Feb. 5, 1935. M. L. MUELLER 1,989,998

DRY KILN

Filed Feb. 9, 1931 2 Sheets-Sheet 1

Fig. 1

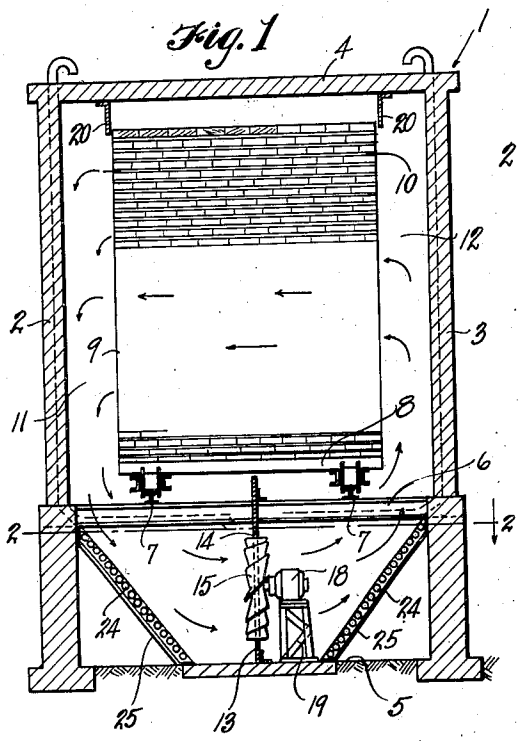


Fig. 3

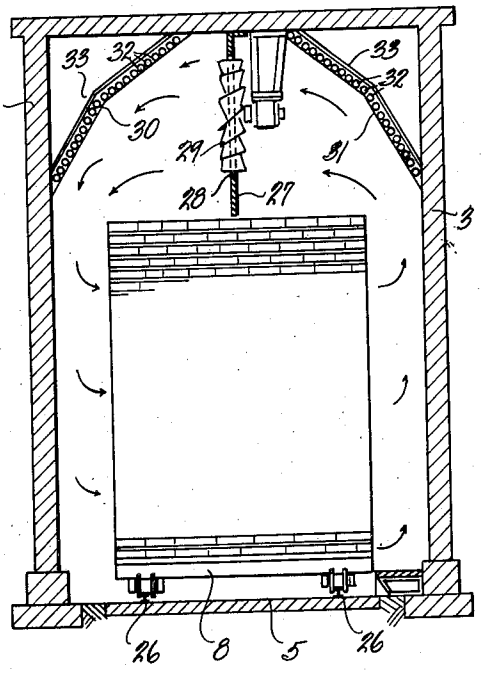


Fig. 2

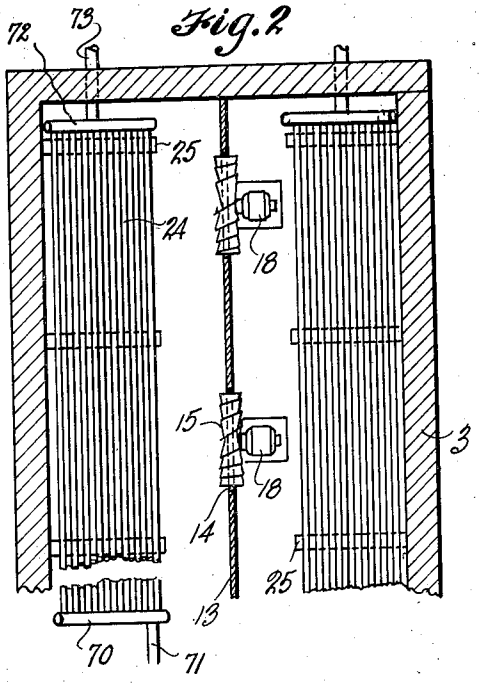
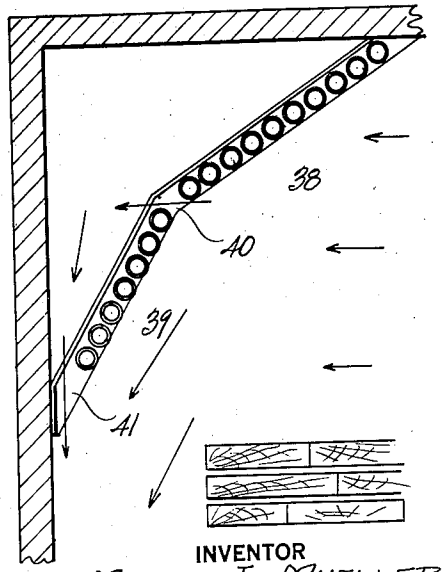


