods 17 are a series of adjacent pivoted hammers or beaters 18 arranged in spaced sections. The adjacent sections of pivoted hammers or beaters are arranged so that when shaft 15 is rotated the hammers will extend at right angles to each other to effect the advance of the materials through the cylinder 6, the hammers or beaters are preferably given a slight angle or twist with relation to the axes of the cylinder so that as the material is struck it is thrown slightly forward. The feed may however be effected by inclining the cylinder or giving the bars 13 a slight helical twist, or any combination of these expedients may be utilized.

Sleeves 8 have secured thereto and are driven by spur gears 19 at each end of the unit, and gears 19 mesh with and are driven by pinions 20. Pinions 20 are rotatably mounted on stub shafts 21 and pinions 23 are rigidly secured to and driven by spur gears 22. Gears 22 are in turn driven by pinions 23 which are rigidly secured to and rotatable with the beater shaft 15. Beater shaft 15 is driven through a clutch 24 by a suitable motor 25 or in any other desired manner.

The cylinder 6 is heated by means of a jacket preferably formed by enclosing it in a concentric cylinder 26 which is spaced away from cylinder 6 by suitable mud rings 26' which form the ends of the heating jacket. For low temperature distillation steam under pressures up to 100 pounds per square inch or more is circulated through the jackets by means of inlet connections 27 and 28 and outlet connections 29 and 30. For higher temperature distillation heated products of combustion are passed through the jacket in the manner disclosed in copending application S. N. 731,146, filed August 9, 1924, of which the present application is a division.

The distilled vapors and gases are withdrawn through opening 31 in the inlet passage 4 and pass through vapor duct 32 into the column 33 of any well known form. From

column 33 the vapors pass through pipe 34 to a condenser 35 of any suitable form in which the distillate is condensed. The materials are passed through the cylinder 6 continuously as the distillation proceeds and are discharged through an outlet opening in the discharge head 7 into a continuously rotating discharge valve 36. The valve 36 is provided with pockets and maintains a mechanical seal against the admission of cold air when only one unit or still is utilized as the material is discharged. Valve 36 is driven by means of a shaft 37 which in turn is driven by sprocket 38 secured thereto, chain 39 and a sprocket 40. The sprocket 40 is mounted on and driven by a spindle 41 which in turn is driven by a pinion 42. The pinion 42 is rotated at its proper relative speed by means of the spiral drive members or teeth 43 (Fig. 3) carried on the gear 19, at the discharge end of the unit.

When more than one unit is utilized the discharge valve 36 of the unit immediately preceding serves as the feed valve for the next unit. Otherwise the succeeding units are duplicates of the one already described as shown in the drawing. A full understanding of the second unit will accordingly be had by reference to the description of the first unit hereinbefore set forth.

Operation

In operation the materials to be distilled are fed continuously and at a predetermined and measured rate into the cylinder 6 by means of valve 2. The beaters or hammers 18 are of suitable size and weight for the particular material being handled and are preferably provided with a slightly inclined striking face to feed the materials forward as the hammers are rotated. The hammers or beaters are rotated at speeds of from several hundred revolutions a minute and upward in accordance with the particular material being treated and the hammers will fly out radially about their individual pistons. As the material drops into the cylinder it is splashed or dashed by the hammers or beaters against the heated walls of the cylinder 6. Wiping or lifting members 13 are rotated at relatively low speeds which usually range from 10 to 20 or more revolutions per minute. The relative speeds of the wipers or lifters must be such that the material is lifted and permitted to drop through the cylinder into the path of the beaters or hammers to be struck, dashed, and spread against the heated cylinder 6 in a thin, rapidly changing layer with the material being advanced continuously through the cylinder from the feed to the discharge end. The rate of feeding material through the valves 2 and 36 is timed so that the proper amount of material is in the cylinder 6 to maintain the proper continuous operation of the unit. The heating action of the cylinder distills the volatile constituents

and as the material advances through the cylinder, the solid structure thereof is shattered as it is dashed from the beaters against the walls of the cylinders, wiped or scraped from the cylinder walls, lifted through the cylinder and dropped back to the hammers, and mixed in rapid succession. The repeated heating, beating, impacting, mixing, shattering and dividing actions continue as the material advances through the cylinder, until it is discharged from the valve 36 distilled to the desired extent and with the solid contents thereof in a finely divided state. As the materials pass through the unit, the constituents vaporized by the action of the heat are continuously withdrawn through opening 31 and duct 32, entrained liquid particles are separated in the column 33, and the distillate is condensed in 35 and led off to storage, or further treated in accordance with the nature thereof. The materials passing out of the discharge valve 36 may be further distilled in succeeding units at different temperatures by varying the jacket temperatures of each unit. For example, fractional distillation may be carried out in succeeding units in the production of absolute or anhydrous alcohol from commercial alcohol by Youngs method. In the first unit a ternary mixture of alcohol, water and benzene may be distilled, in a second unit a binary mixture of benzene and alcohol may be distilled, and in a third unit pure alcohol may be distilled while sludge and dirt will pass out of the discharge valve in the last unit. In distilling carbonaceous matter such as sawdust or straw, charcoal may be continuously produced.

Having described a preferred embodiment of my invention, what is desired to be secured by Letters Patent and claimed as new is:

1. The process of distilling solid carbonaceous materials within a heated cylinder having mounted therein beaters adapted to be rotated at a high speed which comprises the steps of continuously feeding the material into the path of said beaters rotating at high speed; impacting the same against the interior surface of the heated cylinder; removing the same from said surface at relatively lower speeds; dropping the removed materials back into the path of the beaters to be mixed and again impacted against the heated surface; repeating the impacting, mixing, and removing steps in rapid succession; continuously advancing the material through said cylinder as the impacting, mixing and removing proceeds; continually withdrawing the distillate from the cylinder; and condensing the withdrawn distillate.

2. The process of distilling solid carbonaceous substances which comprises continuously feeding the substance into an enclosed space with heated walls; impacting the substance against said walls; quickly removing the substance from said walls into said space;

repeating the impacting and removing steps in rapid succession; advancing the substance continuously through said space in a manner to maintain a relatively thin, rapidly changing layer of the substance on said walls; continuously discharging the treated substance from said space; continuously withdrawing the distillate from said space; and condensing the withdrawn distillate.

In testimony whereof, I affix my signature.
STANLEY HILLER.