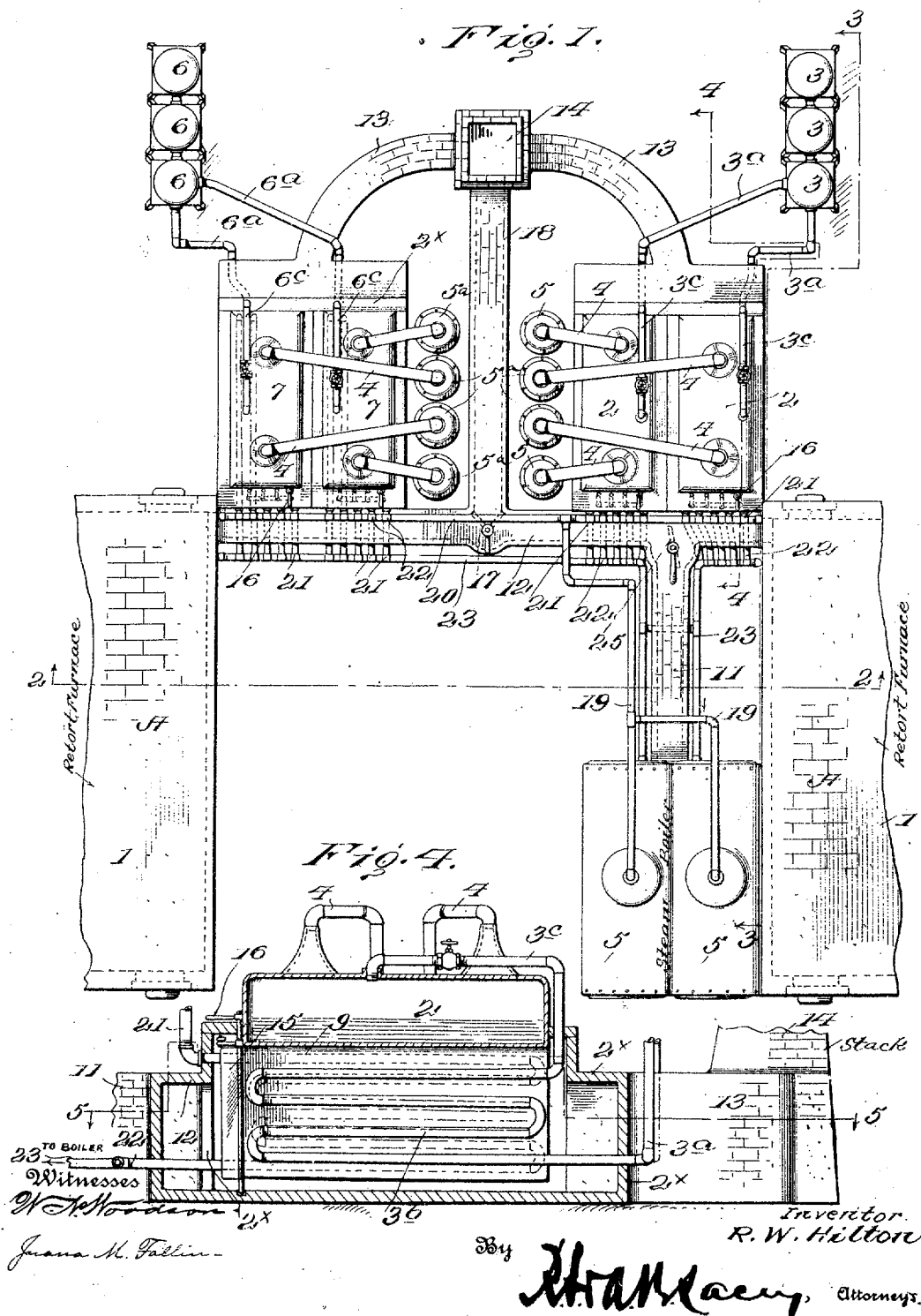


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APPLICATION FILED JAN. 22, 1909.

Patented Feb. 27, 1912.  
3 SHEETS--SHEET 1.



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3 SHEETS—SHEET 2.

Fig. 2.

