

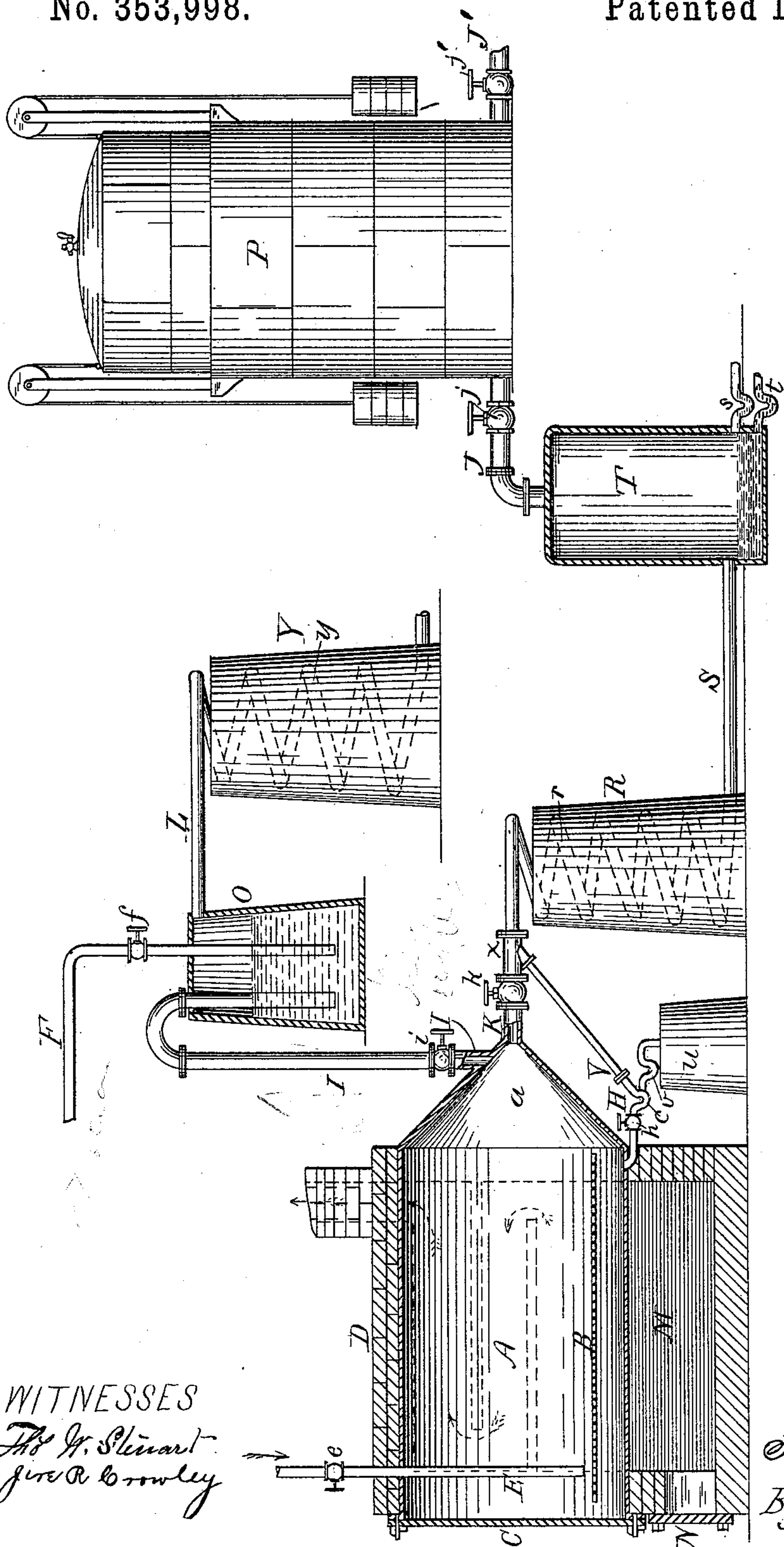
(No Model.)

T. W. WHEELER.

PROCESS OF AND APPARATUS FOR DISTILLING WOOD.

No. 353,998.

Patented Dec. 7, 1886.



WITNESSES  
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# UNITED STATES PATENT OFFICE.

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OF ONE-HALF TO ALLEN MURRAY, OF SAME PLACE.

## PROCESS OF AND APPARATUS FOR DISTILLING WOOD.

SPECIFICATION forming part of Letters Patent No. 353,998, dated December 7, 1886.

Application filed August 26, 1886. Serial No. 211,924. (No model.)

*To all whom it may concern:*

Be it known that I, THOMAS W. WHEELER, a citizen of the United States, and a resident of Washington, in the District of Columbia, have invented certain new and useful Improvements in Process of and Apparatus for Distilling Wood, of which the following is a specification.

This invention relates to the process of and apparatus for distilling pine and other resinous wood and obtaining various useful products therefrom—such as turpentine, light and heavy creosote-oil, pyroligneous acid, tar or black varnish, gas, and charcoal—by the direct continuous distillatory operation applied to a charge of wood.

