Aug. 26, 1930. M. L. MUELLER 1,774,208

DRYING KILN

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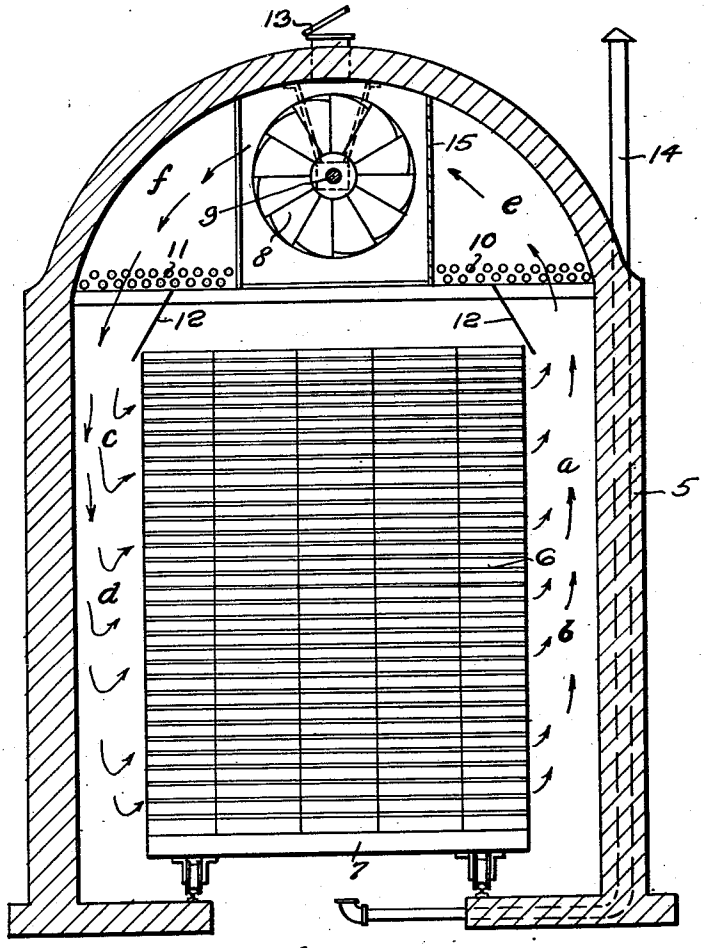


Fig. 1.

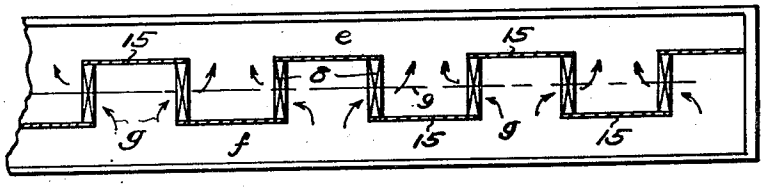


Fig. 2.

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UNITED STATES PATENT OFFICE

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DRYING KILN

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This invention relates to drying kilns, and more particularly to kilns for drying lumber.

The object of the invention is to provide a kiln wherein the air circulating means, such as fans or blowers, are located in the top of the kiln, below the ceiling thereof, by virtue of which certain important functional and economic advantages are attained, as will be more specifically set forth herein.

In the accompanying drawing,

Fig. 1 is a transverse vertical sectional view of a kiln, constructed in accordance with the invention,

Fig. 2 is a fragmentary horizontal sectional view of the fans, and their baffles or partitions.

Like numerals designate corresponding parts in both of the figures of the drawing.

In the drawing, 5 designates the body of a kiln, and 6 a pile of flat piled lumber, on a truck 7. It is common practice to run piles of lumber on trucks of this character into lumber drying kilns.

In the operation of the apparatus, fans 8, on a line shaft 9, draw air upwardly, as indicated by the arrows *a*, from the space *b*, between one side of the pile of lumber, and the adjacent wall of the kiln, and discharge said air, as indicated by the arrows *c*, downwardly into the space *d*, between the other side of the pile of lumber, and the adjacent wall of the kiln. In its passage, the air is heated by passage over the steam pipes, or other suitable radiation, indicated at 10 and 11. I preferably employ baffles 12 to assist in causing the air to follow the path described. A fresh air intake 13, of which there may be as many as desired, provides means for admitting additional air to the circuit, as may be desired. An exhaust vapor vent 14 leads from a point adjacent the bottom of the kiln and provides means for withdrawing the coolest and most heavily saturated vapors. Partitions 15 disposed alternately on opposite sides of the fans provide means for separating the upper portion of one side of the kiln, at *e*, from the upper portion of the other side of the kiln, as at *f*, so that the section *e* constitutes the intake side for all of the fans, and the section *f* constitutes the discharge side for all of the fans, as will be readily apparent from an inspection of the arrows *g*, in Fig. 2.

