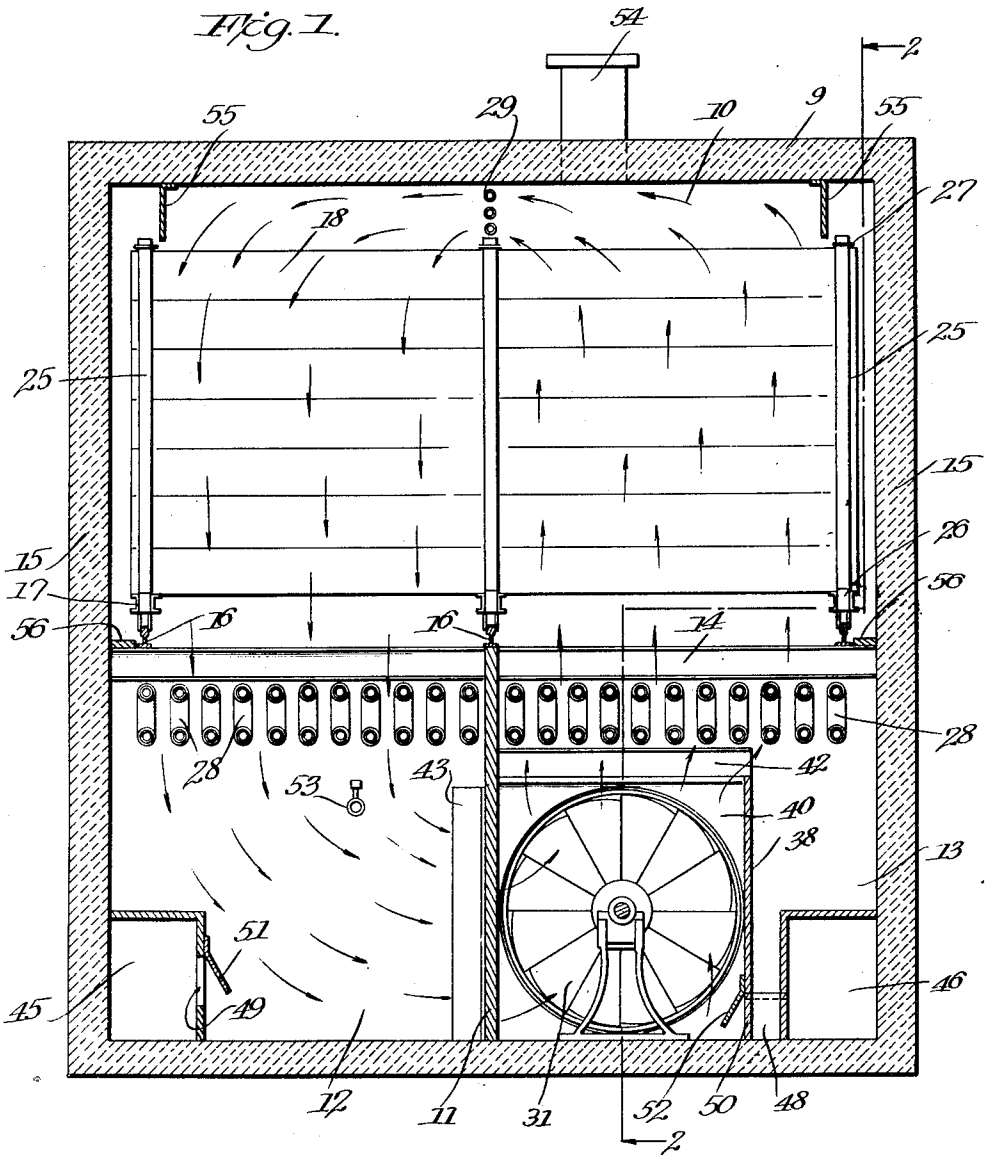
Sept. 29, 1936. D. R. BATTENFIELD 2,055,834

DRY KILN

Filed June 1, 1931 3 Sheets-Sheet 1

Fig. 1.



