Dec. 13, 1955 H. L. MORRIS 2,726,459

BOARD KILN FOR DRYING BOX BOARDS AND LIKE WOODEN PIECES

Filed Nov. 15, 1954 3 Sheets-Sheet 1

FIG. 1

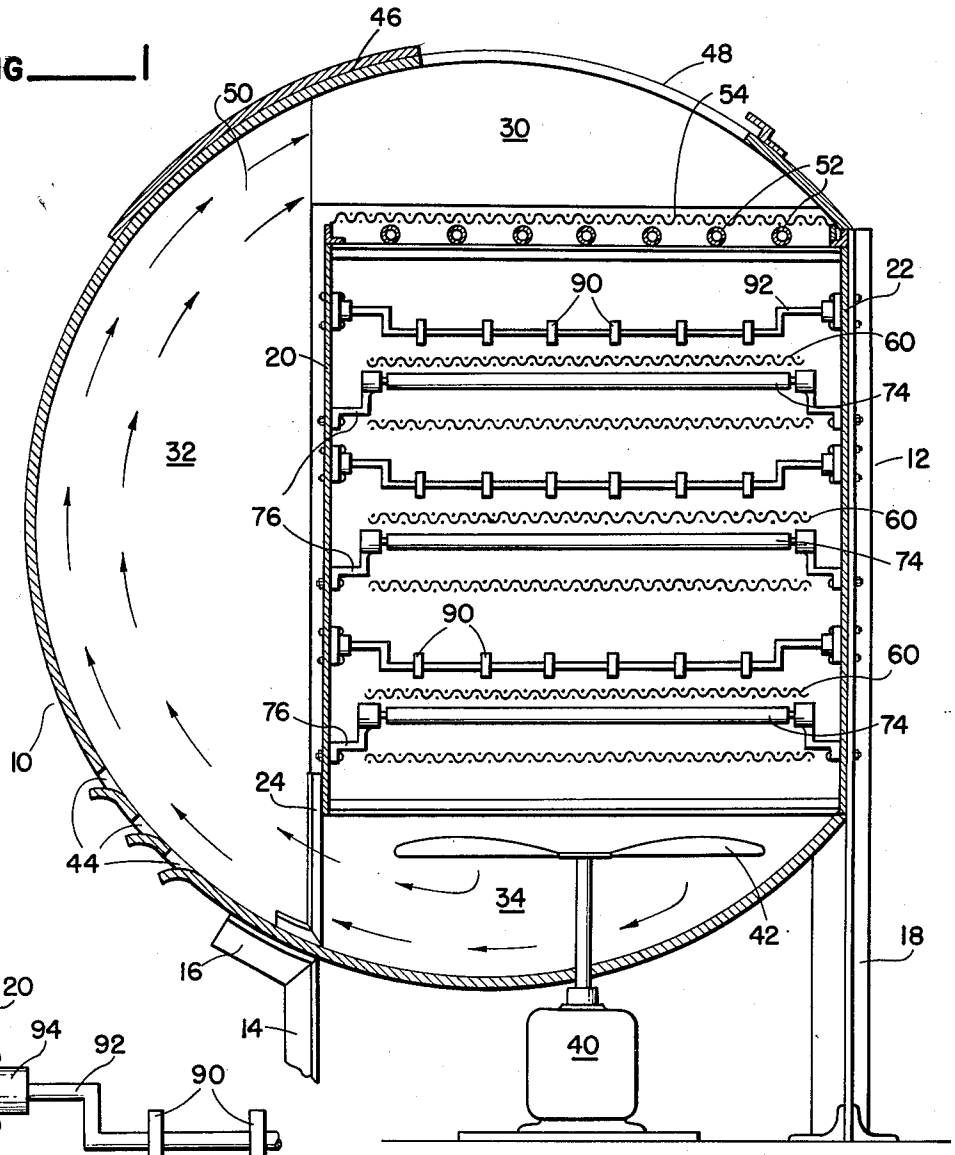
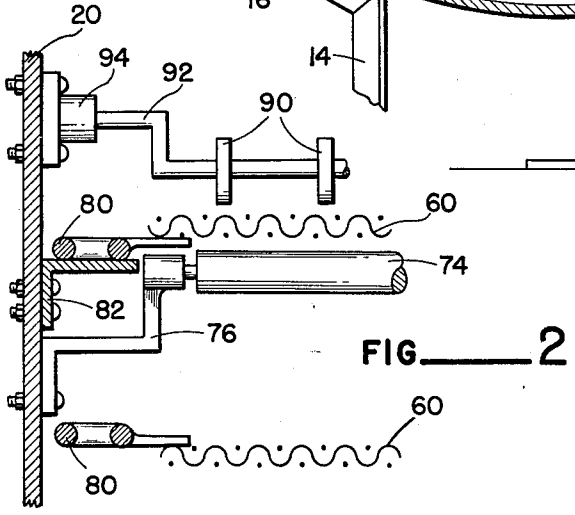