Fig. 4



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DRY KILN

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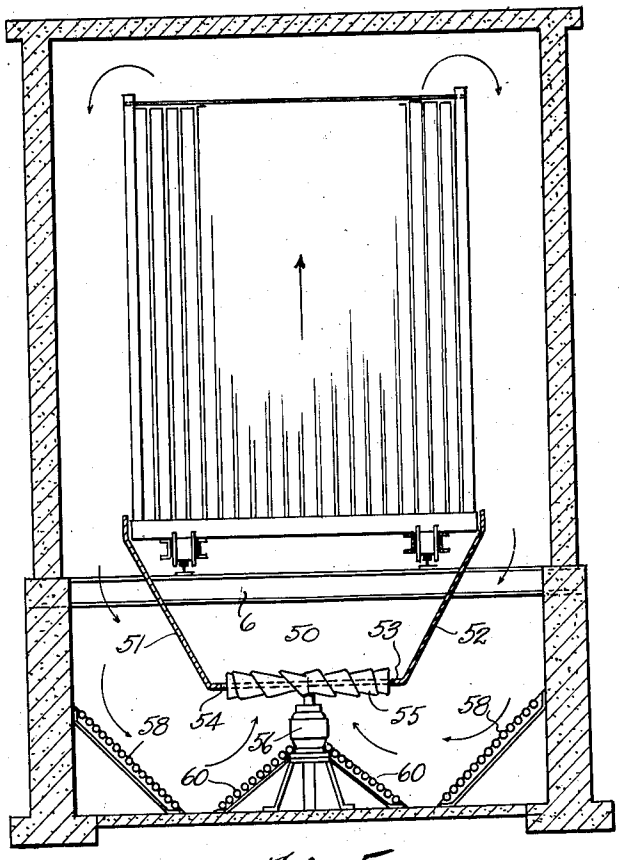

Fig. 5

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DRY KILN

Moritz L. Mueller, Seattle, Wash.

Application February 9, 1931, Serial No. 514,436

1 Claim. (Cl. 34—19)

This invention relates to improvements in dry kilns and particularly to kilns for the drying of lumber wherein a forced circulation of the drying medium is employed to expedite the drying operation.

Explanatory to the present invention it will here be stated that in those types of kilns now generally used for the drying of lumber, the air or gaseous content of the kiln is forcibly circulated through the stock to be dried by the action of rotating fans, and during the course of circulation, it is delivered through grids, or banks of heated pipes to maintain it at the proper temperature and relative humidity for proper drying. It is the usual practice to so locate the stock to be dried within the kiln that it serves in combination with the fan duct to divide the kiln, thus forming a pressure chamber at one side of the stock, and a suction chamber at the other side. With this arrangement the action of the fans is to draw air from the suction chamber and to deliver it into the pressure chamber, from which latter chamber it is drawn or forced through interstices provided in the stock back to the suction chamber. It has been the practice heretofore in such arrangements to locate the heating pipes in the passages from the fan duct leading to and from the pressure and suction chambers, and in such arrangements it is required that the circulated drying medium be twice forced through the pipe grids in each cycle through the stock.

It will readily be obvious to those familiar with the drying of lumber, or the like, that when steam heating pipes are used in a desired or required number to insure effective and proper heating of the air, and the air is forced between the closely placed pipes, they will materially retard circulation, and this will result in the consumption of more power to propel the fans to maintain the rate of circulation or volume of air necessary for successful commercial operations. Furthermore, fans of the character employed for air circulation in kilns of this type are very sensitive to back pressure, thus any retarding influence in the path of circulation very materially increases the power required to propel the fans.

In view of the above explanation it has been the principal object of the present invention to provide a dry kiln construction employing fans of the usual character for creating a forced circulation of the drying medium, and to employ means for heating the circulated medium, but to so locate the said means that they will not retard, or otherwise interfere with flow or circulation.

More specifically stated, the object of the present invention is to construct a dry kiln employing forced circulation of air and in which the air passages to and from the pressure and suction sides of the kiln are unobstructed by any interposition of steam pipes, or other heating elements, through which the air is required to pass during circulation.

It is also an object of the present invention to provide baffles, or deflectors, against which the air is directed during its flow or travel to and from the fans, and to heat these baffles and to so locate them in the kiln that they will facilitate the proper directional flow or circulation of the drying medium rather than to retard it, and will heat the medium by reason of its impingement with their heated surfaces.