Inventor

Daniel R. Battenfield

By Cushman, Bryant & Darby

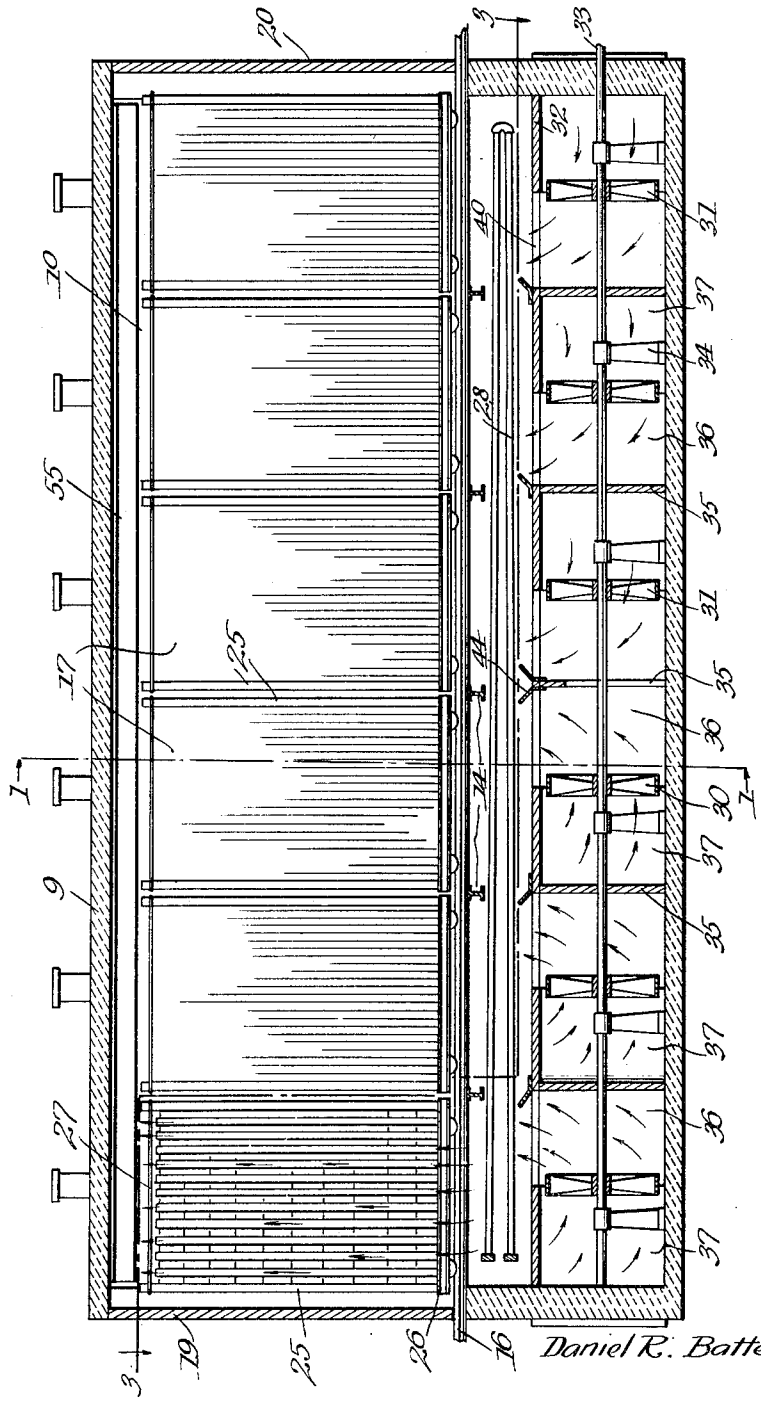
Attorneys

Sept. 29, 1936. D. R. BATTENFIELD 2,055,834

DRY KILN

Filed June 1, 1931 3 Sheets-Sheet 2

Fig. 2.