FIG. 2



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FIG. 3

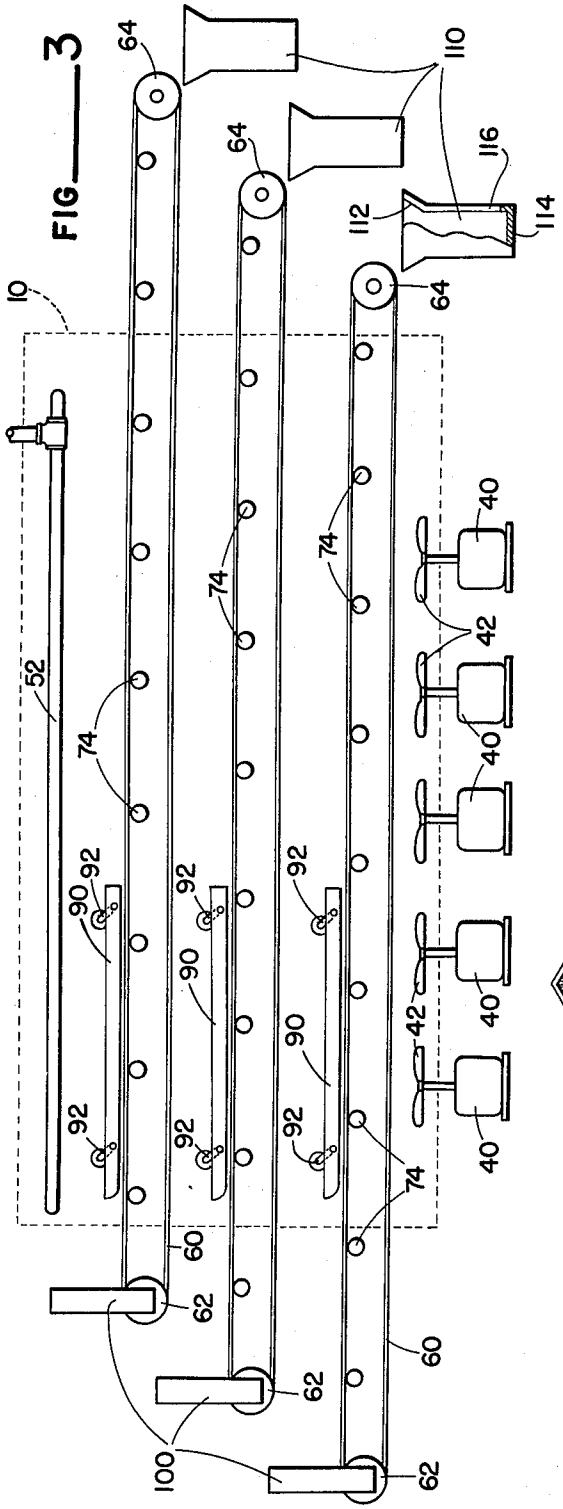


FIG. 4

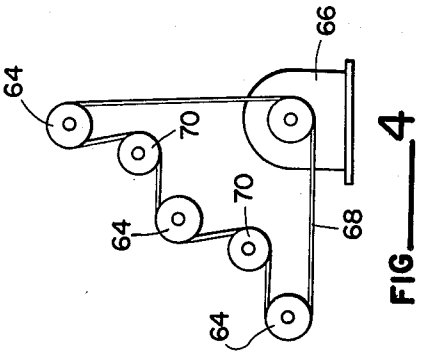
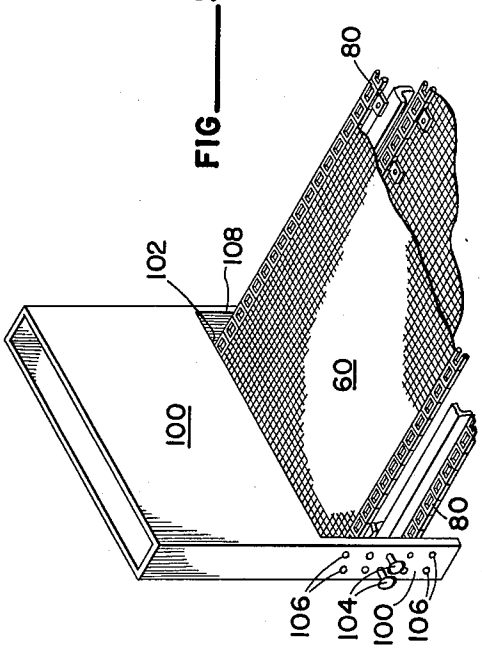