In that figure, the air flow is shown as it would be if the blades of the fans are so set as to cause adjacent fans to discharge air in opposition to each other. This prevents the setting up of a whirling or corkscrew motion of the air and brings about an even distribution of the same.

It will be apparent that with the parts arranged as illustrated in Fig. 1, and with the air flowing forcibly in the direction indicated by the arrows *c*, two opposing forces will come into being. That is to say, the heated air, after it loses the downward momentum, imparted thereto by the fans, will tend to reverse its direction of movement and flow upwardly or rise, because of its heated condition. In its attempt to rise, it is opposed by the additional downcoming air that is still under the momentum imparted to it by the fans. The result of the creation of these two opposing forces, in the relatively narrow space between the side wall of the kiln and the pile of lumber, brings about a lateral diffusion of the air much nearer the source of the air current supply than would be the case if these opposing forces did not exist. The result of this is to, in turn, bring about a very greatly to be desired even distribution of the air through the piles of lumber throughout the height of the latter, it being apparent that the velocity and volume of the air may be controlled at will by varying the speed of the fans.

Kilns, at present in use, fall, for the most part, into three general classes.

1. Natural draft kilns with heating coils located below the lumber, thereby causing air to rise into the stock through convection currents caused by differences of temperature. The air rises between the material and the kilns walls through spaces in the stock.

2. Forced circulation kilns, in which fans are used to accelerate the convection currents, thereby securing a circulation caused by the mechanical force transmitted by the fans, plus the convection currents. In order to

secure the maximum assistance from convection currents, the fan air has been directed with them rather than opposed.

3. A forced circulation kiln in which the air is directed sideways into flat piled stock from a perforated plenum chamber, in which case convection currents neither assist nor oppose.

When lumber is piled flat with horizontal spaces between courses, it becomes a problem to cause air rising in a vertical course adjoining lumber to change its course, abruptly, and assume a horizontal direction. This is further aggravated by the fact that when air propelled, by both fan pressure and convection currents, enters the space which, by commercial necessity, is too small to be an ideal plenum chamber, it has a considerable velocity which carries it into the upper portions of the stock in greater quantities than into the lower portions. Also with changes in the relative proportions of lumber and interspaces, the design cannot be regulated to be correct for all lumber. Air entering the bottom of a restricted rectangular space at a high velocity, will by the natural laws governing its flow continue to hold its upward direction and will not diffuse or turn an abrupt angle unless compelled by some force. Deflectors, baffles and other mechanical means of causing deflecting and diffusing forces to act on this air stream have been used. However, as far as I am aware, no one has proposed to arrange the air stream so that it would have a downward impulse from the fan pressure and an opposing upward impulse from the convection currents caused by the fact that this downward air stream was hotter and consequently of lower density than the atmosphere in any other part of the lumber.

In addition to the lateral diffusion of the air brought about by the downward impelling of the air in the manner above set forth, certain other important functional, structural and economic advantages are present in the arrangement shown and described. For example, the line shaft and the fans carried thereby, when located under the ceiling of the kiln, do not receive water, saw dust, and other materials, such as drop on them when they are located in the bottom of the kiln, in accordance with the present wide spread practice. Further, locating the fan equipment below the ceiling makes it possible to admit fresh air evenly to each fan, automatically, along the top of the kiln. Where the air supply equipment is located below the kiln, it has been the practice to dispose long fresh air ducts longitudinally of the kiln, with the result that the fans nearest the duct inlet receive more fresh air than the middle ones when the inlet is throttled for control of the air supply. When the fans are located under the ceiling, the strong air currents created at that point prevent water of condensation from collecting on the ceiling and dropping on the stock.

In addition, such location of the fans makes it possible to oil the bearings adjacent each fan from suitable openings in the roof, and also makes it possible to repair the fans and associated parts without removing lumber from the kiln.

A further advantage is, that by this arrangement, the spent vapors may be exhausted from the bottom of the kiln, at which point they accumulate, because they are the coolest and most heavily saturated.