Inventor

Daniel R. Battenfield,

By Cushman Darby & Cushman

Attorneys

Sept. 29, 1936. D. R. BATTENFIELD 2,055,834

DRY KILN

Filed June 1, 1931 3 Sheets-Sheet 3

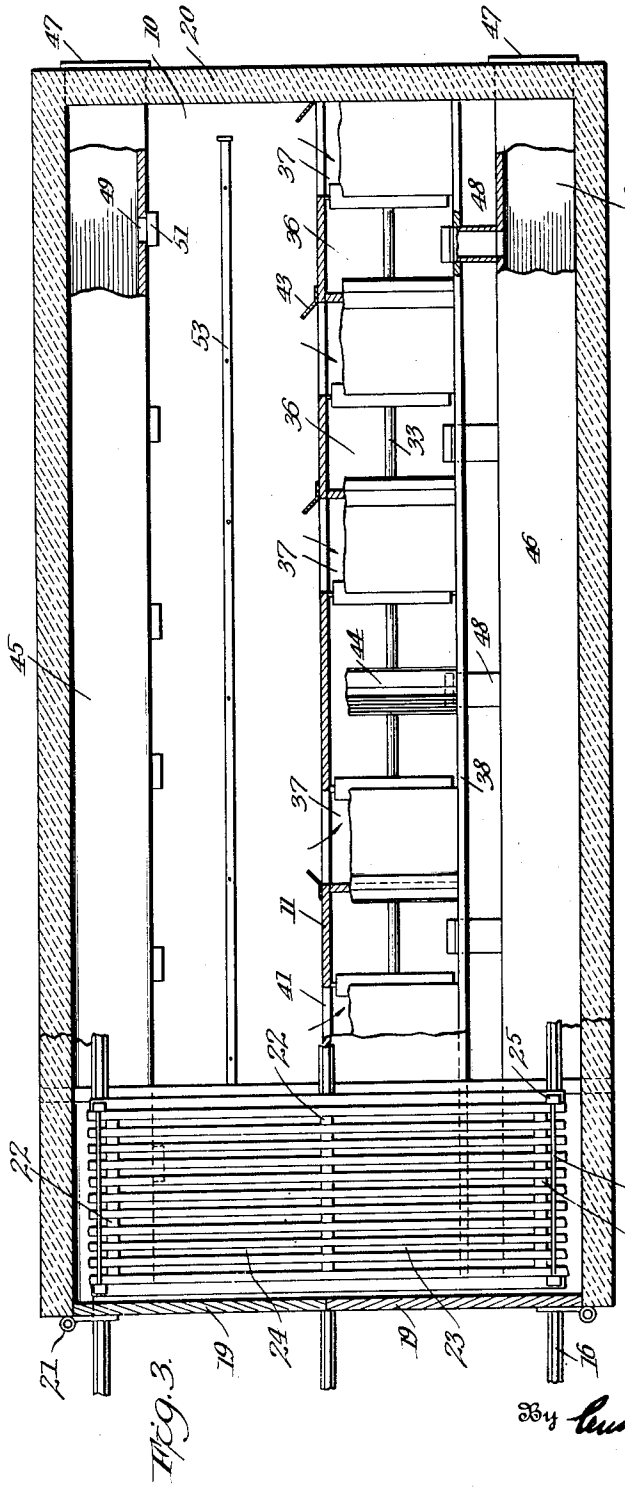


Fig. 3.