FIG. 5



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FIG. 6

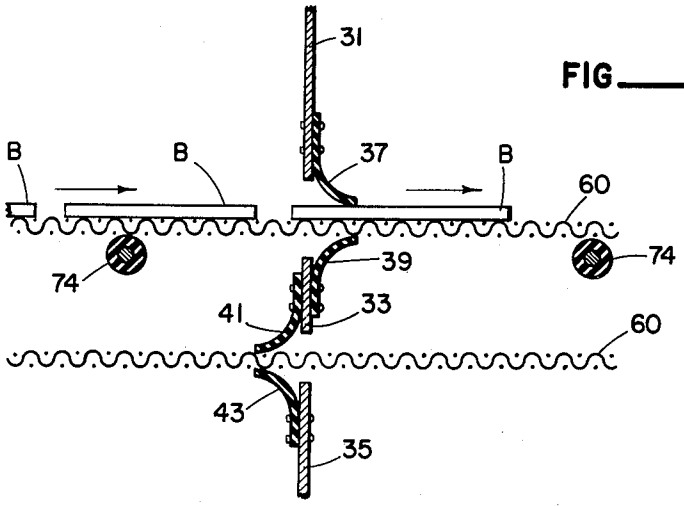
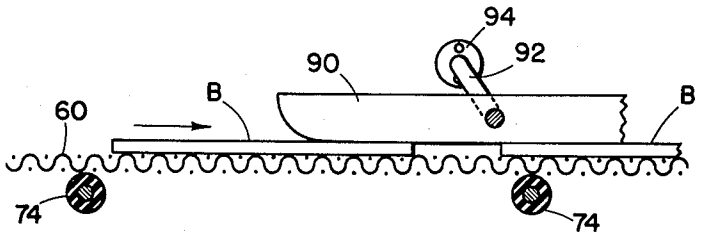


FIG. 7



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BOARD KILN FOR DRYING BOX BOARDS AND LIKE WOODEN PIECES

Henry L. Morris, Sumner, Wash.

Application November 15, 1954, Serial No. 468,735

2 Claims. (Cl. 34—205)

My invention relates to lumber drying kilns and more particularly to a board kiln for drying box boards and like wooden pieces.

The device includes a horizontally elongated tunnel in which an air current is induced against the boxing being dried, the air current, together with certain appliances, holding the boxing in place on a horizontally moving pervious conveyor belt during drying. Additional provisions have been made to adapt the kiln to use in box factories and the like.

A normal drying kiln for green or wet lumber adjacent the saw mill is a rather massive construction i. e., 75 feet to 250 feet long. The lumber is usually stacked on cars and moves through the kiln with spacer strips or sticks disposed between the boards to provide lateral passages for air to the board surfaces. Heated air is introduced near the exit end of the chamber and, moving horizontally therefrom, becomes moisture-laden and is discharged at or near the entrance for the lumber to the chamber. Thus, the cars with their loads move into progressively increasingly hotter and drier air as they pass through the chamber. The volume of air employed is great and large fans are used to move it in powerful currents. Such currents pass between the boards in the stacks although full contact is impeded by the spacing sticks.

Such kilns are not well adapted to drying the small, light boards used in a wooden box factory. The action of the air is often so heavy as to dislodge the boards from their carriers. Also, if these small boards are stacked on cars, a great many spacer sticks have to be used relative the volume of lumber dried and labor costs are high merely for "sticking" the lumber. The light woods used in boxing, such as pine, spruce, and hemlock, are particularly subject to warping. Of course, warping intensifies with thin dimensions of lumber. It is evident, therefore, that equipment is needed to handle a large volume of wooden box materials with a minimum of labor and operable to restrain warping of the box during the drying cycle while rapidly and thoroughly transferring moisture from the boxing materials to the air current.

Therefore, the objectives of my invention include: devising a drying kiln especially adapted for drying boxing and the like; utilizing air currents in such kilns to prevent dislodging of the boxing and to assist in holding materials against warping; devising a continuous feeding and conveying system for the boxing and providing equipment to prevent warping of the boards; devising such drying equipment operable with a minimum of labor and having a large pass through of lumber; and providing the above with the advantages of economical construction, maintenance cost, and rapid and efficient operation.