It is to be understood that the invention is not limited to the precise arrangement shown, because many ways will readily suggest themselves to the engineer to re-arrange the parts. without departure from the principle involved. Therefore, it is to be understood that the invention includes within its purview whatever changes fairly come within either the terms or the spirit of the appended claims.

Having described my invention, what I claim is:

1. The combination with a kiln having a transversely uniformly arched ceiling substantially throughout its length, of a longitudinally extending partition disposed, as a whole, centrally beneath said ceiling and comprising a plurality of longitudinally spaced portions and connecting laterally extending portions, and fans in said laterally extending portions for discharging air from one side of the partition to the other, the air discharged by said fans being guided laterally by the arched ceiling downwardly along the side walls of the kiln.

2. The combination with a kiln having trackways centrally disposed therein to receive piles of lumber, flat piled in spaced courses, and to support the lumber in such position that it is equidistantly spaced with respect to the side walls of the kiln, of a centrally disposed reversible fan located beneath the ceiling of the kiln, the said ceiling being shaped to provide stream line air guiding surfaces of uniform length and curvature upon the opposite sides of the fan, and between the fan and the spaces between the side walls of the kiln and the said lumber pipe.

3. The combination with a kiln having trackways centrally disposed therein to receive piles of lumber, flat piled in spaced courses, and to support the lumber in such position that it is equidistantly spaced with respect to the side walls of the kiln, of a centrally disposed reversible fan located beneath the ceiling of the kiln, the said ceiling being shaped to provide stream line air guiding surfaces of uniform length and curvature upon the opposite sides of the fan, and between the fan and the spaces between the side walls of the kiln and the said lumber pile, and an air heating means upon each side of

the kiln, the air heating means being located the same distance from the fan.

4. The combination with a kiln having a trackway centrally disposed therein to receive piles of lumber, flat piled in spaced courses, and to support the lumber in such position that it is equidistantly spaced with respect to the side walls of the kiln, of a centrally disposed reversible fan located beneath the ceiling of the kiln, the said ceiling being shaped to provide stream line air guiding surfaces of uniform length and curvature upon the opposite sides of the fan, and between the fan and the spaces between the side walls of the kiln and the said lumber pile, and means for preventing the passage of air across the top of the pile of lumber below said fan.

5. The combination with a kiln having a trackway centrally disposed therein to receive piles of lumber, flat piled in spaced courses, and to support the lumber in such position that it is equidistantly spaced with respect to the side walls of the kiln, of a centrally disposed reversible fan located beneath the ceiling of the kiln, the said ceiling being shaped to provide stream line air guiding surfaces of uniform length and curvature upon the opposite sides of the fan, and between the fan and the spaces between the side walls of the kiln and the said lumber pile, and means for admitting air through the roof of the kiln at a point equidistantly spaced from the side walls of the kiln.

6. The combination with a drying kiln, having a longitudinally continuous and transversely arcuate ceiling, of a trackway therein for receiving piles of lumber flat piled in spaced courses, and with the sides of the piles of lumber equidistantly spaced from the side walls of the kiln, a continuous duct immediately below said ceiling, and centrally disposed with respect to the kiln, fans operable to cause air to be intaken through the openings at one side and to be moved in counteracting currents within the duct and discharged through openings at the other side of the kiln, the guiding surfaces provided by the arcuate ceiling being uniform in length and the curvature between said duct and the spaces at the sides of the piles of lumber and heating means having a common and uniform relation to the air circulating means and the spaces at the sides of the piles of lumber.

7. The combination with a drying kiln, having a longitudinally continuous and transversely arcuate ceiling, of a trackway therein for receiving piles of lumber flat piled in spaced courses, and with the sides of the piles of lumber equidistantly spaced from the side walls of the kiln, a continuous duct immediately below said ceiling, and centrally disposed with respect to the kiln, fans operable to cause air to be intaken through the openings at one side and to be moved in counteracting currents within the duct and discharged through openings at the other side of the kiln, the guiding surfaces provided by the arcuate ceiling being uniform in length and the curvature between said duct and the spaces at the sides of the piles of lumber and heating means having a common and uniform relation to the air circulating means and the spaces at the sides of the piles of lumber, and means for preventing air from passing across the tops of the piles of lumber.

In testimony whereof I affix my signature.

MORITZ L. MUELLER.