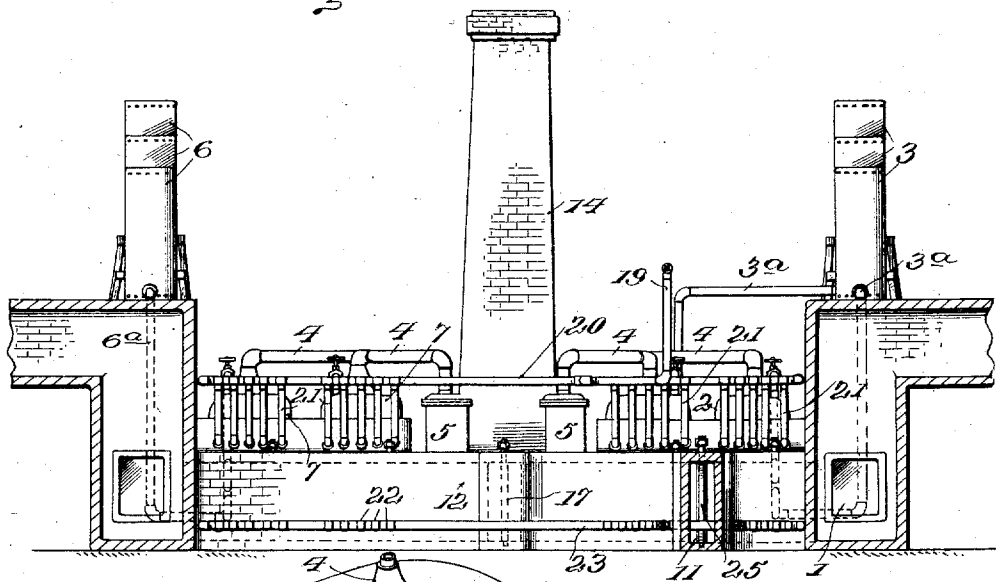


Fig. 7.

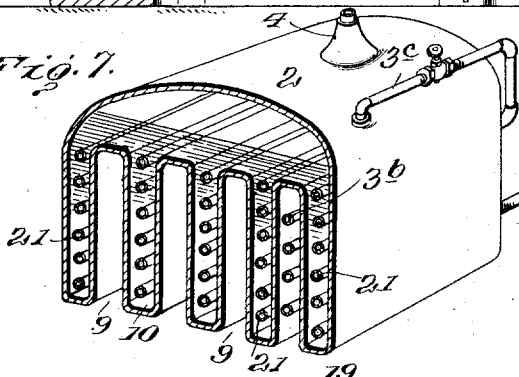
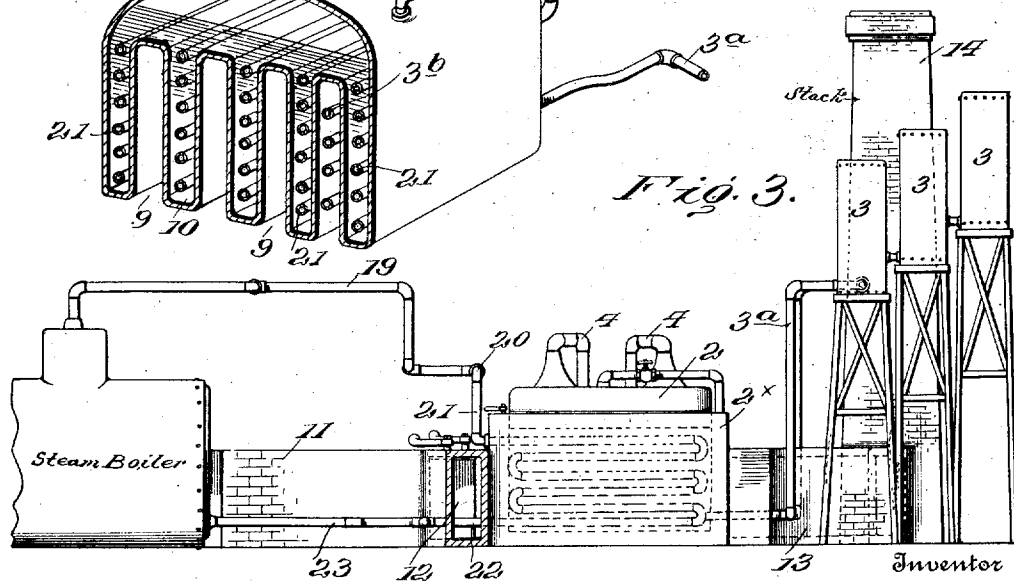


Fig. 3.