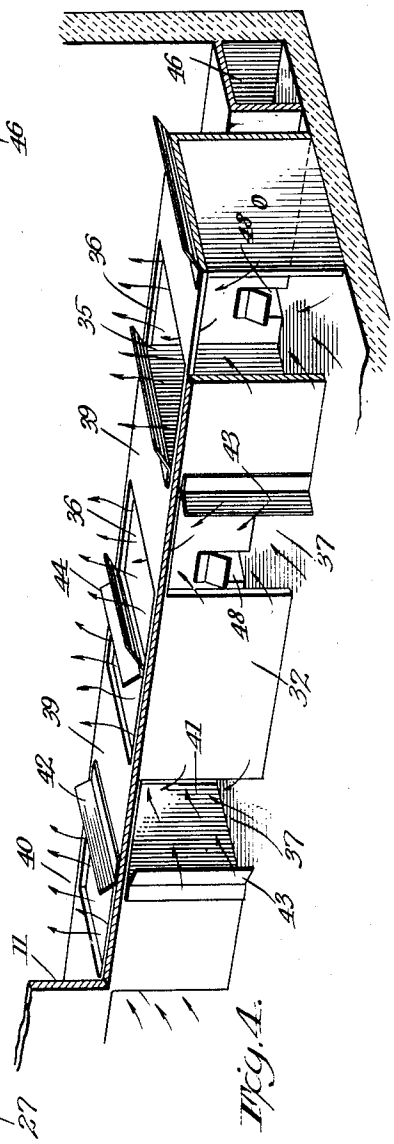


Fig. 4.

Inventor

Daniel R. Battenfield.

By Cushman, Bryant & Darby

Attorneys

Patented Sept. 29, 1936 2,055,834

UNITED STATES PATENT OFFICE

2,055,834

DRY KILN

Daniel R. Battenfield, Jacksonville, Fla., assignor to Moore Dry Kiln Company, Jacksonville, Fla., a corporation of Florida

Application June 1, 1931, Serial No. 541,468

7 Claims. (Cl. 34—46)

The present invention relates to drying kilns and more particularly to improvements in the construction and operation of kilns for drying material such as lumber and the like.

Heretofore, it has been customary to dry lumber by providing air circulating passages in the load and circulating the air through the passages in one direction only in each individual load.

An essential feature of the present invention is to provide a drying kiln with a continuous circulating system for conducting the drying medium through a pile of lumber or other similar material, in which means are provided for dividing the stock load into separate circulating channels or passages that communicate with each other in such a manner that the drying medium circulates simultaneously in different directions through each load during the drying operation.

Another object of the invention consists in providing means for increasing the velocity of the circulation through the load, said means also facilitating the drying of the lumber by dividing the kiln and load into circulating passages which extend in opposite directions, so that the drying medium is required to pass once through each of the passages of each load during its circuit of movement in the kiln. In other words substantially the entire volume of the drying medium is arranged to first pass through a portion of the load in one direction and then through the remaining portion of the load in an opposite direction.

A further object is to provide a drying kiln with a delivery passage and a separate communicating suction passage through which the drying medium circulates in opposite directions in order that the circulation is balanced in the two parts of the load.

Another object is to provide means for insuring a more uniform drying of the ends of the lumber which normally dry more rapidly than the intermediate portions thereof.

Another object of the invention is to provide means which define circulating channels through substantially one half of the stock load or loads on the delivery side of the load and other circulating channels through the other portions of the load on the suction side thereof, whereby the drying medium circulates in opposite directions in the same load and each circuit of circulation passes once through each of the passages of each load.

Another object of the invention is to provide means to produce a transverse reversible circulation of the drying medium once through each of the two passages of each load of lumber and limited circulation across the ends of the lumber.

A further object consists in the provision of means for producing alternate gravity circulation and forced air circulation respectively in different parts of the stock load with each direction of circulation.

A further object of the invention is to provide a fan duct system for a drying kiln which system comprises a housing having mounted therein air circulating means, the sides of the housing being formed with alternately opposed inlet and outlet openings for causing the air to be discharged from one side and sucked in from the other side during the drying operation of the system.

A still further object is to provide means in a fan circulating system for directing the circulation of the drying medium through the substance being dried and also means for reversing direction of the circulation after it has passed through the substance in such a manner that the drying medium will again pass through a portion of the substance before it is returned to the fan system.

Other objects and advantages of the invention will become apparent from the following description taken in conjunction with the accompanying claims.