My invention will be best understood, together with additional objectives and advantages thereof, from a reading of the following description, taken with reference to the drawings, in which:

Figure 1 is an end view, partly in section, showing the interior of a specific embodiment of my kiln;

Figure 2 is an enlarged fragmentary view, partly in section, showing details of the conveyor belt and associated parts;

Figure 3 is a schematic side view of the interior of the kiln;

Figure 4 is a schematic view on elevation showing the driving means for the conveyor belt;

Figure 5 is a perspective view, in fragmentary form, showing the means for feeding boxing to the conveyor belt;

Figure 6 is an enlarged fragmentary view showing details of air sealing means at the ends of the conveyors; and

Figure 7 is an enlarged fragmentary view showing the action of the hold down shoes on the boards.

The kiln tunnel **10** is formed preferably of heavy gauge sheet material of generally cylindrical form. One side **12** is flattened to facilitate attaching supporting means for the tunnel and for a conveyor assembly.

The tunnel may be approximately 50 feet long. The tunnel will accommodate three superposed conveyor belts when it is about thirty inches in diameter and will permit adequate spacing of the conveyor belts as shown for free flow of air between layers of boards. A plurality of pairs of legs are provided at points spaced apart along the tunnel length. The legs are most conveniently formed of angle iron and the like. A short leg **14** is disposed under one side of the tunnel structure and may have rest **16** welded thereto. A long leg **18** supports side **12** of the tunnel and is also secured to one of the plates **20**, **22** which form the main frame for the conveyor belt assembly. Interior legs **24** for plate **20** are preferably aligned with lower legs **14**. The ends of the tunnel are closed as by plates **30**, **32**, and **34** outside of the area of the conveyors to avoid undue loss of heat. Plates intermediate the conveyors, as **31**, **33**, **35**, and resilient flaps **37**, **39**, **41**, **43** supported thereby, act to seal the areas of the conveyor belts, as shown in Figure 6.

Air circulation in the tunnel is provided by a series of fan drive units **40** which may be individually powered or may be connected to a source of power common to the conveyor. The fan blades **42** are so pitched that rotation directs air away from side **12** of the tunnel. The direction of flow of air is indicated in arrows in Figure 1. It will be noted there are tunnel air outlet openings **44** a short distance along the discharge path of travel of air from the fans.

An adjustable sliding door **46** is provided at the top of the tunnel to control entrance of external supplementary air through a large upper tunnel air inlet **48**. This provides a supply of fresh air to the tunnel of normal moisture conditions upon an escape or discharge of part of the moisture-laden heated air from outlet **44**. The door **46**, controlling air inlet, will influence the amount of air exhausted through outlets **44** so that for most operations it is not necessary to have separate adjustment means for outlets **44**. Door **46** permits adjustment of the volume of incoming or added air for the particular type of drying work being undertaken and may be adjusted seasonally to a larger size in summer and smaller in winter with regard to relative humidity. The temperatures in the chamber in general are elevated to expand the same and reduce relative humidity to facilitate moisture absorption. Heating is accomplished by steam coils **52** as the air is moved downwardly toward the area of the conveyors. Coils **52** are covered by a screen **54** to prevent recirculation of debris through the tunnel.

A plurality of air pervious conveyor belts **60** is provided in the tunnel and are supported by idler rollers **62** at one end and power rollers **64** at their other end. Power

rollers 64 may have a common connection with electric motor 66 through a single drive belt 68 engaging each power roller in the proper direction and manner through the operation of idler sheaves 70. It is important to drying that the pervious support provides maximum freedom for passage of air around boards B and the minimum disruption of the air current by the supporting belt also means that the air will have the maximum opportunity to hold the boards B flat against warping.

Various types of screen-like endless belts could be used. These require additional intermediate support for their upper runs, which is provided here by a series of rollers 74 rotatably mounted on brackets 76 secured to side plates 20, 22. An endless chain 80 is attached to each edge of each belt 60 and the upper run rests on angle iron flange guides 82 secured to plates 20, 22.

The currents of air, which are downwardly directed through the area of drying, tend to hold the boards flat to conveyor belts 60. This avoids any tendency to dislodge boxing materials from their original flat positioning on conveyor belt 60 and additionally acts to prevent warping.

To additionally secure the boards in place and more importantly, for the purpose of holding the boards against warping during drying, hold down shoes 90 provide sliding contact with the upper surfaces of the boards. Figure 7 shows the action of shoes 90 on boards B. From Figure 3 it will be observed that the shoes may only extend one or two rows from the entrance end of the kiln. The air stream exerts considerable pressure on boards B against warping and usually is supplemented by hold down shoes only in the area shown. These shoes have sled like conformation and may be several feet in length and formed of heavy gauge sheet material. Laterally of the conveyors, a three-inch spacing of the shoes is suitable.

