

(Model.)

2 Sheets—Sheet 1.

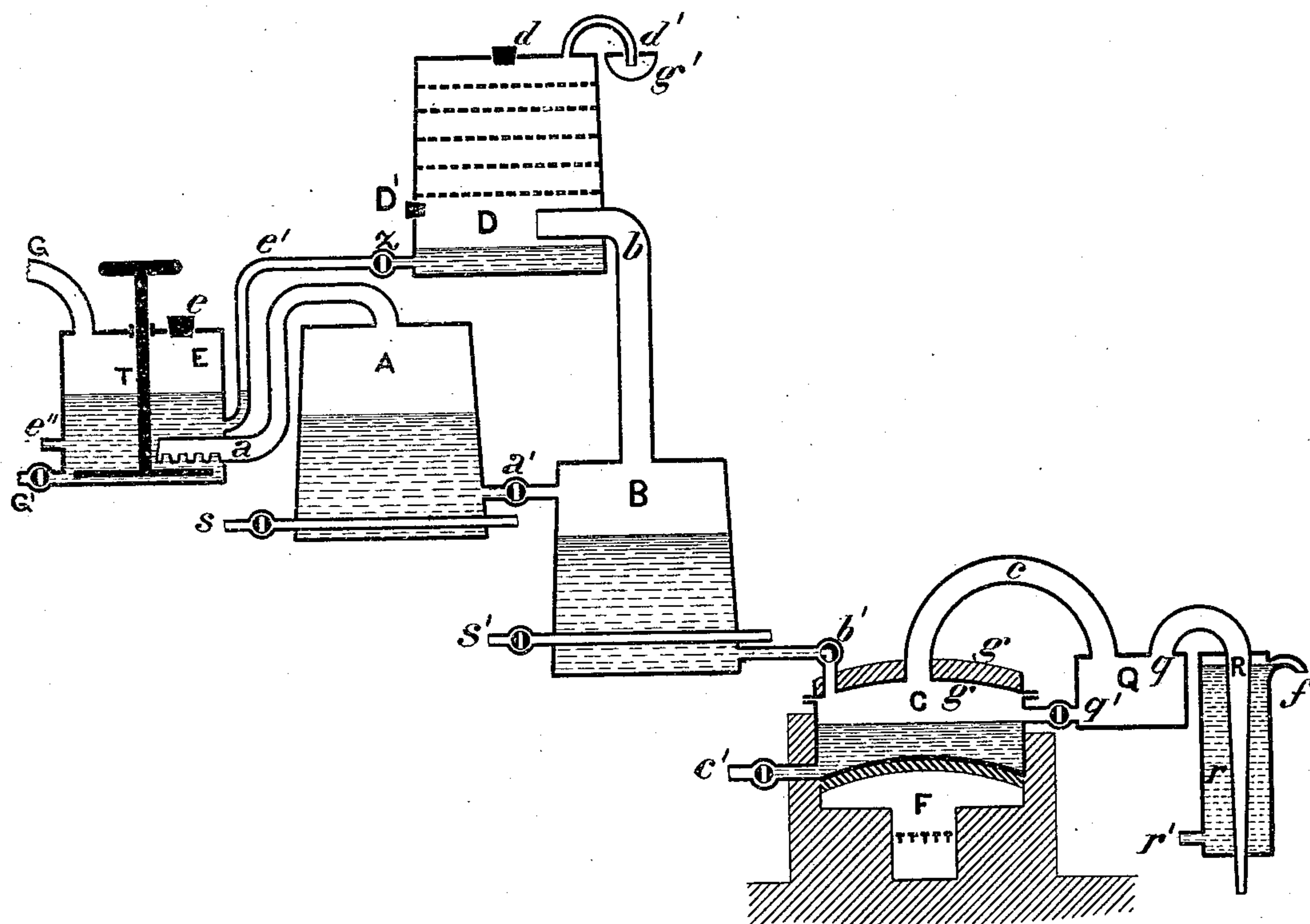
J. A. MATHIEU.

Apparatus for Purification of the Products resulting  
from Distillation of Wood.

No. 234,998.

Patented Nov. 30, 1880.

FIG. 1.



WITNESSES

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(Model.)