Referring to the drawings in which is disclosed a preferred embodiment of the invention:

Figure 1 is a sectional view taken substantially along the line 1—1 of Figure 2.

Figure 2 is a sectional view taken substantially along the line 2—2 of Figure 1.

Figure 3 is a sectional view taken substantially along the line 3—3 of Figure 2.

Figure 4 is a detail perspective view of the fan housing.

Referring to the drawings in which like numerals indicate like parts in the several views, 9 designates a kiln for drying material such as lumber or the like, which preferably is of elongated shape, but may be of any longitudinal and cross sectional dimensions so as to provide a drying chamber 10 for receiving the material to be treated.

The lower portion of the drying chamber is divided by the partition 11 into separate passageways 12 and 13. The partition 11 extends longitudinally the full length of the kiln and terminates at a point adjacent the upper surface of the transverse I-beams 14. The beams 14 are suitably spaced from one another and preferably are embedded in the sides 15 of the kiln and act as supports for the tracks 16 which carry the wheel

trucks or bunks 17 on which is mounted the stock load of lumber 18 or other material to be introduced into the drying chamber 10 for treatment. Each end of the kiln has a pair of doors 19 and 20 hinged as at 21 to the sides of the kiln to provide inlet and outlet openings for the introduction and withdrawal of the load 18 to the drying chamber.

The lumber 18 is piled on each of the trucks 17, preferably on edge but may be stacked in any other preferred manner. The layers of boards of the stock load are spaced apart by suitable stickers 22 (Fig. 3), preferably placed vertically between the layers of lumber to provide passages or interstices 23 and 24 on opposite sides of the medially disposed stickers 22 for permitting air circulation through the load. As shown, the stickers 22 are arranged in rows, one row preferably at each end of the stock load and the intermediate row or rows preferably located at or near the center of the load to divide the passages 23 and 24 into air delivery channels and suction channels of circulation that are spaced from each other by the centrally disposed row of stickers 22. The stickers 22 are preferably made of lumber, and in some cases may be formed of one of the boards to be treated, or may be made specifically for the purpose of spacing the layers and used over and over again in successive loads. In some cases the stickers 22, which are a constituent part of each load, are division members for passage of air circulation, and in other cases layers of lumber are division members for passages of air circulation through the stock loads.

As illustrated, the stock loads of material to be dried are preferably composed of individual boards of lumber horizontally stacked in layers and spaced apart preferably by the transversely placed stickers 22 so that each load contains boards which extend substantially its full length.

The load preferably is maintained firmly in position on each of the trucks 17 by the standards 25, the lower ends of which fit in the sockets 26 formed in the bottom of the truck. The standards 25 are arranged in opposed pairs that may have their upper ends connected by the flexible binders or straps 27 (Fig. 3), so that when the lumber is positioned between the standards and the binders moved to force the upper ends of the opposed standards together, the lumber will assume a compact form. Heating coils 28 are positioned beneath the stock load at a point to be in the path of maximum air circulation and may be supported or suspended from the I-beams 14. Additionally, heating pipes 29 may be positioned in the chamber 10 above the load, to insure further heating of the air or treating medium as it issues from either the passage 23 or 24, depending upon the direction of circulation of the air.

It will be noted that the partition 11 is arranged in substantial alignment with a partition comprising the medial row or stickers 22 (Fig. 1), which preferably are a constituent part of the lumber to constitute means dividing the lower portion of the drying chamber and the stock load of lumber into separate air circulating channels comprising the aligned passages 13 and 23 on one side and the aligned passages 12 and 24 on the other side thereof.