The object of the invention is to increase the quantity and improve the quality of the turpentine and of the light and heavy creosote-oil, and particularly to quickly run off an increased yield of creosote-oil, and to provide for readily separating the distillate into its various constituent substances with little or no contamination of one with another; also, to prevent explosion, and to provide for the safe separation, storage, and use of the gas; also, to provide a convenient arrangement of pipes and valves at one end of the distilling-retort, whereby quick and safe manipulation and control of the apparatus may be effected and improved results secured.

The apparatus embodying my improvements is represented, partly in vertical section and partly in elevation, in the accompanying figure of drawing.

The distilling-retort A is made preferably of plate metal in cylindrical or rectangular form in cross-section, and its rear end is provided with a conical head, *a*, which is in the nature of a vapor-dome. Its front end is provided with a removable lid, C, which is tightly secured in place by screw-bolts or other clamping devices.

The retort is set in a masonry furnace and surrounded by brick-work D, and below it in the furnace is placed the fire-box M, having a fuel and ash door, N. A perforated floor or grate, B, is supported a short distance above the bottom of the retort, for supporting the charge of wood and permitting the tar to ac-

cumulate beneath it. A steam-supply pipe, E, having a valve, *e*, passes down through the retort near the front end and opens near the bottom, as shown. Near the apex of conical vapor-chamber *a* connects the turpentine or light-vapor pipe I, having controlling-valve *i*, and such pipe connects with the top of the washing-chamber O and projects down into such chamber below the surface of the lime-water contained therein. A steam-supply pipe, F, having valve *f*, also connects with the top of chamber O and projects down into the lime-water for the purpose of agitating it and keeping it sufficiently warm to prevent condensation of the turpentine. A pipe, L, leads from chamber O above the lime-water and connects with the worm *y* in tub Y. The turpentine running from the worm is collected in suitable vessels. Pipe K, having valve *k*, projects from the apex of vapor-chamber *a* and connects with the condensing-worm *r* in tank R, and such worm is connected at its lower end by pipe S with the receiver and separator tank T, which is provided, near the bottom, with a trap-pipe, *s*, for drawing off the creosote or other oil, and with trap-pipe *t* for drawing off pyroligneous acid. A pipe, J, having valve *j*, connects the top of separator T with the gas-holder P, in the usual manner. A pipe, J', having valve *j'*, leads from the holder, and in practice is connected with the fire-box M of the furnace, where the gas is burned for heating the retort. A residuum or tar pipe, H, having valve *h* and a U-shaped trap, *c*, connects with the bottom of the distilling-retort below the perforated grating B, and a second trap-pipe, *v*, connects with trap *c* and opens into the tar-tank *u*, which may have a valved draw-off cock. A vent-pipe, V, for the escape of gas, connects with pipe H and with pipe K by means of coupling *x*. Pipe V is inclined, as shown, so that matter which condenses will flow down and out through the tar-trap.

Having described my apparatus, I will now describe the operation which includes my process of obtaining and separating the various products of distillation, as follows: A retort of the proper size being in use, it is charged full with about a cord of pine or other resinous wood and the lid tightly secured.



Valve *i* is opened and valves *k* and *h* are closed. A small low fire is kindled in fire-box M, and steam under full head is admitted through pipe E, so as to fill all the space in the retort. With a continuous flow of steam and a low fire a temperature of about 112° Fahrenheit is maintained in the retort for from three to four hours. The steam at temperature named thoroughly softens the wood and opens the pores so that all the light turpentine vapor is driven out of the wood and run into the washing-receiver O, where it is forced into and through the contained lime-water. Here the acid and any heavy matter that may have been carried with the vapor is separated and held while the purified vapor and uncondensed steam pass off by pipe L to worm *y* in tub Y. During the flow of vapor into washer O a current of steam is admitted by pipe F into the lime-water for the purpose of agitating it and keeping it warm, whereby the turpentine vapor is better subjected to the action of lime, and is also prevented from condensation in the washer. At the end of three and a half or four hours, according to the progress of distillation, the steam is shut off and the temperature is raised by means of fire heat to from 200° Fahrenheit to 230° Fahrenheit, and is thus maintained for a period of two hours or more till the light oil and water are run off. When the steam is shut off and the temperature is raised, valve *k* of pipe K is opened, and as soon as good turpentine vapor ceases to flow valve *i* of pipe I is closed and the oil vapor passes into worm *r*, where it is condensed and the resulting light oil flows by pipe S into receiver T, from which it is drawn by trap-pipe *s* into suitable vessels. Water of condensation may be drawn off through trap-pipe *t*. The light oil and water having been driven off at the end of about two hours and the pyroligneous acid commenced to run, the temperature in the retort is raised to from 300° Fahrenheit to 400° Fahrenheit, and thus maintained for about six hours or longer till such time as the oil runs off from receiver T of the same gravity as the pyroligneous acid. Then valve *k* should be closed and valve *h* in tar-pipe H opened. During the six to eight hours distillation last described heavy creosote-oil and pyroligneous acid are condensed in worm *r* and collected in separator T, and the oil is drawn off into suitable receptacles through trap-pipe *s*, while the acid is drawn off through trap-pipe *t*. Any gas which passes to the separator T is conducted by pipe J into holder P. Soon after valve *k* is closed and valve *h* opened the fire is lowered and the retort is gradually cooled down. The residual tar and gas will flow off for an hour or two, the tar being collected in tank *u* and the gas in holder P. The temperature of the retort having been sufficiently lowered the charcoal is drawn, the tar if any remains is removed, and the retort is recharged with wood for another run or distilling operation.