2 Sheets—Sheet 2.

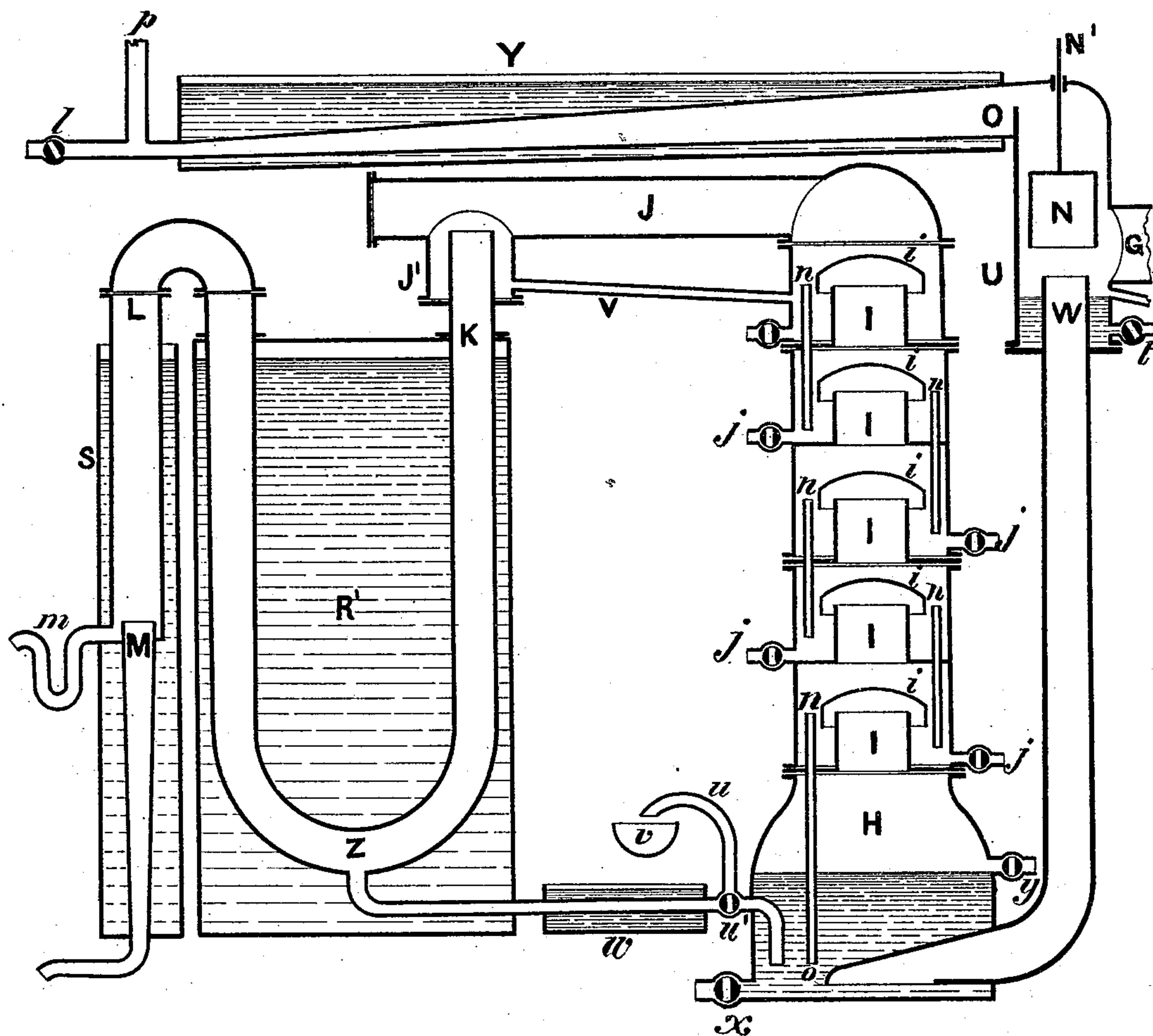
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## Apparatus for Purification of the Products resulting from Distillation of Wood.

**No. 234,998.**

**Patented Nov. 30, 1880.**

**FIG. 2.**



**WITNESSES.**

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# UNITED STATES PATENT OFFICE.

JEAN A. MATHIEU, OF HUNTER'S LAKE, PENNSYLVANIA.

APPARATUS FOR PURIFICATION OF THE PRODUCTS RESULTING FROM DISTILLATION OF WOOD.

SPECIFICATION forming part of Letters Patent No. 234,998, dated November 30, 1880.

Application filed January 30, 1880.