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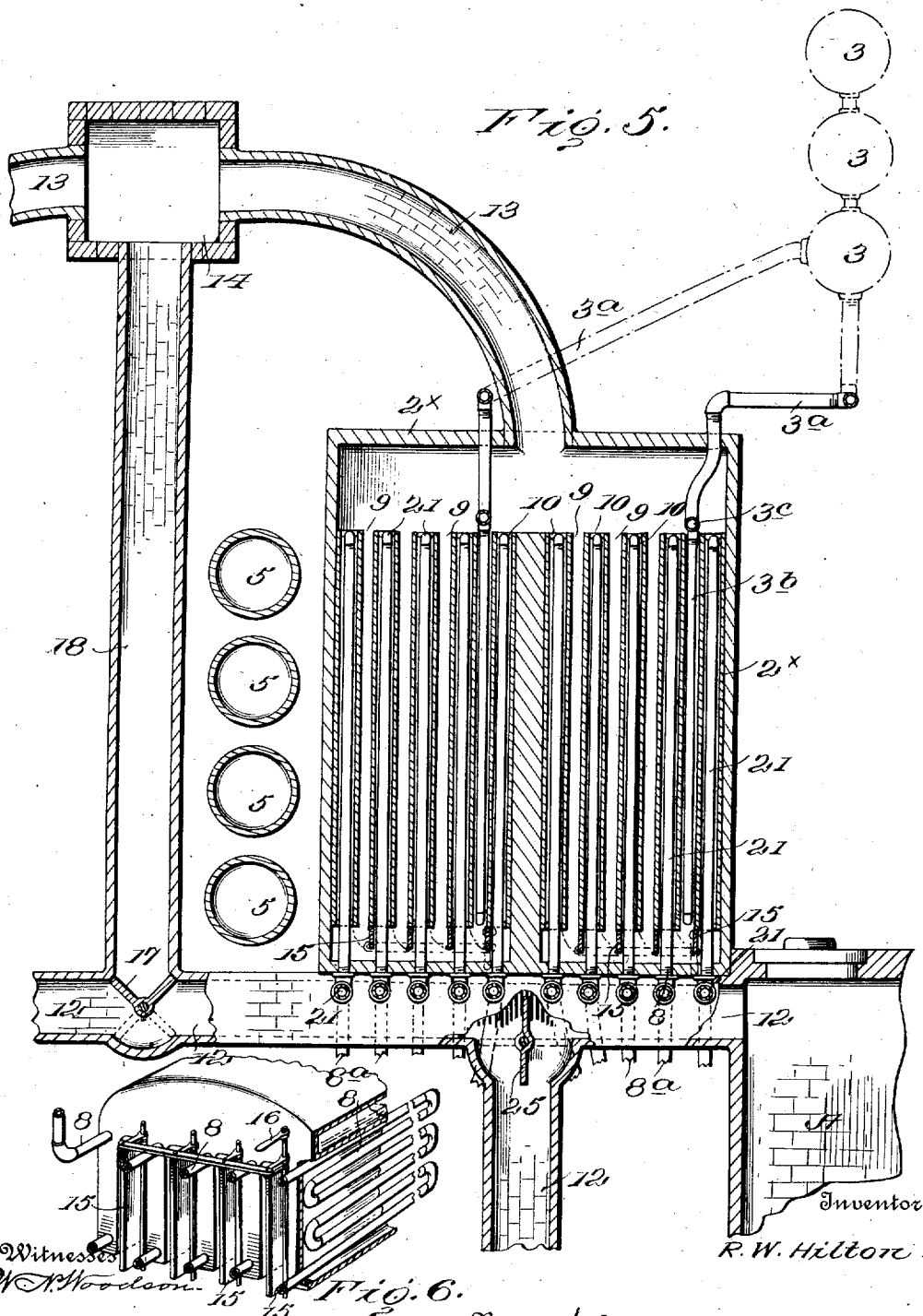
Stranley, Attorneys.

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3 SHEETS—SHEET 3.



# UNITED STATES PATENT OFFICE.

ROBERT W. HILTON, OF SMETHPORT, PENNSYLVANIA.

## WOOD-DISTILLING APPARATUS.

1,018,419.

Specification of Letters Patent.

Patented Feb. 27, 1912.

Application filed January 22, 1909. Serial No. 473,684.

### *To all whom it may concern:*

Be it known that I, ROBERT W. HILTON, citizen of the United States, residing at Smethport, in the county of McKean and State of Pennsylvania, have invented certain new and useful Improvements in Wood-Distilling Apparatus, of which the following is a specification.

