A. P. DERBY & J. H. DARGIE.

METHOD OF TREATING WOOD AND OTHER POROUS MATERIALS.

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1,166,819. Patented Jan. 4, 1916.

Fig. 1.

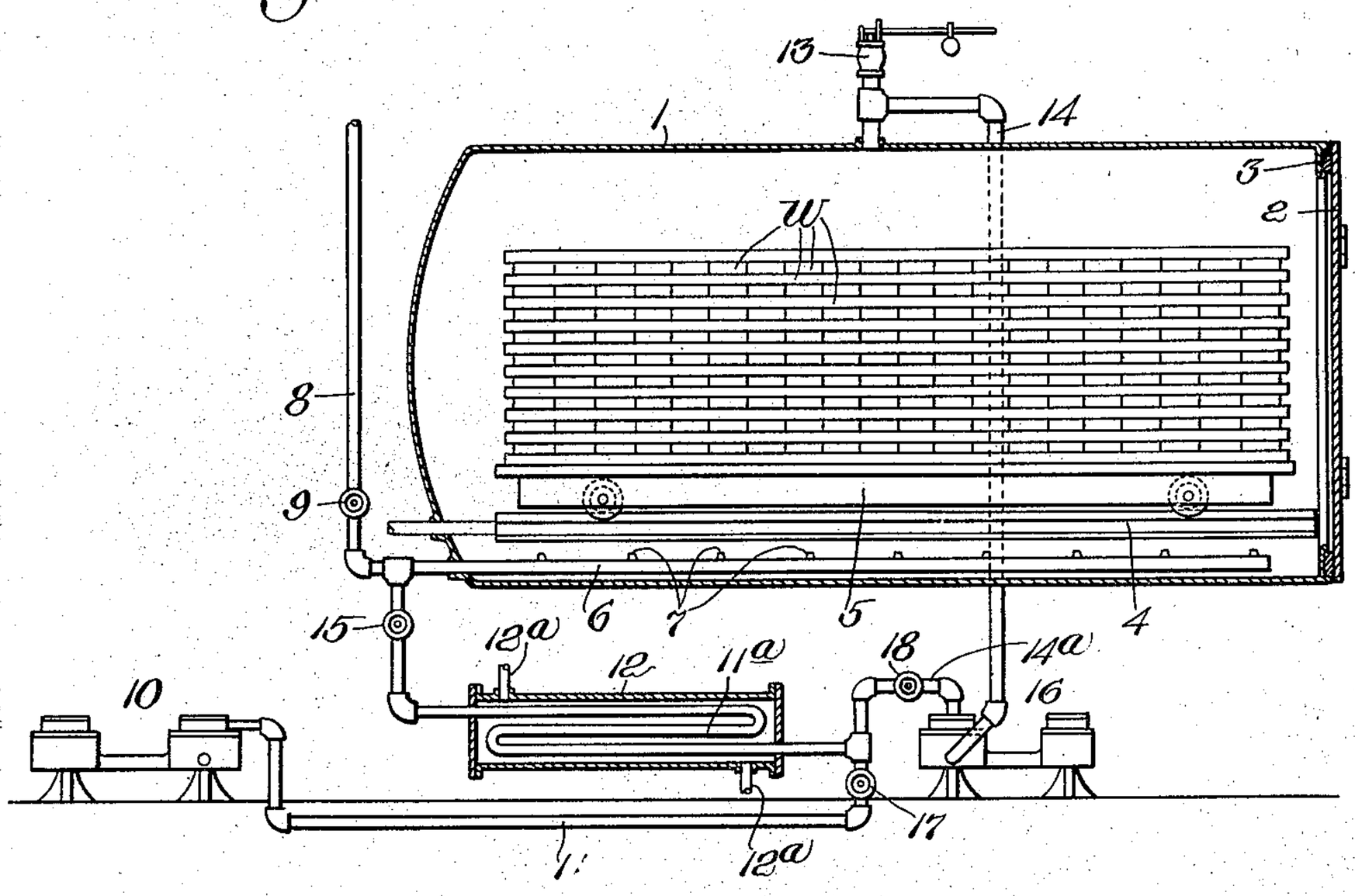
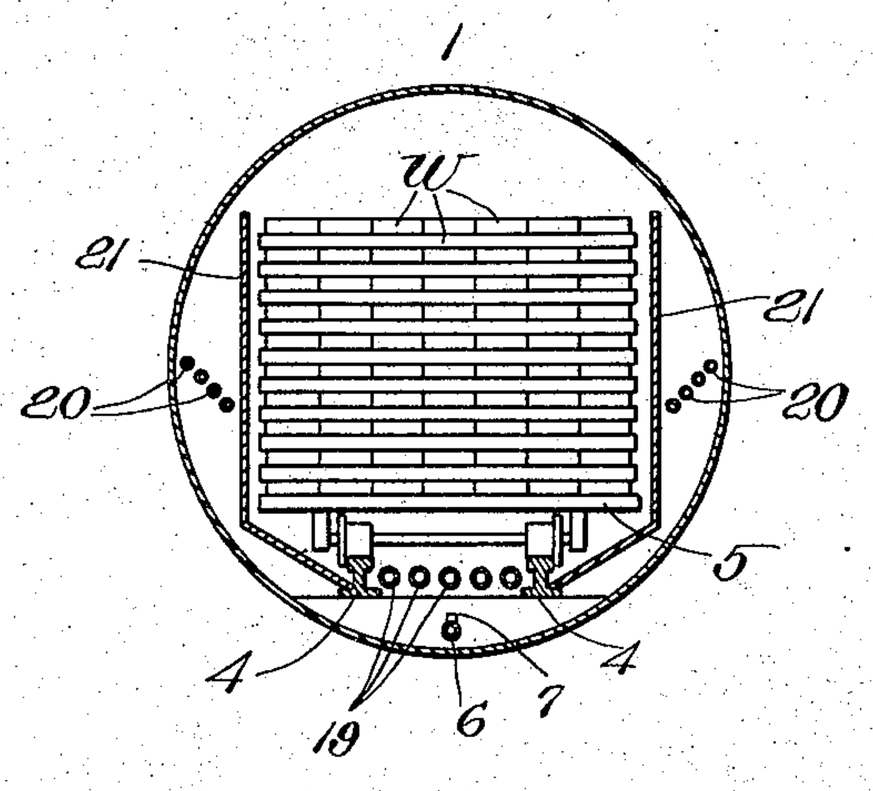


