

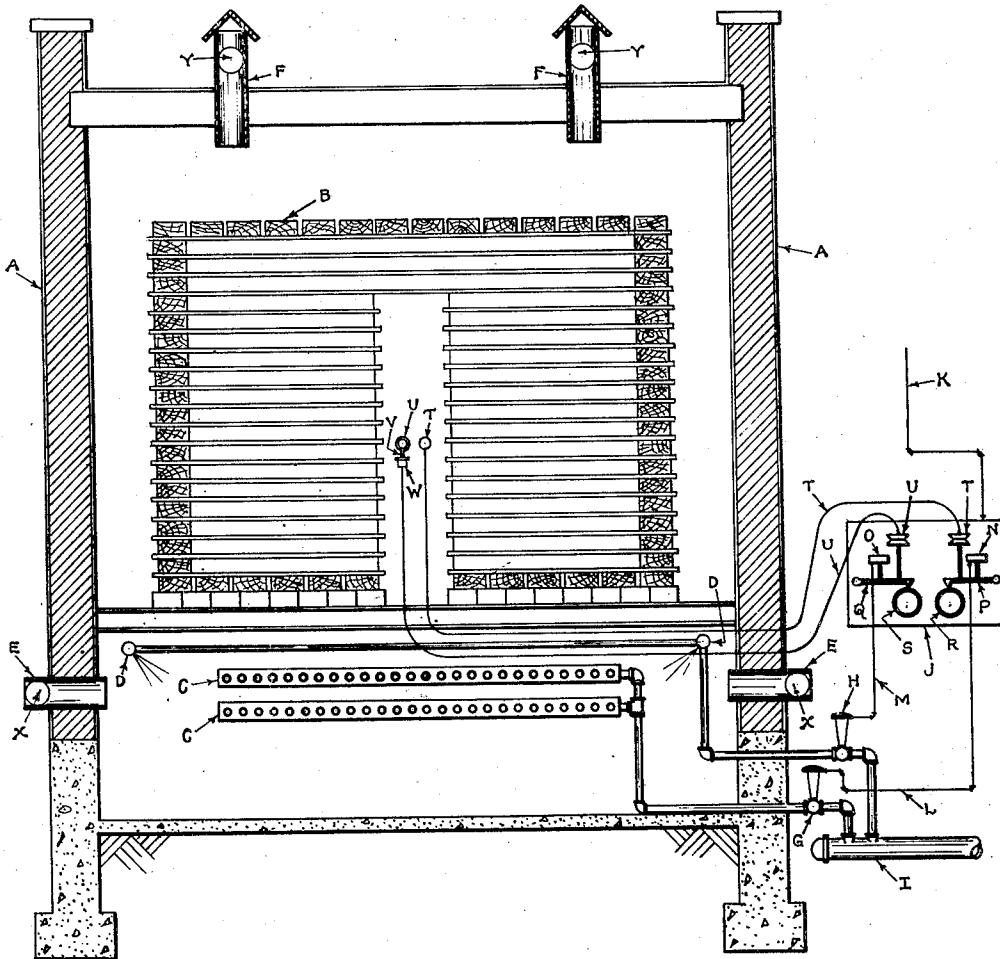
Sept. 23, 1924.

1,509,533

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METHOD FOR SEASONING WOOD

Filed Oct. 27. 1923



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UNITED STATES PATENT OFFICE.

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THE CITIZENS OF THE UNITED STATES OF AMERICA.

METHOD FOR SEASONING WOOD.

Application filed October 27, 1923. Serial No. 671,221.

(FILED UNDER THE ACT OF MARCH 3, 1883, 22 STAT. L., 625.)

To all whom it may concern:

Be it known that I, ROLF THELEN, a citizen of the United States of America, and an employee of the Department of Agriculture, residing in Madison, Wisconsin (whose post-office address is Madison, Wisconsin), have invented a new and useful method for seasoning wood.

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, its officers and employees, and by any person in the United States without the payment to me of any royalty thereon. I hereby dedicate the same to the free use of the Government and the people of the United States.

This method consists essentially in subjecting the wood to be dried to temperatures and humidities which are made to rise and fall periodically in accordance with a predetermined time schedule.