Transverse circulation of the air or other heating medium through the chamber 10 preferably is effected by means of the two sets of fans 30 and 31 which extend longitudinally of the kiln and are positioned within a housing 32, one of the side walls of which is formed by the partition 11 (Fig. 1). The fans 30 and 31 are keyed or otherwise secured to a reversible drive shaft 33 which extends longitudinally of the chamber 10 and may be connected to a motor or the like, not shown, in any well known manner. The shaft 33 is revolubly supported by the standards 34 secured to the bottom of the kiln. The fans 30 are preferably right hand and are arranged in series on one side of the shaft 33, while the fans 31 are preferably left hand and are arranged in series on the other side of the shaft, so as to neutralize end thrust and equalize the distribution of circulation of the air within the kiln. Obviously, the fans may be all of the same pitch or may be arranged in opposed pairs to discharge air in counter-acting currents; in fact any desired arrangement of the fans may be employed for producing continuous transverse circulation through the load.

The housing 32 is divided by the vertical walls 35 into a series of separate sections or compartments in each of which is mounted one of the fans to divide the same into sub-compartments 36 and 37 that will be referred to as air delivery compartments and suction compartments for effecting continuous transverse air circulation in the kiln (Fig. 2). It will be noted that the compartments 36 and 37 are alternatively disposed on opposite sides of the fans and extend substantially the full length of the drying chamber. As the direction of rotation of the fans 30 and 31 is reversible, it will be seen that the terms "air delivery compartment" and "suction compartment" are used in a relative sense, depending upon the direction of circulation of the fans.

The housing 32 which constitutes the fan system is defined by the bottom of the kiln 10, the partition 11 on one side, a wall 38 on the opposite side, and a top wall 39, the sections being divided into the various compartments by the cross walls 35, so as to constitute five closed sides for each of the compartments 36 and 37.

The top wall 39 of the housing 32 is provided with spaced opening 40, which are arranged to communicate the compartment 36 with the passage 13, while the side wall 11 of the housing has a series of spaced openings offset relative to the openings 40, so as to establish comunication between the compartments 37 and the passage 13. It will be seen that upon the rotation of the fans 30 and 31 in a counter-clockwise direction, as indicated by the arrows in Figure 1, communication is established between the compartments 36 and 37 of each of the sections to effect continuous circulation of the air within the kiln, the air being drawn in from the passages 12 and 24 through the openings 41 to each of the compartments 37 and carried over to the compartment 36 from where it is forced through the openings 40 to the passages 13 and 23 respectively. By providing means simultaneously directing the air in opposite directions through the load, the main volume of air passes the same footage of lumber in both directions, thus insuring an even and uniform drying thereof.

The openings 40 and 41 in each of the compartments 36 and 37 are preferably provided with flexible baffles 42 and 43 respectively, which may be adjusted by flexion for directing the circulation transversely within the kiln. The medial partition 35 (Fig. 2) may also be formed with the substantially Y-shaped baffles 44 for deflecting the air in the desired direction. While the vertical walls 35 that separate the housing into the various compartments are arranged at right angles

to the air discharge from the fans, it is obvious that they may be arranged at any desired angle, since in some cases it is preferable to change the angle of the walls 35 to provide a freer discharge from the fans in both directions of circulation.

Fresh air conduits 45 and 46 extend longitudinally of the bottom of the kiln on opposite sides of the fan housing 32, and are opened at one end of the kiln by the doors 47 (Fig. 3) to control the volume of fresh air delivered to the drying chamber. The conduit 45 is located on the left hand side of the kiln and is used when the circulation is moving from the passageway 12 into the housing 32 and being forced upwardly through the passageway 13. The passageway 46 is located on the right hand side of the kiln and communicates with each of the compartments 37 through the small conduits 48 (Fig. 3). The openings 49 and 50 in the conduits 45 and 46, may be provided with louvers 51 and 52 respectively, (Fig. 1), for permitting control of the fresh air delivered into the kiln.

Spray pipes 53 may be positioned within the heating chamber for the release of live steam to humidify the air within the kiln. Ventilators 54 are positioned in the top of the kiln to supply the kiln with the desired amount of excess moisture. The ventilators are so positioned that the air will be exhausted from the kiln after it has passed at least once through the stock load 18, thus increasing the efficiency of the kiln and reducing the steam consumption.

