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 DRY KILN FOR DRYING LUMBER AND OTHER MOISTURE BEARING SUBSTANCES.  
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1,228,989.

Patented June 5, 1917.

Fig. 1.

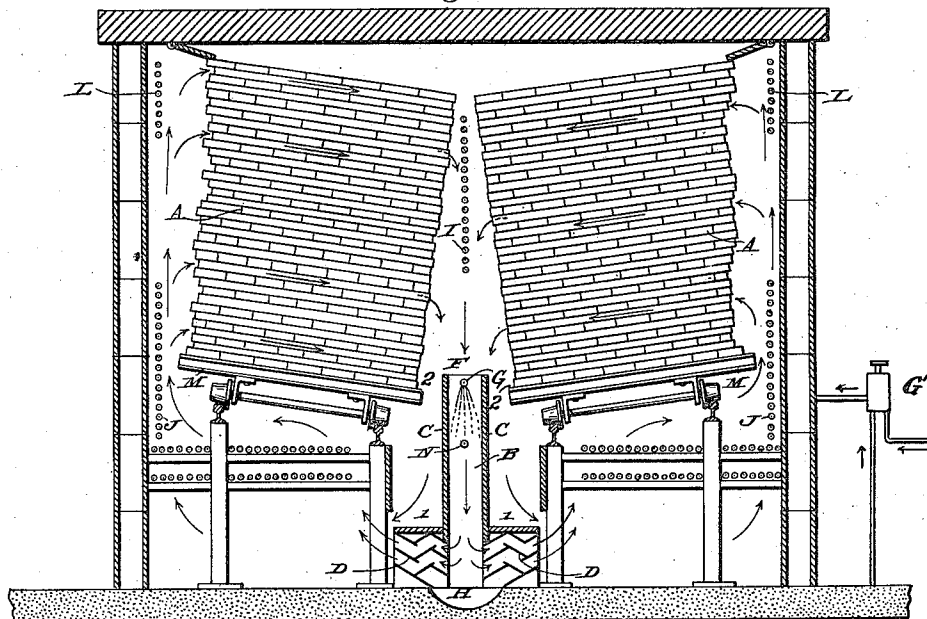
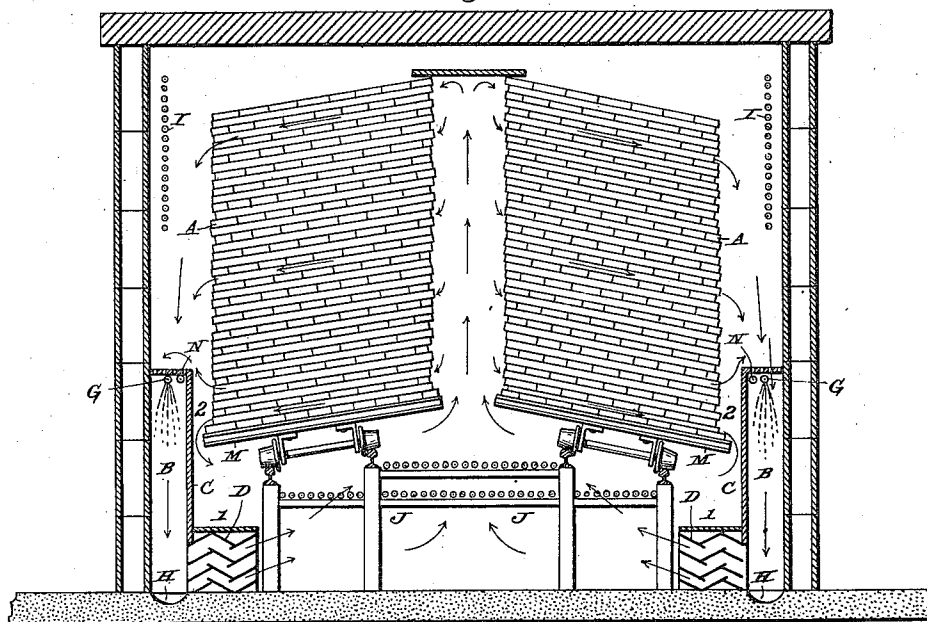


Fig. 2.



Witnesses:

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# UNITED STATES PATENT OFFICE.

HARRY DONALD TIEMANN, OF MADISON, WISCONSIN.

DRY-KILN FOR DRYING LUMBER AND OTHER MOISTURE-BEARING SUBSTANCES.