It is well known that stresses are induced in wood during the ordinary process of seasoning and that they can be relieved and the quality of the wood thereby increased, by a high humidity treatment in which the wood is exposed for a number of hours to an atmosphere of greater humidity and, optionally, higher temperature than employed during the drying. This high humidity treatment softens the surface of the wood temporarily and allows said surface to absorb moisture from the atmosphere, which results in reduction or entire relief of the drying stresses through the yielding of the softened surface. In ordinary practice such treatments may be given once or twice during the seasoning period, or oftener in the case of thick stock of refractory species.

Attempts have been made to take advantage of the well-known benefits of high humidity treatments and to secure faster seasoning by the use of intermittent steaming processes which cause fluctuations in the humidity of the atmosphere surrounding the wood. These steaming processes are automatically controlled by means of wet-bulb or differential thermostats which are specially constructed for this purpose, and are provided with mechanism which allows the

humidity to fall a predetermined amount before the steam spray valve is opened to raise the humidity again. The rate at which the humidity rises and falls is dependent upon the rate at which the steam spray is supplied and the rate at which the kiln loses humidity through leakage or otherwise. No provision is made to maintain either the maximum humidity or the minimum humidity for a measurable period of time. Any temperature changes produced are merely incidental and not subject to regulation. It is well known that increase in temperature hastens transfusion and that it is desirable to have the inside of the wood to be dried hotter than the outside. This can be accomplished only by intermittent heating and cooling of the wood, most or all of the drying taking place during the cooling and at the cooler temperature. Furthermore, since it takes time for the wood to warm up and again to cool off, it is desirable or even necessary to maintain the maximum and minimum temperatures and their corresponding humidities for an appreciable period of time.

The methods described are inadequate in that they make no provision for rise and fall in the temperature or for maintaining the temperature and the humidity at a constant value for an appreciable time. Neither do they provide for definite correlation between the time element and the oscillations in humidity.

The present invention makes provision for the complete control of the temperature and of the humidity of the atmosphere surrounding the wood to be dried at all times and for their variation or oscillation according to any desired time schedule. The method is as follows: When the seasoning is started, the temperature and humidity are both raised at a predetermined rate to a predetermined high level and maintained for a predetermined time; after which they are both lowered to a predetermined low level, at a predetermined rate, and maintained for a predetermined period at said low level; and then raised at a predetermined rate to the former high level, the cycle being repeated continuously. As seasoning progresses the high and low levels for both

temperature and humidity may be changed in accordance with the needs of the wood being dried.

Figure 1 represents a cross-sectional elevation of a dry kiln adapted for oscillating treatments as contemplated in this application. In this drawing A represents the kiln building, which may be of any conventional construction; B represents the lumber to be dried; CC are the heating coils or other means of heating the kiln and its contents; DD are steam spray lines for supplying steam for increasing the humidity in the kiln; EE are air intake flues, and FF are air outlet flues; G is a diaphragm valve on the heating coils; H is a diaphragm valve on the steam spray lines; I is the steam supply pipe; J is the thermostat; K is the compressed air supply line to the thermostat; L is the compressed air supply line from the thermostat to the diaphragm valve on the heating coils; M is the compressed air supply line from the thermostat to the diaphragm valve on the steam spray lines; N is the air valve for heat control; O is the air valve for humidity control; P is the air valve lever system for heat control; Q is the air valve lever system for humidity control; R is the cam for the heat control; S is the cam for humidity control; T is the temperature sensitive element for heat control; U is the temperature-sensitive element for humidity control; V is the wick surrounding the bulb of the temperature-sensitive element U; W is a water reservoir for wick V; XX are dampers in the air intake flues; YY are dampers in the air outlet flues.

