July 30, 1963 J. N. KOKORAS 3,099,226

SKIN DRYING APPARATUS

Filed Dec. 19, 1960 3 Sheets-Sheet 1

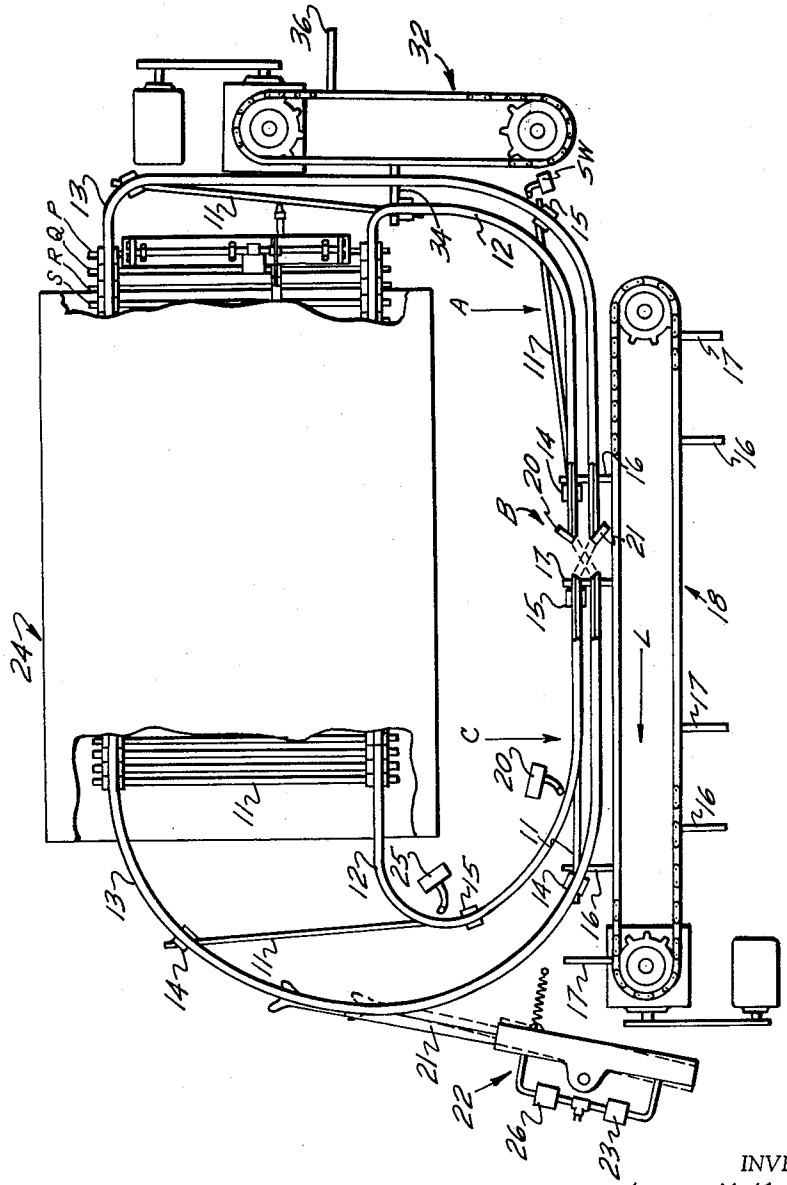


FIG. 1

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SKIN DRYING APPARATUS