This invention relates to distilling apparatus and more particularly to a peculiar form of still and to means designed to secure important advantages in the application of heat to the still, the primary object of the invention being to provide means whereby the otherwise wasted heat from a retort furnace, such as is used for the dry distillation of wood in the manufacture of pyroligneous acid, may be utilized as one means for heating the still in which said pyroligneous acid after being neutralized is distilled.

A further object is to provide means whereby the heated products of combustion from said furnace may be directed, either into intimate contact with the walls of the still, or may be more or less directed into the stack without coming in contact with the still walls.

A further object is to provide means whereby the liquid to be treated may be preheated before it enters the still, and also to provide means whereby steam may be introduced into the interior of the still to assist in heating the liquid therein.

My invention is shown in the accompanying drawings wherein:

Figure 1 is a top plan view of a wood alcohol distilling plant. Fig. 2 is a section on the line 2—2 of Fig. 1. Fig. 3 is a section on the line 3—3 of Fig. 1. Fig. 4 is a section on the line 4—4 of Fig. 1. Fig. 5 is an enlarged horizontal section of a portion of the distilling plant shown in Fig. 1. Fig. 6 is a perspective view of one of the stills. Fig. 7 is a like view of one of the stills, the steam pipes entering the same and passing between the legs of the same being removed.

Corresponding and like parts are referred to in the following description and indicated in all the views of the drawings by the same reference characters.

In order that my invention may be understood, it is necessary to refer briefly to the ordinary process of making wood alcohol, it

being borne in mind, however, that my invention is not limited to the production of wood alcohol.

The destructive distillation of wood produces inflammable gases, a strongly acid distillate, and a certain quantity of tar. The aqueous distillate contains methyl alcohol, acetic acid, acetone and methyl acetate, the distillate being known as pyroligneous acid. The tar and pyroligneous acid are drawn off and neutralized with lime, thus separating therefrom the acetic acid.

By the usual process, the pyroligneous acid with as little tar as possible is drawn off from the crude distillate obtained from the wood retort and is cleared from tar as far as possible by subsidence. To the supernatant liquor which contains a little tar and the crude acetic acid, alcohol, acetone and methyl acetate is added lime for the purpose of neutralizing the acetic acid and converting it into acetate of lime. This mixture of calcium acetate, alcohol, acetone, etc., is then distilled to drive off the alcohol and acetone.

My invention does not relate in any manner to the process of securing pyroligneous acid from wood but to the distillation of the mixture above named and whereby crude spirit is distilled off from the solution containing the impure acetate and the tarry substance. I have therefore not shown in the drawings any apparatus for the condensation of the vapor from the wood retorts, nor have I shown any apparatus for the separation of tar, or for the separation of acetic acid.

In the drawings A designates retort furnaces having the usual construction of those designed for destructive distillation. From these retort furnaces A the gas, the acid distillate and the tar are carried to condensers (not illustrated in the drawing). The tar and pyroligneous acid are allowed to stand and separate in suitable vessels, which are not illustrated, however, as being no part of my invention, and the pyroligneous acid is then neutralized with lime by any suitable apparatus and is then, by means of pipes which it is unnecessary to illustrate, conveyed to storage tanks 3 from which the liquid is conveyed to the stills 2 by conducting pipes 3<sup>a</sup>. It is in these stills 2 and the means whereby they are heated and the heat controlled, that my invention lies.

One of the stills 2 is illustrated in Figs. 4, 6 and 7. Each still consists of a hollow body or casing, the lower portion of which is formed with a plurality of downwardly extending legs or compartments 10, the legs being spaced or separated from each other by longitudinally extending passages 9 which are open at both ends. It will be understood that these legs or compartments 10 open into the body of the stills 2, 3, the lower portion of the still, or preferably the lower portions of two conjoined stills, is inclosed within a wall 2<sup>x</sup>, the rear end of this wall being spaced from the rear end of the still, as shown in Figs. 4 and 5. The pipes 3<sup>a</sup> from the storage tanks 3 enter the wall 3<sup>x</sup> and pass, each into a passage 9 between two adjacent legs of each still. Each pipe is formed into a series of coils 3<sup>b</sup> extending up to the upper end of the passage 9. The pipe then extends out from the rear end of the passage and is carried upward over the top of the still and then downward into the upper portion of the still, as at 3<sup>c</sup> (see Fig. 4). This arrangement of the pipe provides for preheating the liquid to be distilled before its entrance into the body of the still.