It is also an object of the invention to provide for the use of electric motors for operation of the air circulating fans which are insulated in novel manner to successively resist the excessive heat within the kiln, which heretofore has rendered use of electric motors impractical without provision of special cooling equipment.

Other objects of the invention reside in the various details of construction, in the combination of parts and in their mode of operation and relationship to each other, as will hereinafter be fully described.

In accomplishing these and other objects of the invention, I have provided the improved details of construction, the preferred forms of which are illustrated in the accompanying drawings wherein:

Fig. 1 is a cross sectional view of a dry kiln embodying the present invention.

Fig. 2 is a horizontal sectional view of a portion of the dry kiln taken substantially on the line 2—2 in Fig. 1.

Fig. 3 is a transverse sectional view illustrating an alternative form of construction.

Fig. 4 is an enlarged sectional view of a construction detail.

Fig. 5 is a sectional detail of a kiln embodying the present invention, designed for drying edge stacked lumber.

Referring more in detail to the drawings—in Figs. 1 and 2, 1 designates, in its entirety, a dry kiln embodying the present invention. This kiln comprises opposite side walls 2 and 3, a top wall 4, and a bottom wall or floor designated at 5. Transversely of the kiln are horizontal beams 6 which support thereon parallel, track-forming rails 7—7 along which wheel-supported lumber trucks, as designated at 8, are movable.

On the truck 8, as illustrated in Fig. 1, is a pile

9 of lumber or other material to be dried, this pile being arranged to provide interstices 10 horizontally therethrough from the chamber or passage 11, formed between the pile and side wall 2, into the chamber or passage 12, formed between the pile and the opposite side wall 3 of the kiln. Extended lengthwise of the kiln, centrally below the cross beams 6, is a partition wall 13 provided at regularly spaced intervals with openings 14 within which fans 15 are disposed.

In Fig. 2 I have illustrated the fans as each having a direct mounting on an electric motor 18 supported by a frame structure 19, however it is to be understood that any desirable driving means may be provided. In some instances, a line shaft may be used to better advantage. When electric motors are employed it is quite essential, because of the excessive heat within the kiln, that the windings thereof be properly and effectively insulated with a substance which will not be destroyed or rendered ineffective by reason of the heat within the kiln. It is to be understood that temperatures up to 240° F. are used in lumber drying, and this is above the melting point of the rubber composition usually used for insulating the motor coils. The melting of this insulation is destructive to motors, but I have overcome this difficulty by using motors in which the copper windings are insulated by asbestos coatings which will effectively resist heat up to 400° F. It is also desirable to seal the motor construction in a manner suitable for keeping all windings protected from acids, vapors, etc., which are given off in the drying of lumber. The motor should also be provided with a drain hole for draining out condensation. Motors may have reduction gearing incorporated therewith when it is desired to operate the fan at a low speed, or the fans may be driven direct from the motor shaft.

In the arrangement of Figs. 1 and 2, the passage of air across the top of the lumber pile from one side of the kiln to the other is prevented by plates 20 extending downwardly from the roof 4 closely adjacent the top and sides of the lumber pile.

In the course of operation, the fans 15, are revolubly driven by the motors to create a forced circulation of air, drawing it downwardly from the chamber at one side of the lumber pile and delivering it forcibly into the chamber at the other side, from which it flows through the horizontal interstices in the pile back to the starting point. Reversal of direction of rotation of the fans effects a reversal in the direction of flow of the drying air.

As was previously stated, the circulated drying medium is ordinarily heated by the placing of steam pipes, or coils of heated pipes, within the passages leading from the suction and pressure chambers to and from the fan duct. These steam pipes are ordinarily used in large numbers in order that proper heating may be maintained, especially at the start of a drying operation, and their use materially interferes with the flow of air and consequently materially increases the power that is required to operate the fans. The present invention has overcome this undesirable result by elimination of pipes and coils through which the air must flow and by the substitution therefor of heated deflectors, located at points in the kiln where deflectors are ordinarily used to obtain proper directional flow of the medium. Fig. 1 illustrates a preferred deflector arrangement for kilns where the fan system is located beneath the stock. Each of these deflectors comprises a bank of steam pipes 24 supported by brackets or bars 25. The pipes extend lengthwise of the kiln in close relation to each other and may be placed in contact with each other if this is desired, but it is preferred that they be slightly spaced apart so that air may pass entirely around them. The deflectors thus formed by the banks of steam pipes are located in the opposite lower corners of the kiln in an inclined position so that air forcibly delivered from the fans will strike the deflector at one side of the kiln and will be deflected upwardly thereby and air flowing downwardly from the chamber at the other side of the lumber pile will impinge with the other deflector and be deflected laterally toward the fans. It will be observed that the air thus twice engages with heated surfaces during each cycle. While I have illustrated the deflectors in Fig. 1 as being perfectly straight, it is to be understood that they may be straight, or curved radially, or shaped to give a stream-line effect if this is desired.