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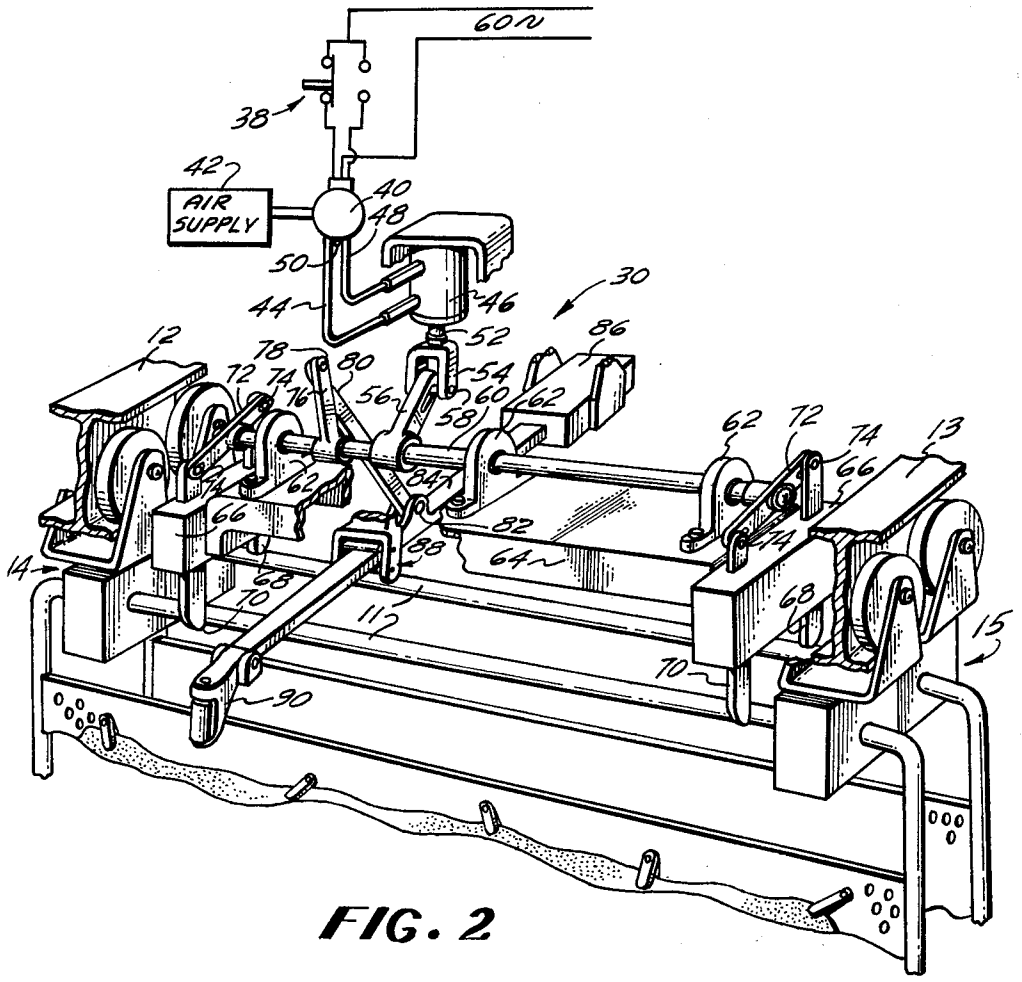


FIG. 2

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SKIN DRYING APPARATUS

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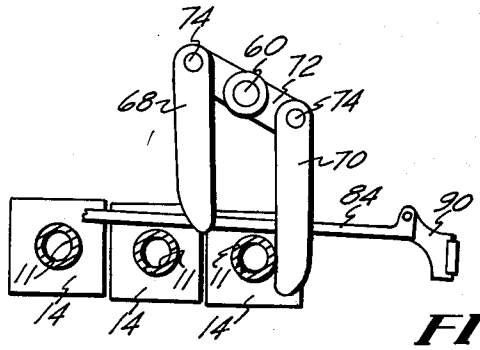