*To all whom it may concern:*

Be it known that I, JEAN ANTOINE MATHIEU, of Hunter's Lake, Sullivan county, Pennsylvania, have invented a certain new and useful  
5 Apparatus for Purification of the Products Resulting from Distillation of Wood, of which the following is a specification, reference being had to the accompanying drawings, where-  
in—

10 Figure 1 is a section through the series of retorts; and Fig. 2 is a section, on a large scale, through the column-washer and its connections.

Besides non-condensable gases, the products  
15 derived from the distillation of wood are spirit of wood or methylic alcohol, pyroligneous acid, and tar. If these substances, after distillation, are condensed and run into suitable reservoirs, they will separate into two layers—the  
20 lower one being tar, the upper one pyroligneous acid mixed with spirit of wood, both of these substances holding a certain proportion of tar in solution.

The object of my invention is to separate the  
25 pyroligneous acid from the spirit of wood, and also from the tar, and, after purifying it, to convert it into acetates of copper, lead, iron, lime, soda, baryta, &c., as may be desired.

A and B, Fig. 1, are large tanks or vessels,  
30 preferably of wood, and having steam-coils *s* and *s'* at the bottoms. A pipe, *a'*, with stop-cock, leads from the bottom of A into the top of B. A similar pipe, *b'*, leads from the bottom of B into the top of the retort C, preferably constructed of copper or iron, and having  
35 an arched top and bottom lined exteriorly with fire-brick, as shown at *g*.

The retort C is heated by fire upon the grate F, and is provided with a discharge-pipe, *c'*,  
40 closed by a stop-cock. A pipe, *c*, leads from the top into a drip-box, Q, from which a small pipe, *q'*, with stop-cock, leads back into the retort C. From the top of the box Q a second pipe, *q*, leads into a condenser-pipe, R, or  
45 worm, immersed in cold water contained in the vessel *r*, through which a circulation is kept up by means of the inlet *r'* and overflow-pipe *f*.

The tank B communicates, by a pipe, *b*,  
50 with a vessel, D, provided with a series of shelves pierced with holes, so as to allow a free circulation of vapor through the vessel D.

These shelves are indicated by the broken lines above the entrance of the pipe *b*, and may be of any number desired.

Between the ends of the shelves and the  
55 side of the vessel a space is left (not shown in the drawings) sufficiently large to permit access to a person descending through the man-hole *d*. A smaller aperture, *D'*, closed by a  
60 plug, admits air to the vessel when desired, and a pipe, *d'*, dipping beneath the surface of liquid in vessel *g'*, acts as a safety-valve in case the pressure in the vessel D becomes too  
65 great.

A small pipe, *e'*, with stop-cock *z*, leads from the bottom of D into another tank, E. The tank A communicates with the tank E by a pipe whose end is pierced with holes, as shown  
70 at *a*, and beneath these holes a stirrer, T, is adapted to revolve.

Discharge-pipes *G'* and *e''*, provided with stop-cocks, are arranged at different levels in the tank E, and from the top a pipe, *G*, leads  
75 into the apparatus shown in Fig. 2. A circular drip-box, U, receives the pipe *G* and communicates with a condensing-pipe, O, or worm, immersed in a cold-water tank, Y, and terminating in two branches, *p* and *l*—the former  
80 vertical, the latter provided with a stop-cock.

From the lower part of the drip-box U (which is provided with discharge-pipes *t*) extends the pipe W, which can be closed at top by the inverted cup N, actuated by the rod  
85 N'. The pipe W leads to the bottom of the washing-column H, provided with a series of shelves, which have short vertical pipes I, of large diameter, covered by inverted pans, whose rims descend below the tops of the  
90 pipes I. Each shelf is provided with an overflow, *n*, at the level of the top of pipe I and a discharge, *j*, having stop-cock.

From the top of the column a pipe, J, with drip-catch J' and return-conduit V, leads to the U-shaped condenser K, immersed in wa-  
95 ter-vessel R, and having a discharge, Z, leading through a second water-tank, *w*, to the stop-cock *w'*, where it branches upward, as shown at *u*, into a trough, V, and downward into H, as shown at *o*. The pipe K, after  
100 emerging from R, leads into a second drip-catch, L, with a trapped discharge, *m*, and thence into a condenser or worm, M, immersed in cold-water tank S.