1,228,989.

Specification of Letters Patent.

Patented June 5, 1917.

Application filed December 18, 1915. Serial No. 87,615.

(DEDICATED TO THE PUBLIC.)

*To all whom it may concern:*

Be it known that I, HARRY DONALD TIEMANN, a citizen of the United States; and an employee of the Department of Agriculture of the said United States of America, residing at Madison, in the county of Dane, State of Wisconsin, (whose post-office address is Madison, Wisconsin,) have invented certain new and useful Improvements in Dry-Kilns for Drying Lumber and other Moisture-Bearing Substances.

This application is made under the act of March 3, 1883, chapter 143 (22 Stat., 625), and the invention herein described and claimed may be used by the Government of the United States or any of its officers or employees in the prosecution of work for the Government, or any person in the United States, without payment to me of any royalty thereon.

My invention is an improvement on my former dry kiln described in Letters Patent of March 5 and March 12, 1912, Nos. 1,019,743 and 1,019,999, respectively. This improvement consists primarily of an arrangement of parts by which advantage is taken of the natural tendency of cooled air to descend as it is cooled by the pile of lumber being dried, and at the same time the features of humidity regulation and increased circulation by means of sprays of water, claimed in my former patents, herebefore referred to, are retained in the improved dry kiln herein described.

The object of my invention is to increase the circulation of the air within the pile of lumber and at the same time to regulate the humidity of the air passing through the pile, so as to obtain more rapid, uniform and thorough drying than has been accomplished heretofore.

It is well known that in any given inclosure the cooler air tends to descend by reason of its greater density, and the warmer air to rise. It is also well known that any substance from which moisture is being evaporated is cooled thereby. I have discovered through very careful experiments in dry kilns that this air is considerably cooler within a pile of lumber and also that it tends to descend. Experiments on a commercial scale have shown that this tendency is of considerable consequence and espe-

cially so when the lumber is frozen when first placed in the kiln.

The nature and scope of my invention will be more readily understood by the following description taken in connection with the accompanying drawings, wherein I have illustrated a cross section of my improved kiln with a load of lumber in the form of boards in place. The kiln may be either of the progressive or the compartment form. In the former a chamber much longer than its width is used with rails running lengthwise of the chamber, the lumber being periodically run in at one end, and removed at the other. In the compartment kiln the truck loads of lumber are placed in the kiln and remain stationary until they are dry.

Figures 1 and 2 show cross-sections of two forms of drying kilns.

Referring to the drawings: A represents the lumber placed in piles, and B a vertical flue about 8 or 12 inches wide running the entire length of the kiln through the center or one flue on either side and formed by the waterproof partitions, C. D indicates suitable baffle plates consisting of a series of boards placed in zigzag fashion as shown at 1-1, the purpose of which is to separate the fine mist from the air and allow this air to pass through in a saturated condition but free from entrained particles of water. F represents a spray of water running the length of the flue, which is supplied from suitable nozzles, G, the temperature of the water being regulated by means of a temperature regulator, G'. Arranged at the bottom of the kiln is a gutter, H, for collecting the drip and returning it to any desired place. The temperature of the spray of water, F, may be altered at will, a suitable apparatus for effecting such change in temperature having been described in my former patents, referred to above. I also provide a series of cold water condenser pipes, I, for use at the end of the drying operation when very low humidity is required. Steam heating pipes, J, are so placed that the chief heating effect is produced where the upward current of air is desired. Auxiliary heating pipes, L, may be placed near the top of the column of upward rising air to maintain its temperature constant, whenever cooling occurs through contact with the

side walls but are not essential to the apparatus. Solid baffle plates, M, are arranged below the piles of lumber, A, to direct the flow of heated air and to shield the lumber from the radiation of the steam pipes, J. N is a perforated steam pipe, for use, if needed, for extremely high humidities and high temperatures.

It will be noted that the lumber as shown is piled in an inclined manner, the downward slope being in the same direction as the descending air currents. This slope is not an essential part of my invention but facilitates the natural tendency of the air to descend as it cools. My invention applies to edge-piled lumber and flat-piled lumber as well as to the sloping pile shown in the drawing.

It will be further seen that the slope of the lumber is produced by a dip in the inner rails. The rails before entering the kiln are on a common level and the lumber may be piled on the truck horizontally. Upon entering the kiln the inner rails drop below the level of the outer rails, thus automatically inclining the lumber in the desired fashion. The lumber may be piled on a sloping truck with the rails horizontal, if preferred.