FIG. 3A

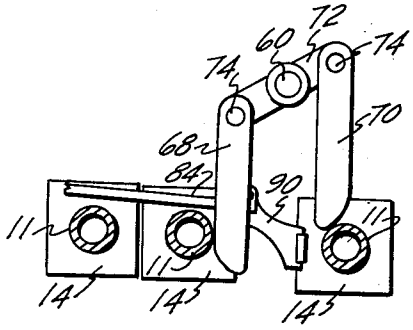


FIG. 3B

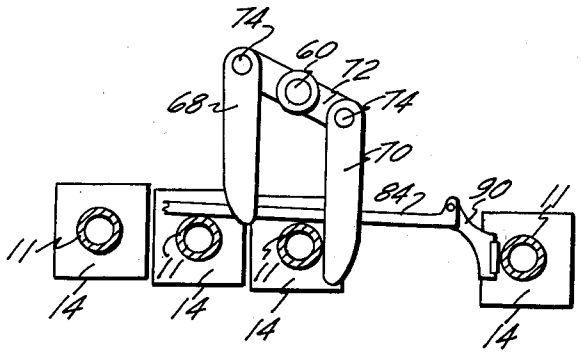


FIG. 3C

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SKIN DRYING APPARATUS

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3 Claims. (Cl. 104—91)

The invention pertains generally to apparatus used in the curing of leather and particularly to improved apparatus for continuously and automatically removing unwanted moisture from hides.

A required step in the process of curing leather is one of drying the skins from which the leather is being made so that the moisture in the skins is reduced to a predetermined amount. However, the removal of any moisture from skins will, if care is not taken, result in undesirable dimensional changes in the skins. Therefore, it is common practice in the art to attach skins to so-called "drying boards," so that dimensional changes in the skin during drying are eliminated or kept so small as to be ineffective in causing intolerable dimensional changes. As is known, attachment of skins to drying boards is accomplished by either pasting or tacking the skins to a solid flat holder or by toggling the skins to a perforated holder.

Whatever method of attaching the skins to a drying board is used, it will be recognized that firm support must be given the skins. This means that the drying boards must be substantially constructed and consequently be relatively heavy, in order that the drying boards will not be deformed during the drying cycle and the natural tendency of the skins to shrink during drying will be overcome. It follows then that, when skins are being dried in production quantities that it becomes highly desirable to provide mechanized means to handle large numbers of drying boards so that skins may be dried as efficiently and inexpensively as possible.

Apparatus filling the need just mentioned is disclosed in my copending application Serial Number 715,428, filed February 14, 1958, now U.S. Patent No. 2,975,727. In the cited patent, a closed loop conveyor system for moving loading drying boards sequentially through a drying oven is described in detail. Briefly, the system comprises a pair of overhead tracks from which a number of drying boards are suspended. The tracks pass through a drying oven, being inclined from the inlet to the outlet end thereof and so spaced one from the other that the drying boards are parallel to each other within the drying oven. Outside the drying oven, the tracks are relatively close together so that the drying boards are moved sequentially end-to-end. A novel feature of the invention resides in the means for holding the drying boards within the oven and ensuring removal of the boards in proper sequence. Thus, a brake assembly consisting of a first and a second similar holding device actuated alternately to allow removal of the board closest to the outlet end of the drying oven is described. Each of the holding devices consists of a toothed holding element rotatably mounted on a shaft which in turn is fixed to a standard. A ratchet mounted on the toothed holding element and a cooperating pawl allows each toothed holding element to rotate a fixed amount when the pawl is disengaged from the ratchet. By properly spacing the two holding devices along the tracks, it is possible to actuate the holding devices alternately in accordance with movement of a drying board outside the oven so that the force of gravity on the drying boards within the drying oven causes the drying boards to move into close proximity one with the other against the brake assembly and also causes the drying board nearest the outlet end of the drying oven to slide out therefrom.

While the brake assembly just mentioned has been successively used for some time, experience therewith has shown ways in which operation may be made more foolproof and positive. When there are large numbers of drying boards, say 75, each weighing approximately 250 pounds, in a drying oven and bearing against the brake assembly, it will be appreciated that extremely large forces are generated when the movement of such a large mass is interrupted. If there is any "bounce" in the pawl, it then becomes possible for the pawl to miss a tooth in the ratchet, therefor, to allow excessive rotation of the toothed holding element. Jamming of the brake assembly sometimes then occurs. Another cause of jamming has been traced to the human factor. Personnel operating the drying apparatus have, for reasons of their own caused jamming of the brake assembly by manually operating the pawls used in the reference in improper sequence.