Shoes 90 are supported by crank rods 92 held in suitable bearings 94 at their ends which in turn are also supported by plates 20, 22. Cranks 92 are free to swing relative bearings 94 and sled shoes 90 and their weight bear on boards on the underlying conveyor belt. It will be understood that boards pressing thereagainst which are unusually warped will tend to swing shoes 90 upward rather than catching and causing trouble in the machinery. The successive weights of the multiplicity of shoes will in time press even refractory boards down into place and hold them against warping during the drying operation.

Wet or green boxing is fed onto the conveyors by a series of hoppers 100 which are shaped to receive the boxing lying flat in stacks and are replenished through their tops during the running of the conveyors. The lower edge 102 of the hopper should be spaced from the upper run of conveyor belt 60 the thickness of a single boxing board. Adjustment of this relationship for different thickness boards is provided by the means of a pair of pins 104 insertable through a series of openings 106 in legs 108 depending from the side of the hopper. The belts 60 are adapted to frictionally and mechanically engage the under surface of the boards and withdraw them from beneath the stack in the feed hoppers. For widely different widths and lengths of boxing, hoppers 100 on the machine may be exchanged for different sizes of hoppers.

At the other end of the conveyor run, a series of receiving hoppers 110 are provided having flaring mouths to receive the boards as they fall off the ends of the conveyors. A suitable form of receiving hopper has a flaring mouth 112, a closed bottom 114 and a vertical, upwardly open slot 116 on its side away from the conveyor so that an operator may insert his hand to remove a stack of the dried boxing from the receiving hopper.

It will be observed from the foregoing that I have provided a kiln drier well adapted for boxing and the like and which will meet all of the objectives set forth above to the benefit of the industry. The free flow of air around the boxing permitted by the pervious spaced belts leads to drying in a surprisingly short time due to the rate of air travel, the relative humidity of the air and the expansion of the air by heat immedaitely preceding the impingement on the boxing.

Having thus particularly disclosed my invention, I do not wish to be limited to the exact details of the construction shown but wish to cover those modifications thereof which will occur to those skilled in the art and lie properly within the scope of my invention, as defined in the appended claims.

I claim:

1. A kiln drier for boxing and the like, comprising: a substantially cylindrical, horizontally elongated tunnel having in its top an air inlet opening in the form of a broad doorway extending along the length of the tunnel and having an adjustable sliding door slidable circumferentially of the tunnel to cover more or less of the inlet opening, whereby adjustment is provided for summer and winter conditions, and said tunnel having in its bottom exhaust air openings; heater means within said tunnel and adjacent the inlet opening; a plurality of superposed, endless, pervious conveyor belts positioned adjacent one side wall of said tunnel and between said inlet and exhaust openings; fan means in said tunnel including a multiplicity of blades spaced along the length of said tunnel below said conveyors and having blades rotated and formed to pull air downward through said heater means and through said pervious belts and directing the air therefrom in an annular stream along the inner wall of the tunnel to the other side of the tunnel away from said conveyors past said air exhaust openings, exhausting part of the air through said exhaust openings and returning the air to above said heating means past said inlet opening and directing the recirculated air and the air from said inlet opening back through said heater means to repeat the process in a continuous cycle, the air stream induced by said fan means having sufficient velocity to tend to hold boxing and boards flat on the pervious belts against warping.

2. A kiln drier for boxing and the like, comprising: a horizontally elongated tunnel having in opposite walls inlet and exhaust air openings; heater means within said tunnel and adjacent the inlet openings; a plurality of endless pervious conveyor belts between said inlet and exhaust openings, a series of transverse rollers bearing on the under side of the upper run of each conveyor belt and at least one row of hold down shoes above the upper run of each conveyor, each row of shoes consisting of a series of parallel sled-like members and supporting means for said shoes permitting vertical swinging of the shoes, whereby the shoes have sliding contact with boards moving on said conveyor belts and press the boards to the belts against warping and are movable to accommodate badly warped boards; fan means in said tunnel disposed to move air in a stream passing through said heater means through said pervious belts normal to boxing disposed thereon and past said exhaust openings, exhausting part of the air therethrough and recirculating the remainder past said inlet openings and directing the recirculated air and the air from said inlet openings back through said heater means to repeat the process in a continuous cycle, the air stream induced by said fan means having sufficient velocity to tend to hold boxing and boards flat on the pervious belts against warping.

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