The operation is as follows: The tank A being filled with crude pyroligneous acid and the stop-cock *a'* being closed, it is heated gently and slowly by the steam-coil *s*. The first exceedingly volatile products pass over, with some acid vapors and steam, into the tank E, issuing from the holes at *a* into a warm solution of potash, lime, soda, or other base, which is kept agitated by the stirrer T. The acid portions being thus retained, the others pass out through the pipe G; and the inverted cup N being loosened, so as to seal the pipe W, the volatile vapors pass upward into the condenser O, where a very low temperature is maintained, so as to condense them, and into which a slightly acid solution can be introduced by the pipe *p* if ammonia is present. The condensed liquid can then be withdrawn at *l*. When the vapors from the first slight heating of the tank A have ceased to come over, the cup N is raised, and the stop-cock *l* being closed, warm water is introduced by the pipe *p* until a proper level is reached in the condenser-pipe O (now no longer cooled) and in the pipe *p*, which, being left open, thus acts as a safety apparatus to prevent too high a pressure. The heating of the tank A being then continued, the less volatile vapors pass downward through the pipe W into the column H, at the bottom of which, and on each shelf to the level of the overflow-tubes *n*, is placed a warm and non-volatile acid, such as dilute sulphuric acid, the temperature of which is maintained constantly above that at which wood spirit condenses. The vapors are thus obliged by the inverted pans *i* to bubble up through the washing acid solution, whereby all traces of ammonia or other basic substances are removed. They then pass through the pipe J and into the U-tube K, (any condensed portions being caught in the drip-catch J' and returned by the conduit V to the column,) where they are partly cooled, so as to remove the water, the vessel R being filled with liquid kept at a temperature sufficiently high to permit the wood spirit to pass in vapor while condensing the water, which is drawn off at Z, and either run into the trough *v* or into H, as may be desired. After passing through this tube K the vapors flow into the condenser M, where they are finally condensed, and at whose entrance the drip-catch L removes the less volatile portions. When all the methylene and analogous volatile parts are driven off from the tank A, the cock *a'* is opened, and the residue flows into the second tank, B, where, the cocks *a'* and *b'* being closed, it is heated more highly by the steam-coil *s'*. The pyroligneous acid is then disengaged in the form of vapor and passes into the vessel D, where sheet or leaf lead has been previously placed on the shelves, and, the cock *z* and openings D' *d* being closed, the vapors circulate through the vessel, attacking the lead. As they condense and combine with the lead they drip down onto the bottom of the vessel, and when a sufficient quantity has accumulated the distillation in B is stopped,

and the openings D' *d* are opened to admit air, which both cools the contents of D and supplies the oxygen necessary for further combination. The solution is then drawn off, or, if desired, it is admitted into the vessel E by the pipe *e'* and converted from a basic into a neutral or acid salt by contact with the acid vapors issuing from *a*.

Instead of lead, the vessel D may contain upon its shelves soda, potash, lime, baryta, or other base.

When the vapors from the tank B come over too highly charged with tar the distillation is stopped, and the contents are run through the pipe *b'* into the retort C, where they are highly heated by the fire on F, and the tar is freed from all matters less volatile than itself, which, after passing through the drip-catch Q, are condensed in the condenser R. The tar itself is then withdrawn at *e'*.

The degrees of heat in the several tanks and their respective condensers may be varied arbitrarily, so as to yield products of any density desired, and hence I prefer to leave them to the discretion of the skilled workman.

Broadly speaking, the products are separated by manipulating, as above, into, first, products more volatile than wood spirit of commerce; second, wood spirit; third, pyroligneous acid in the form of salts; fourth, tar; and the principal matters removed as impurities are water and ammonia vapors.

I am aware that the column H, above described, is not new, such a device being shown in Letters Patent No. 61,388, dated January 22, 1867; and I am also aware that the use of a U-shaped tube as an intermediate condenser is old. I therefore do not claim either of these elements singly, but only in combination with one another and with other devices, as hereinafter stated.

I claim—

1. The combination or system of distilling-vessels A, B, and C, communicating with one another, and each having its respective condenser, whereby the separation of the products of wood-distillation is carried on continually and simultaneously, substantially as described.

2. The combination, with the distilling-vessels A and B, having communicating pipe *a'*, and with the condensing and combining vessel D, of the tank E and its stirrer T, whereby the more volatile products of distillation are freed from acid traces by passing them through a basic solution obtained from the products of the second distillation, substantially as described.

3. The combination, with the distilling-vessel A, of the tank E, provided with a stirrer, T, the column H, the U-tube K, and the condenser M, whereby the distilled products are freed during one operation from acid, alkaline, and watery impurities.

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