Baffles 55 extend from the top of the kiln to a point adjacent the upper adjacent ends of the load, while laterally disposed baffles 56 project from the sides of the kiln adjacent the lower ends of the load, so as to provide means to prevent the air from evading the load and also to protect the ends of the stock by reducing the circulation across the ends of the load.

In operation the load of lumber 18 or other material to be dried, is first placed on the wheel trucks 17 with the lumber piled edge to edge and the layers spaced by the stickers, so as to provide the spaced air circulating passages 23 and 24 in the load. The trucks are then rolled on the tracks 16 into the kiln through the doors 19 so as to assume a position in which the central stickers 22 form a continuation of the partition wall 11, so that one side of the heating chamber, assuming that the fans are rotated in a counter-clockwise direction, provides an ascending air circulating passage formed by the passages 13 and 23, while the other side constitutes a descending passage formed by the passages 12 and 24. The fresh air or heating medium introduced into the kiln through the conduit 45 is drawn in through the openings 41 of the compartments 37 into the housing 32 and is forced upwardly through the openings 40 in the compartments 36 so as to first pass the heating coils 28 and then through the passages 23 of the load. The air is then deflected across the top of the load past the heating coils 29 and is drawn downwardly through the passages 24 and 12 by the suction of the fans. It will, therefore, be seen that in each circulation of movement the air in the kiln illustrated passes upwardly through one part of the load and downwardly through the other part thereof, so as to pass twice through each load during its circuit of movement.

Upon reversing the direction of rotation of the fans, that is to say, upon the fan revolving in a clockwise direction, the circulation of the air through the kiln is reversed.

It will be seen that by reason of separating the load on each of the trucks 17 into separate passages by the medial stickers 22, that the air circulates simultaneously in opposite directions on opposite sides of the load, thus increasing its velocity and facilitating the drying operation. On reversal of circulation of the air by rotation of the fans in a clockwise direction, that part of the load which had upward circulation against the force of gravity and a downward circulation with the force of gravity is automatically reversed, so that the part of the load that has the gravity circulation then loses its gravity effect and the side of the load which would not have the gravity circulation gains the same. It is by reason of the reversal of circulation that the force of gravity acts alternatively on the different parts of the same load or associated loads for producing a greater uniformity in drying. Moreover, as the air delivery circulation and suction circulation act separately on two parts of the same load at the same time, they co-act to balance the circulation in the two parts of the load.

It will be seen that in operation the circulation is alternatively aided by gravity in passing through one part of the stock load in either direction for circulation. Consequently, at the beginning of the drying period there is a greater gravity circulation through the load than at the end of the drying period. The gravity circulation tendency in one part of the load materially aids the fan circulation in producing an upward circulation in a different part of the load. Towards the end of the drying process the gravity circulation is diminished, but the gravity circulation rate is lower and the dry atmosphere is easily forced through the interstices or passages 23 and 24 of the load, so that at the beginning of the drying process the gravity circulation aids in effecting uniform circulation and at the end of the drying period the fans more easily force circulation through the lumber or the like.

Obviously, the fans and their associated parts instead of being placed below the stock load as shown, may be located above the stock load which would merely involve the inverting of the kiln as shown in Figure 1. Moreover, the fan circulating system can equally well be placed on either side of the load which would differ from the present disclosure in that the adjacent layers of lumber would be separated by horizontally disposed stickers or spacing means so that the air circulation would be horizontal through the stock load instead of vertical. When the fan circulating system is positioned above or in the outside wall of the kiln, the fresh air ducts 45 and 46 would be eliminated as the fresh air would deliver to the heating chamber through suitable openings formed in the walls of the fan housing. In this construction also, the fresh air ports 45 and 46, and the ventilators 54 would be in effect transposed at each reversal of circulation, since the ports on the suction side of the housing for the fan would act as fresh air ports and those on the delivery side would function as ventilators.