The operation of the control system is as follows: The thermostat automatically controls the temperature and humidity in the kiln at any given time in conjunction with the heating coils and the steam spray lines which it operates. The dampers XX and YY are opened far enough so that the natural draft of air will keep the humidity below the desired point. The humidity can then be automatically raised by the opening of the steam spray lines. The operation of the thermostat itself is well understood since instruments of this and similar kinds have been on the market and in commercial use for many years. It is briefly as follows: Changes in the temperature of the bulbs of the temperature-sensitive elements T and U cause pressure changes in these elements, in turn causing motion in the lever systems P and Q through the expansion and contraction of diaphragms or similar devices. These lever systems control the operation of the air valves N and O, which in turn control the supply of steam to the heating coils and the steam spray lines, respectively, through the diaphragm valves G and H. Any desired changes in the temperatures at

which the air valves N and O open and close can be made by suitable cams, R and S. One end of each lever system rests upon its respective cam and as the cam is rotated by clock work, the movement imparted to the lever system serves to change the adjustment and thus produce corresponding changes in the kiln temperatures. The dry bulb system connected with the temperature-sensitive element T controls directly the temperature of the kiln. The other system connected to the temperature-sensitive element U controls the wet bulb temperature, the bulb of the temperature-sensitive element being kept constantly wet by means of the wick V and water reservoir W. Since humidity is a direct function of dry bulb temperature and wet bulb temperature, control of these two also controls the humidity. A specific illustration of the operation follows: When the temperature in the kiln falls, the pressure in the temperature-sensitive element T also falls. Motion is imparted to the lever system P thus operating the air valve N and permitting escape of the air from the diaphragm valve G. This valve then opens, permitting steam to flow into the heating coils. When the temperature again rises to the desired point the operation is reversed and the steam is shut off. The wet bulb thermostatic system works in precisely the same manner, controlling the wet bulb temperature. The rate of rotation of the cams is so chosen that the desired number of oscillations per unit of time can be secured. A rate of one revolution in six hours has worked out very satisfactorily under certain conditions. As the cam rotates one end of the lever system follows the cam contour, producing the desired changes in the set of the instrument and thus the desired changes in temperature. Other well-known types of control instrument can also be used. A concrete example follows. Upon starting the seasoning the temperature is raised to 165 degrees F. and the humidity to 78 per cent as rapidly as possible; these conditions are maintained at this high level for two hours; then lowered to 150 degrees F. and 28 per cent in an hour's time; maintained at this low level for two hours; and then raised in an hour's time to the former high level, 165 degrees and 78 per cent. This cycle is then repeated continuously. During the high level period the wood is warmed and the moisture distribution throughout made more uniform through increased transpiration of the moisture. During the low level period evaporation of moisture takes place, aided by the heat stored in the wood, and the surface becomes drier. The uniformity of moisture distribution throughout the wood is reduced during this period. The humidity oscillations prohibit the formation of drying stresses and the temperature oscill-

lations increase the seasoning rate, thus producing a better result in a shorter time.

The oscillations in the temperature and humidity can be produced by any well-known means such as hand control of steam valves, semi-automatic control, or complete automatic control. I prefer to use full automatic control of the air-operated type, the instrument being commonly called a time-temperature-humidity controller and being available upon the open market. This instrument is, in essence, two air-operated thermostats, one a dry-bulb thermostat and one a wet-bulb thermostat, provided with a pair of clockwork driven cams. These cams serve through levers, to change the adjustment or setting of the thermostats, thus changing the dry-bulb temperature and the wet-bulb temperature, and consequently the humidity as well. The profiles of the cams and the speed of their rotation determine the temperatures and the rate of temperature change, and any desired schedule can be reproduced by the use of the proper cams. The dry-bulb thermostat usually operates on the heating coils and the wet-bulb thermostat on the steam spray line used to increase the humidity in the dry kiln. The dry-bulb thermostat therefore controls the tempera-

ture in the kiln and the wet-bulb thermostat controls the wet-bulb temperature and, in conjunction with the dry-bulb thermostat, the humidity in the kiln. Provision must be made in the dry kiln, by ventilation or otherwise, to enable the atmosphere to be cooled and the humidity to be reduced faster than the rate determined by the schedule. Otherwise the thermostats cannot control the rate at which the temperature and humidity fall during the periods when they are dropping.

Having fully described my invention and the manner in which it can be applied I claim as novel:

The herein described method for seasoning wood, consisting of subjecting said wood to an atmosphere whose temperature and humidity are maintained at high levels and low levels alternately; the temperature and humidity at the respective levels, the length of time during which said temperature and humidity are maintained at each level, and the rate of change of said temperature and humidity from one level to another being regulated in accordance with a predetermined time schedule.

October 13, 1923.

ROLF THELEN.