Each of the stills 2 is connected by a pipe or gooseneck 4 to condensers 5 which may be of any desired character and which are therefore not shown in detail. In these condensers the volatile methyl alcohol, together with water, is condensed into crude wood spirit. This crude wood spirit may be again distilled, and for this purpose the crude wood spirit may be placed in the tanks 6 from which it will pass by the pipes 6<sup>a</sup> into the stills 7, from which it is carried to the condensers 5<sup>a</sup>. The stills 7 are precisely similar in construction to the stills 2, and the pipes 6<sup>a</sup> each enter one of the compartments of the corresponding still, are coiled in these compartments and extend up over the compartments as at 6<sup>a</sup>, precisely as do the pipes 3<sup>c</sup>.

As a means for heating the stills, the products of combustion and heating gases from the retort furnaces which would be otherwise wasted, are conducted from the retort furnaces A to a transverse flue 12 which extends across the entire front of the battery of stills and connects the retort furnaces. This flue 12 opens into the casing 2<sup>x</sup> of each pair of stills and the heated gases and vapors passing along the flue 12 will pass into the casing 2<sup>x</sup>, thence into the passages 9 between the legs 10 of the still, and act to heat the liquid in the legs or compartments 10. A flue 11 for carrying off the heated products of combustion from the furnace for heating the steam boilers 5 leads to and communicates with the transverse flue 12 so that the otherwise wasted products of combustion from the steam boiler furnace may also be utilized for heating the

stills. The heated products of combustion from the retort furnaces and from the steam boiler furnace are conducted into the flue 12 and from thence conducted between the legs of the several stills, the heat passing beneath the bottoms of the stills and around the ends and sides thereof. The products of combustion thence pass into flues 13 which lead to a stack 14 from which the products of combustion are discharged after they have yielded a large portion of their heat. It will be seen that by this arrangement the combined heat of the retort furnaces and of the steam boiler furnace passes beneath the bottoms of the stills, and around the ends and sides thereof and that thus a very large superficial area of still is subjected to this heat, and that the heat which would be ordinarily wasted and discharged without doing its full work, is made to do service in heating the stills for the final distillation. The transverse flue 12 is also connected to the stack 14 by means of an intermediate flue 18. In order to control or regulate the passage of hot products of combustion through and around the legs of the stills, I provide dampers 15 having the form of gates or shutters and located at the openings of the passages 10. These dampers when turned in one direction will prevent the passage of heated air into the spaces between the legs of the stills, and when turned in the other direction will permit the passage of the heated air therethrough. Any desired arrangement or construction of dampers may be used but as illustrated in the drawings the dampers consist each of a vertical shutter pivoted or hinged on one edge. These dampers may be operated in any suitable manner and I have shown for this purpose handles or levers 16 which project out the flue 12 into convenient position for actuation, these handles being connected each to a plurality of dampers. These dampers and operating levers are very simply shown in the drawing for the reason that any form of dampers may be used for this purpose, as will be understood by those skilled in the art.

In addition to the dampers 15 which control the passage of heat between the legs of the still, I have also provided a three-way damper 17 arranged in the flue 12 at the junction of said flue with the flue 18. This damper has the form of two vanes at right angles to each other and may be rotated in a complete circle and thus turned so as to close off the flue 18, leaving the transverse flue entirely open from end to end, or may be shifted to close off one end of the transverse flue, leaving the other end of the flue 12 connected to the flue 18, or this damper may be so turned that both ends of the flue 12 are in communication with each other and also with the flue 18.

By this arrangement of parts the heat may be passed around and through either set of stills to the exclusion of the other sets, or both of said sets of stills may be closed so that the heat may freely pass along the flue 12 and so directly out through the flue 18 to the stack.

In addition to the features above described, I have provided means whereby the liquid in the still is heated by steam pipes which extend into the compartments 10. For this purpose I provide the steam boilers 5 of any usual or ordinary construction. Conducting pipes 19 pass from these steam boilers and connect with a transversely extending pipe 20 which as shown is located above the flue 12. This pipe 20 has extending through it the branch pipes 21. There is one of these branch pipes for each of the compartments or legs of the still. The pipes 21 extend downward from the pipe 20 and enter the legs of the still, and within these legs are each formed a coil extending longitudinally through the interior of the legs, the extremity of the coil being conducted out of the leg and carried back to the boiler by the return pipes 22 and 23, as clearly shown in dotted lines in Fig. 4 and in full lines in Fig. 6.