It is to be understood that the form of the invention herewith shown and described is merely illustrative of a preferred embodiment and that such changes may be made as fall within the purview of one skilled in the art without departing from the spirit of the invention and the scope of the appended claims.

I claim:—

1. The method of drying lumber which consists in providing a pile of lumber piled in spaced

courses into two parts having substantially completely separated passages disposed transversely of the length of the lumber, and passing a heating medium in one direction through the passages in one part of the pile of lumber and in the opposite direction through the passages in the other part of the same pile of lumber.

2. A drying kiln of the class described including a drying chamber, a housing extending longitudinally of the chamber and having an upwardly projecting side dividing one portion of the chamber into separate passages, a track in said kiln arranged to receive a lumber stock load, the lumber stock load being movable on said track to assume a position adjacent to the housing, means in alignment with said upwardly projecting side for separating the load into spaced layers providing two separated passages forming a continuation of the passages within the kiln, means for introducing fresh air into said kiln, and reversible fans operatively mounted in said housing for effecting the circulation of the air simultaneously in opposite directions through the two passages of said load.

3. A drying kiln of the class described including a drying chamber, a housing extending longitudinally of the chamber and having an upwardly projecting side separating the lower portion of the chamber into separate passages, a track in said kiln arranged to receive a stock load of lumber, the stock load being movable on said track to assume a position immediately above the housing, means providing circulating passages in the stock load, said means separating the load medially into a continuous circuit having passages extending in opposite directions and communicating with the passages in said kiln, a series of fans revolubly mounted in said housing for effecting circulation of the drying medium through said circuit whereby the drying medium passes in opposite directions twice through each load in each circuit of movement, and means in said kiln adjacent the ends of the load for reducing the circulation of the drying medium at said ends.

4. A drying kiln of the class described including a drying chamber, a housing extending longitudinally of the chamber and having an upwardly projecting side separating the lower portion of the chamber into separate passages, a track in said kiln arranged to receive a stock load of lumber, the stock load being movable on said track to assume a position immediately above the housing, vertically disposed stickers separating the load into circulating passages, said stickers being positioned in substantial alignment with the projecting portion of the side of the housing whereby to divide the kiln and the load into a delivery passage and a suction passage extending in opposite directions, means for introducing a drying medium into said kiln, fans revolubly mounted in said housing, said housing having openings in different sides thereof whereby to effect circulation twice through the stock load in each circuit of movement.

5. A drying kiln of the class described including a drying chamber, a housing extending longitudinally of the chamber and having an upwardly projecting side separating the lower portion of the chamber into separate passages, a track in said kiln arranged to receive a stock load of lumber, the stock load being movable on said track to assume a position immediately above the housing, vertically disposed stickers separating the load into circulating passages, said stickers being positioned in substantial alignment with the projecting portion of the side of the housing whereby to divide the kiln and the load into a delivery passage and a suction passage extending in opposite directions, means for introducing a drying medium into said kiln, fans revolubly mounted in said housing, said housing having spaced vertically disposed partitions providing separate compartments, a fan revolubly mounted in each of said compartments and dividing the same into subcompartments having openings in different walls thereof which communicate respectively with the passages in the lower portion of the chamber whereby to effect circulation twice through the stock load in each circuit of movement.

6. The method of drying lumber which consists in dividing a pile of lumber piled in spaced courses into two substantially, completely separated halves and passing air in one direction through one half of the pile of boards and in the opposite direction through the other half of the same pile of boards.

7. A dry kiln having a lumber stock load therein, said load comprising boards arranged edge to edge in layers, a row of stickers separating the layers, the medial stickers providing two circulating passages for each layer, one a delivery passage and the other a suction passage, each of said passages extending across substantially one-half the length of the load, said kiln having a partition member in alignment with said stickers, a fan positioned within the kiln and communicating with said passages, whereby to effect transverse circulation through one passage of the lumber in one direction and through the other passage in the opposite direction.

DANIEL R. BATTENFIELD.