By connecting the vapor-pipe I below the top of the retort, and at or near the apex of vapor-chamber *a*, the steam rises through and is held in contact with all portions of the wood, especially in the top of the retort, to much better advantage than would be the case if such pipe rose directly from the top of the retort. Since vapor-pipe I dips into the lime-water, a little back-pressure is produced, causing the steam to act most efficiently on the whole charge of wood, and more quickly soften and open its pores. The charge of wood being thus brought into a favorable condition, the oil and pyroligneous acid may be more quickly run off than heretofore, and the yield thereof largely increased.

In a patent granted to me July 5, 1870, No. 105,019, the use of steam in connection with the distillation of pine wood is described; but the process therein set forth was not operative to produce economical or satisfactory results, and I was obliged to make many experiments in order to arrive at my present successful method of operation and secure my present greatly-improved results. My present process is distinguished from that described in my patent in a number of important particulars, among which are, that the wood is subjected to the action of steam at a low temperature (about 112° Fahrenheit) for only a short time (about three and one-half hours) at the commencement of the distillation, to soften the wood and drive off the turpentine vapor; then the steam is shut off and the turpentine-vapor pipe closed, and the temperature is gradually raised by fire heat, first, to about 230° Fahrenheit, to run off the light oil and water, then to about 400° Fahrenheit, and the creosote-oil and pyroligneous acid thus rapidly distilled off in large quantities, and separated from each other in a specially-arranged separator. It is to be noted that creosote-oil and pyroligneous acid are the products mainly sought and obtained by my present process, and that by such process, too, the operation is shortened from twenty-two or twenty-four hours to about twelve hours. No such results could be obtained by the process described in my former patent. I also make provision for washing the turpentine vapor in lime-water during agitation with steam, to separate acetic acid and other impurities. I also make provision for safely separating the gas from the tar and other products, and store it in a holder, so as to prevent danger by explosion. Instead of attempting to discharge all the products of distillation at the same time, as was proposed in my former patent, I secure much better results by conducting off the different products separately through different pipes, at successive periods of the distillation, as the temperature is raised in the retort.

The dry distillation of hard wood—such as oak—first at a comparatively low temperature to drive off the water, and then at a higher temperature to obtain acetic acid, heretofore



described, would not produce the results which I secure by my process, and such operation forms no part of my invention.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

1. The process of distilling pine or other resinous wood and obtaining useful products therefrom, which consists in subjecting it in a distilling-retort to the action of steam at a low temperature to soften and open its pores and drive off the turpentine vapor, and then shutting off the steam and raising the temperature by fire heat, and thereby rapidly driving off the oil and pyroligneous acid and collecting and separating such products, as described.

2. The process of obtaining and separating the products of pine or other resinous wood, which consists in subjecting it in a distilling-retort to the action of steam under low pressure and temperature, thereby softening the wood and driving off the turpentine vapors, passing such vapors into a bath of lime-water which is warmed and agitated by a current of steam, then, when the wood is softened, closing the valves of the steam-pipe and turpentine-vapor pipe, opening the oil-vapor valve, and gradually raising the temperature to nearly 400° Fahrenheit, and thus quickly running off the creosote-oil and pyroligneous acid and separating them till they run off of the same gravity, then opening the tar-valve, and gradually lowering the temperature till the tar and gas are run off, as described.

3. The distilling-retort, having a vapor-chamber at one end, in combination with a turpentine-vapor pipe connecting with said vapor-chamber and projecting at its outer end

into the liquid of the washer, an oil-vapor pipe, connecting also with said vapor-chamber and with a condensing-worm, and a separating-chamber having draw-off pipes and a gas-escape pipe, for the purpose described.

4. In combination with the distilling-retort having a conical vapor-chamber, the oil-vapor pipe leading from such chamber, the connected condenser, and a receiving and separating chamber having two trapped draw-off pipes arranged one a short distance above the other, near its bottom, and a gas-escape pipe extending from its top to a gas-holder, for the purpose described.

5. In combination with the distilling-retort, a vapor-pipe leading from one end to the condenser, a tar-pipe leading from the bottom of the retort and having a trap, and the inclined vent or gas pipe connecting the tar-pipe with the vapor-pipe, and means for collecting the oil, tar, and gas, as described.

6. The combination of the distilling-retort, a washing-chamber, and a condenser with a vapor-pipe leading from the end of the retort and dipping into the fluid of the washer, a steam-pipe also projecting into the washing-fluid, and a pipe connecting the top of the washing-chamber with the condenser, as and for the purpose described.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 21st day of August, 1886.

THOMAS W. WHEELER.

Witnesses:

THOS. W. STEUART,  
JOHN N. WALKER.