Fig. 2.



Inventors:
Ashton P. Derby,
James H. Dargie,
by Roberts Roberts & Cullman
Attorneys

UNITED STATES PATENT OFFICE.

ASHTON P. DERBY AND JAMES H. DARGIE, OF GARDNER, MASSACHUSETTS, ASSIGNORS TO P. DERBY & COMPANY, INC., OF GARDNER, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

METHOD OF TREATING WOOD AND OTHER POROUS MATERIALS.

1,166,819. Specification of Letters Patent. Patented Jan. 4, 1916.

Application filed June 11, 1915. Serial No. 33,621.

To all whom it may concern:

Be it known that we, ASHTON P. DERBY and JAMES H. DARGIE, citizens of the United States, and residents of Gardner, in the county of Worcester and State of Massachusetts, have invented new and useful Improvements in Methods of Treating Wood and other Porous Materials, of which the following is a specification.

This invention consists in a new method of drying porous materials, and more particularly a method of drying and seasoning wood.

The invention comprises a treatment by which the liquid content of the wood is removed and the wood brought to a thoroughly seasoned condition suitable for use quickly and without injury, thereby avoiding the long and tedious methods heretofore practised, incident to seasoning wood by exposure to the atmosphere or by kiln drying. In spite of the relatively short time required for the performance of this method the wood treated thereby will be found to be thoroughly seasoned and ready for use, and in better condition than when dried by the methods now in vogue. The seasoning of wood by mere exposure to the atmosphere involves simply the slow drying of the watery contents of the wood by evaporation, and as is well known requires many months of time. Artificial drying or kiln drying, while more rapid, is in some respects defective, because on account of the high artificial heat employed and the circulation of air, the surface portions of the wood dry before the interior has had an opportunity to lose its moisture, causing what is called "case hardening," preventing or materially retarding the drying of the interior of the wood, with the result that "checking" occurs on the surface, and that when the wood is worked into a manufactured article it will "move," or expand and contract unevenly, by reason of the different conditions of the surface and interior portions. It has been proposed to counteract this tendency to "case hardening" by introducing wet steam, or water vapor, at atmospheric pressure into the kiln during the drying process so as to keep the surface of the wood from drying too fast and to give an opportunity for the sap to evaporate from the interior of the wood. This expedient does not, however, shorten the time required for kiln drying, nor does it alter the fundamental principle of kiln drying which is to evaporate the moisture from the wood while maintaining such an air circulation about it as to carry the moisture off as it is delivered from the wood. It has been proposed to introduce live steam into a closed vessel containing the wood by which the sap, etc., is put into solution and carried off. But this necessitates the use of very high temperatures which are injurious to the wood.