It will thus be seen that the still is heated not only by the passage of the heat products of combustion through the passages 9 from the legs or compartments 10, but that the liquid in the interior of the compartments 10 is heated by the steam coils connected to the pipes 20. The steam itself does not escape into the still but as before remarked passes out again and is discharged into the boiler, thus providing for a constant circulation of steam within the legs of the still.

In the practical operation of my invention the liquid in the tanks 3 is conducted by the pipes 3<sup>a</sup> into the coils 3<sup>b</sup> where it is preheated by heat entering the casing 2\* from the flue 12. After being preheated the liquid in the pipes 3<sup>a</sup> and 3<sup>b</sup> is conducted up and discharged into the upper end of the main body of the still 2. Here it is heated by the steam pipes 21 which pass through the legs, and by the heat of the products of combustion pipes passing from the retort furnaces and the boiler furnace between the legs. The vapor from the steam passes off through the goosenecks 4 and is carried to the condensers 5.

The hot products of combustion from the retort furnaces A are carried into the transverse flue 12. From this flue they may be directed either between the legs of the still and through the interior of the casing 2\* and thence by way of the flue 13 to the stack; or by shutting off the dampers 15 the products of combustion may be carried to the flue 18 and pass directly outward to the stack. By operating the damper 17 it is

possible to cut off either pair of the stills and take the heat entirely from one of the retort furnaces and pass it around one of the pairs of stills and not around the other; or the flue 18 may be entirely cut off and every particle of the heat passing from the retort furnaces, or the steam furnaces may be carried into the casing 2\* through and around the legs of the still. In order to cut off heat passing out through the flue 11 or to regulate the passage of the heated products therethrough, I provide the damper 25 which, as shown in Fig. 5, is located at the junction of the flue 11 with the flue 12 and which is operated in any suitable manner.

It is to be understood that my invention is not limited to any particular number of stills or to other immaterial features disclosed in the drawings, or to any particular size or proportion of parts, and that various changes might be made in the details of construction and the arrangement of these parts without departing from the spirit of the invention.

While I have described my improved still as being used in connection with a plant for the destructive distillation of wood, I wish it understood that the improved still and the means for heating the same may be used for the distillation of any product.

Having thus described the invention, what I claim is:—

1. In apparatus of the character described, a still provided in its lower portion with a plurality of transversely extending passages, said passages dividing the lower portion of the still into a series of depending compartments, steam pipes entering the several compartments and extending through the same, and means for carrying heat independently of the steam pipes into the passages between said compartments.

2. In apparatus of the character described, a still provided in its lower portion with a series of transversely extending passages, said passages dividing the lower portion of the still into a series of depending compartments, steam pipes entering these compartments and coiled therein and then passing out of the compartments, a furnace, and means for conducting the products of combustion from the furnace into the passages between the compartments beneath the still.

3. In apparatus of the character described, a still provided in its lower portion with a series of open-ended passages, said passages dividing the lower portion of the still into a series of compartments, a furnace, means for conducting a heating medium into the passages between the compartments, and a liquid supply pipe leading into said still, said supply pipe entering one of said passages in the bottom of

the still, being coiled therein, and then being extended into the still, whereby the liquid therein may be pre-heated.

4. In apparatus of the character described, a still, a casing surrounding the still, a furnace, a stack, a flue leading from the furnace to the stack and communicating with the casing of the still, means for cutting off communication between said flue and the interior of the casing, and a flue leading from the casing to the stack.

5. In apparatus of the character described, a plurality of stills, casings inclosing the stills, a furnace, a flue extending entirely across the fronts of the still casings and communicating with the furnace, a stack with which said flue is connected, flues leading from the rear ends of the still casings to said stack, and means for diverting the products of combustion passing into the first named flue either into the still casings or into the stack.

6. In apparatus of the character described, two batteries of stills, each battery

being surrounded by a casing, a furnace, a transverse flue communicating with the furnace and extending entirely across the fronts of the still casings, said transverse flue communicating with the casings, means whereby the communication may be cut off between the transverse flue and the casings, flues leading from the rear ends of the still casings to a common discharge stack, and a middle discharge flue extending between the pairs of still casings, connected at one end to the middle of the transverse flue and at the other connected to said stack, and valves in the transverse flue whereby the products of combustion from the furnace may be shut off from the intermediate flue or from either end of the transverse flue.

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

ROBERT W. HILTON. [L.S.]

Witnesses:

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F. H. HUNGIVILLE.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."