In Fig. 3 I have illustrated an arrangement embodied by this invention, adapted to kilns in which the fan system is located above the lumber pile. In this latter arrangement the lumber truck travels on rails 26 mounted on the floor of the kiln and the kiln is divided centrally above the stock or lumber pile by a longitudinal partition 27 with openings 28 in which fans 29 are mounted. The deflectors 30 and 31 are made up of closely placed steam pipes 32 supported by brackets 33. In this construction air delivered by the fans impinges against the deflector at one side in the same manner as in the construction of Fig. 1, and is deflected downwardly. It flows through the stock, thence upwardly to impinge the baffle at the other side, and then flows to the fans.

In either constructon illustrated, the usual ventilators for admittance of cold air and outlet of heated air may be employed and these would be located at places found to be most practical or in the places where such ventilators are ordinarily placed.

In Fig. 4 I have illustrated an arrangement of pipes whereby the delivery of air from the fans into the pressure chamber may be directed or controlled.

In this arrangement the deflector is formed by two sections or banks of pipe, 38 and 39, in planes forming an obtuse angle with each other. A space as at 40 is provided between the two deflector sections and also a space 41 is provided between the side wall and lower edge of deflector section 39. This construction permits air to be delivered through the space 40 into the corner back of the deflector and it is discharged directly downward through space 41 along the side of the kiln. The air delivered by the fan is deflected downwardly by the deflector 39 and the resultant angle after it meets the air from opening 41, is dependent on the angular relationship of the two streams. Thus by proper angular placement of deflector 39, the air may be delivered or directed downwardly as desired into the pressure chamber.

In Fig. 5 is an arrangement for edge stacked lumber. In this arrangement an air duct 50 is formed longitudinally of the kiln below the track by two longitudinally extending plates 51 and 52 which terminate at their upper edges closely adjacent opposite sides of the lumber truck on which the stock is piled, and converge downwardly toward each other and are joined by a horizontal wall 53, in which openings 54 are provided for horizontal fans 55. Each fan is connected with

a driving motor 56 or other suitable propelling means.

The passages at opposite sides of the lumber pile communicate with the chamber formed within the base of the kiln, and in operation the fans deliver air drawn from this chamber, upwardly through the vertical interstices in the stock, from whence it flows in opposite lateral directions, passing downwardly along opposite sides of the stock to the bottom chamber.

In this latter instance the downflowing air engages inclined deflectors 58—58 along the outer walls and is directed inwardly. Then it engages a second set of deflectors 60 and is directed upwardly to the fans. The deflectors 58—58 face inwardly and upwardly, thus the air streams twice engage heated surfaces in pasing to or from the fans. These deflectors are formed of steam pipes or heated elements of any other suitable character, arranged as are the pipes of the deflectors previously described.

It is to be understood that in any of the constructions illustrated steam or other heated, fluid medium is delivered to the pipes and is circulated therethrough in the usual well-known manner. For example, as shown in Fig. 2, the pipes are all connected at one end of the kiln to a header 70 to which a steam supply pipe 71 is attached. A leader 72 connects the pipes at their other ends and an outlet pipe 73 leads from this leader.

It is not intended that the present invention be confined in use to any particular type of kiln or fan system, but that it cover the use of heated deflectors or baffles for heating the circulated drying medium by reason of contact therewith, and that these deflectors or baffles be so located as to least retard the air flow, and to avoid the necessity of air flowing through the heating coils or elements, as is ordinarily done.

Having thus described my invention, what I claim as new therein, and desire to secure by Letters-Patent, is:

In a drying kiln including means therein for supporting stock to be dried in a manner to provide air passages at opposite sides of the stock, a partition wall dividing the kiln above the stock and having openings therein, fans in the said openings for creating forced circulation of air transversely of the kiln and deflectors located in the kiln at opposite sides of the fans and against which the air in circulation will contact and will be directed in the passages to and from the fans, said deflectors comprising heated surfaces providing intermediate spaces for the passage of part of the air from the fans through the deflectors and said deflectors being spaced from the walls of the kiln whereby a passage is provided for the outflow of that air which passes through the deflectors for delivery in a stream which meets the deflected stream of air from the deflectors to affect its directional course.

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