In distinction from the treatments above mentioned, the present method consists in introducing mixed steam and air in heated condition into a closed chamber containing the wood, and alternately raising the pressure of such heated, mixed steam and air, and blowing off. The duration of the several periods of high pressure is sufficiently long so that the mixture of steam and air will thoroughly permeate the wood and penetrate the pores containing sap and moisture. The sudden release of pressure by blowing off causes the mixed air and steam to exhale from the pores carrying off with it each time some of the sap and moisture in the wood. This alternate pressure and blowing off treatment is repeated until the sap and other soluble matter is practically removed. Then the process is finished by shutting off the steam supply and continuing the introduction of heated air, alternately raising it to high pressure and blowing off, whereby with each blowing off the humidity of the gases in the chamber is progressively reduced. During said finishing treatment with air a constant forced circulation of the air is maintained charged with a gradually and progressively decreasing quantity of moisture.

In performing this method the wood to be treated is arranged in a pile, with spaces between the individual pieces, in an apparatus such as that shown in the accompanying drawings, wherein—

Figure 1 represents the apparatus in longitudinal section, partly in elevation; and Fig. 2 represents a cross section of the chamber.

It will be understood that the apparatus shown in the drawings is merely illustrative, and may be widely varied without departing from the principle of the invention.

1 represents a tight chamber in which the wood is treated. At one end of chamber 1, is a door 2 which closes against a gasket 3 to render the door tight. A track 4 is laid within the chamber, upon which a truck 5 may be rolled carrying a pile of boards or pieces of wood W. The wood is loaded on the truck outside of the chamber and the several pieces of wood are spaced apart a little, as shown. Then the loaded truck is rolled along the tracks into the chamber 1, and the door closed, hermetically sealing the chamber.

An inlet pipe 6 enters the lower part of chamber 1 below the pile of wood and is provided with a series of delivery nozzles 7. Connected to the inlet pipe is a steam pipe 8, controlled by a valve 9, and communicating with a suitable source of steam supply (not shown). An air compressor 10 is connected by pipes 11 and 11ª to inlet pipe 6. Between the air compressor 10 and inlet pipe 6, the pipe 11ª passes through a heater box or chamber 12, provided with suitable heater connections 12ª for circulating a heating medium through heater 12 and about the coils 11ª.

At the top of the chamber 1 is an automatic pop valve 13 of the kind which will resist pressure up to a predetermined point and will then blow off and will remain open until the pressure has been again reduced substantially to that of the atmosphere or to a point much below the blowing off pressure.

A pipe 14 connects the top part of the chamber 1 with the inlet pipe 6 through a circulation pump 16, pipe 14ª and pipe 11ª which passes through the heater box 12. Pipe 11ª is controlled by a valve 15, and pipe 11 is controlled by a valve 17.

The process performed by the apparatus is as follows: The air compressor 10 is started, forcing air into chamber 1 through pipes 11, 11ª and 6. The air is heated as it passes through the heater box 12. A jet of high pressure steam is also introduced from steam pipe 8 into pipe 6, mingling with and humidifying the air, and the mixed air and steam enter the chamber 1 through the nozzles 7, from which the mixture is blown upward in a number of uniformly disposed jets through the pile of wood. This mixture of air and steam is forced into the chamber until a pressure is attained of about 40 pounds to the square inch, at a temperature of from 180° to 200° F. Thereupon the automatic pop valve 13 opens, suddenly relieving the pressure, and permitting the pressure to fall to a low point, say 5 pounds to the square inch. The valve then automatically closes and the pressure is again raised by the incoming mixture of air and steam until the predetermined pressure for which the valve is set is again reached, whereupon the valve 13 is again automatically opened, and the pressure again suddenly reduced. This process is repeated for from two to ten hours according to the thickness and kind of lumber. The high pressure causes the hot mixture of air and steam thoroughly to penetrate the pores of the wood, reaching all the sap and other soluble matter in the pores, and the sudden reduction of pressure by blowing off, which results in the sudden expansion or outrush of the compressed air and steam from the pores of the wood, carries off with it the softened and diluted sap and other soluble materials. The alternate application and release of the pressure finally carries off substantially all the sap, etc., and the presence of the steam in the air not only aids in removing the sap but effectually prevents case hardening of the surface of the wood, which results from the use of hot dry air alone. Case hardening causes checking, and also prevents the proper drying and seasoning of the interior of the wood. It is found further that a much lower temperature may be used, with the same drying effect, than is possible when steam alone is used,—a very important factor since high temperatures seriously injure the wood. After the alternate high and low pressure treatment with mixed hot air and steam has been continued until the wood is nearly dried, the process is continued and completed by shutting off the steam supply by closing valve 9, and leaving the air compressor in operation to continue the delivery of hot air alone through pipe 6 and nozzles 7. The pressure is alternately raised and lowered, as already described, by the action of the automatic pop valve 13, the hot air supply being continuous. During this treatment with hot air, a circulation is maintained through the circulation system consisting of pipe 14, controlled by valve 18, and a circulation pump 16, which takes its suction from the top of the chamber 1, and delivers into the air passage through pipes 11 and 11ª from compressor 10, in front of heater box 11, so that the air, which will cool slightly while passing through pipe 14, is again heated up before it enters the chamber. The circulation pump is started when the steam is shut off, the air compressor 10 being in operation all the time, thus maintaining to the end of the treatment a forced circulation of the hot air and the residual steam about and through the lumber. As the pressure in chamber 1 is blown off at intervals during the air treatment, the same as during the steam and air treatment, the humidity of the air under circulation during this part of the process will with each blowing off be automatically and progressively decreased until finally the air is to all intents and purposes quite dry. Near the end of the treatment the process may be hastened if desired by admitting high pres-