In practising my invention the load of lumber is run into the kiln, and the door is closed as nearly air tight as possible. The entire kiln is thus shut off from the outside air, there being no ventilators or communications with the outer air. It is thus independent of atmospheric conditions, which is of great advantage. The air is heated by the pipes, J, and rises along one side of the pile of lumber, A. As the heated air comes in contact with the cold wet wood portions of it are cooled and descend between the layers of boards to the opposite side of the pile. Here the cooled air sinks downward and a part enters the spray-flue, B, where it is cooled or heated as the case may be by intimate contact with the spray of water, F, and is reduced to a completely saturated condition. A steam spray may be used also in conjunction with the water spray in the flue, B, whenever excessively high humidities at high temperatures are called for, though ordinarily this will not be needed. The air then passes through the eliminators, D, into the space beneath the heating pipes, J, still in a saturated condition and at a certain desired temperature. This temperature is the dew-point of the air after it passes through the heaters, J. This dew-point temperature is controlled by the temperature of the water used in the sprays, F. Thus any desired humidity in the air above the heating pipes, J, can be maintained. The sprays furthermore greatly increase the circulation through the downward force of the

water in the narrow chamber, B. By the use of hot water the dew-point temperature is raised and consequently the air is humidified. When cold water is used the dew-point is lowered and the air is dried, the sprays acting as condensers.

For very dry conditions I have found that the cold water spray used in this manner is not economical, due to the excessive circulation produced and the consequent extraction of heat from the large volume of air passing through. For this condition the condensing pipes, I, are to be used. While I have found that the condensing pipes do not produce nearly so great a circulation, not so much circulation is required at the end of the drying operation, since very little evaporation is taking place at this stage. At the beginning, especially with green lumber, a large circulation is desirable, and here the sprays are particularly efficient. A small space, as shown at 2-2, is left on either side of the flue, B, between it and the lumber, to permit of a certain amount of local circulation, which adds to the efficiency of the process, without any additional expenditure of heat.

From the foregoing, it is thought that the construction, operation and many advantages of the herein described invention will be apparent to those skilled in the art, without further description; and it will be understood that various changes in the size, shape, proportion, and minor details of construction may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

Having thus described my invention, I claim:

1. In a dry kiln consisting of a closed chamber, the following sequence of parts: heating pipes arranged so as to produce an ascending column of heated air along one side of the pile of lumber; a pile of lumber so arranged that the heated air may pass freely through the pile in cooling, in a downward direction; said lumber being so piled as to leave a space on the opposite side of the pile through which the cooled air may descend; a vertical flue near the bottom of the pile, into which the cooled descending column of air may enter; a spray of water in this flue; means for regulating the temperature of this spray of water; baffle plates near the bottom of this flue for separating the mist from the air, substantially as described.

2. In a dry kiln consisting of a closed chamber the following sequence of parts: heating pipes arranged so as to produce an ascending column of heated air along one side of the pile of lumber, an auxiliary heater placed near the top of the ascending column of air; a pile of lumber so arranged as to allow the heated air to pass freely

through the pile in cooling in a more or less downward direction; said lumber being so piled as to leave a space on the opposite side through which the cooled air may descend as it emerges from the lumber; a set  
5 of pipe condensers in the descending column of air; a vertical flue near the bottom of the pile into which the cooled descending column of air may enter; a spray  
10 of water in this flue; means for regulating the temperature of this spray of water; baffle plates near the bottom of this flue for separating the mist from the air, substantially as described.

15 3. In a dry kiln consisting of a closed chamber, the following sequence of parts: heating pipes arranged so as to produce an ascending column of heated air along one side of the pile of lumber; an auxiliary  
20 heater placed near the top of the ascending column of air; a pile of lumber so arranged as to allow the heated air to pass freely

through the pile in cooling in a more or less downward direction; said lumber being so piled as to leave a space on the opposite  
25 side through which the cooled air may descend as it emerges from the lumber; a set of pipe condensers in the descending column of air; a vertical flue near the bottom of the pile into which the cooled descend-  
30 ing column of air may enter; a spray of water in this flue; means for regulating the temperature of this spray of water; a perforated steam pipe in this flue; baffle plates  
35 near the bottom of this flue for separating the mist from the air, substantially as described.

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

HARRY DONALD TIEMANN.

Witnesses:

HARRY IRION,

W. B. GREELEY.