sure steam to steam heater coils 19 situated under the pile of lumber in chamber 1. This repeated application of hot air under pressure with its gradually diminishing humidity, penetrates the pores of the wood and gradually takes up the residual moisture which remains after the mixed steam and air treatment, while the repeated reduction of the pressure causes the air to exhale from the pores of the wood carrying with it the moisture, until not only is the interior of the wood thoroughly dried out, but finally as the humidity of the hot air decreases, the exterior of the wood also is dried, and the seasoning is completed.

The completion of the process may be further hastened at the final stage by circulating cold water through condensing coils 20 situated at the sides of the tank (Fig. 2) and at the outside of partitions or walls 21, extending from the lower part of the tank upward at the sides of the pile of lumber. These parts set up a circulation of air upward through the lumber between the walls 21, over the tops of said walls, and downward between said walls and the walls of the tank, thereby condensing any residual moisture in the air as the cooler downwardly moving currents pass over coils 20, and further drying and cooling the air previous to the removal of the lumber.

We claim:

1. The method of seasoning wood, which consists in subjecting the wood in a closed chamber to mixed air and steam in heated condition, alternately and repeatedly raising and lowering the pressure of said mixed, hot air and steam, and thereafter discontinuing the supply of steam and finishing the drying by subjecting the wood to a treatment of hot air.

2. The method of seasoning wood, which consists in subjecting the wood in a closed chamber to mixed air and steam in heated condition, alternately and repeatedly raising and lowering the pressure of said mixed, hot air and steam, and thereafter discontinuing the supply of steam and introducing into said chamber hot air, and alternately and repeatedly raising and lowering the pressure of said hot air.

3. The method of seasoning wood, which consists in subjecting the wood in a closed chamber to mixed air and steam in heated condition, alternately and repeatedly raising the pressure of said mixed hot air and steam and suddenly blowing off, and thereafter discontinuing the supply of steam and continuing the drying by subjecting the wood to a treatment of hot air.

4. The method of seasoning wood, which consists in subjecting the wood in a closed chamber to mixed air and steam in heated condition, alternately and repeatedly raising the pressure of said mixed hot air and steam and suddenly blowing off, and thereafter discontinuing the supply of steam and introducing into said chamber hot air, and alternately and repeatedly raising the pressure of said hot air and suddenly blowing off.

5. The method of seasoning wood, which consists in subjecting the wood in a closed chamber to mixed air and steam in heated condition, alternately and repeatedly raising the pressure of said mixed hot air and steam and suddenly blowing off, and thereafter discontinuing the supply of steam and introducing into said chamber hot air, and alternately and repeatedly raising the pressure of said hot air and suddenly blowing off, and maintaining a forced circulation of the air and the progressively diminishing residue of steam, during said air pressure and blowing off treatment.

6. The method of seasoning wood, which consists in subjecting the wood in a closed chamber to mixed air and steam in heated condition, alternately and repeatedly raising the pressure of said mixed hot air and steam and suddenly blowing off, and thereafter discontinuing the supply of steam and introducing into said chamber hot air, and alternately and repeatedly raising the pressure of said hot air and suddenly blowing off, maintaining a forced circulation of the air and the progressively diminishing residue of steam, during said air pressure and blowing off treatment, and finally condensing the residual moisture in the air within said chamber.

Signed by us at Gardner, Massachusetts, this ninth day of June, 1915.

ASHTON P. DERBY.
JAMES H. DARGIE.

Witnesses:
JAMES A. STILES,
GERTRUDE A. LIVELY.