Theferore, it is an object of the invention to provide an improved brake assembly for use in skin drying apparatus.

Another object of the invention is to provide a brake assembly for the outlet end of a drying oven which is capable of handling extremely high intermittent loads.

Still another object of the invention is to provide a brake assembly which will "fail safe," that is, will not allow more than one drying board at a time to pass out of a drying oven.

A still further object of the invention is to provide a brake assembly which may not be tampered with or intentionally jammed.

These and other objects of the invention are obtained generally by providing apparatus in which two sets of movable holding bars are alternately interposed between the drying board nearest the outlet end of a drying oven and the remaining boards and an ejector is operated to push the last drying board out of the drying oven. Common control means are provided for the brake assembly and the ejector and consists of a switch disposed adjacent one track so that the trailing end of a drying board coming out of the drying oven actuates same. Actuation of the switch in turn energizes a solenoid valve to allow compressed air into an air cylinder which in turn moves the sets of dogs and the ejector in sequence so that the last drying board in the drying oven is pushed out of the drying oven and the remaining drying boards are placed in position for further movement.

For a more complete understanding of the invention, reference is now made to the drawing in which:

FIG. 1 is a plan view, partially schematic, of a closed loop drying apparatus according to the invention;

FIG. 2 is a perspective view of the apparatus contemplated by the invention, showing the control means therefor partially in schematic form; and,

FIGS. 3A, 3B and 3C are schematic diagrams showing the position of the elements in the contemplated apparatus at various times in the operational cycle.

Referring now to FIG. 1, the particular manner in which the invention may be incorporated in a skin drying system is shown. Drying boards **11** are supported by supporting assemblies **14**, **15** on a pair of overhead tracks **12**, **13**. As shown more clearly in FIG. 2, each of the endless tracks preferably has the cross-sectional shape of an I-beam and the supporting assemblies **14**, **15** are each in the form of roller assemblies.

For convenience in explanation, point A will be considered to be the starting point in the cycle. It will also be assumed that the drying boards **11** are perforate and adapted to toggling, it being recognized that pasting or tacking boards may also be used. When the supporting assembly **14** of a drying board approaches point A, one of a number of driving bars **16** carried on an endless belt **18** comes into contact with the supporting assembly **14** so as to move the drying boards in the direction shown by the arrow L. As the drying boards move, operators on

either or both sides of the drying boards attach skins to be dried to the drying boards after removing any skins which are on the drying boards and have been dried. When the supporting assembly 14 reaches point B, it strikes cross-over 20 and is transferred to track 13. It is understood that cross-over 20 is a section of I-beam similar to the shape of the I-beam used to make the overhead tracks 12, 13 and is normally kept in a raised position by a spring (not shown). One of a number of driving bars 17, also attached to the endless belt 18, comes into contact with the supporting assembly 15 so as to assist driving bar 16 in contact with supporting assembly 14 in moving the drying board 11. When supporting assembly 15 reaches point B, it strikes cross-over 21 (which is comparable in construction to cross-over 20) so that supporting assembly 15 is transferred to track 12.

During the time taken for the drying board 11 to travel from point A to point C, operators attach skins to the drying board 11 as previously stated. When supporting assembly 15 reaches point C, it actuates a switch 20. At that time the supporting assembly 14 is in position at the end of plunger 21 in a pneumatic drive assembly 22. The switch 20 energizes momentarily a solenoid valve 23 allowing high pressure air to enter the pneumatic drive assembly 22 to drive the plunger 21 outwardly therefrom and propel the drying board 11 into a drying oven 24. When supporting assembly 15 passes a switch 25 a solenoid valve 26 is momentarily actuated so as to force plunger 21 back into its original position. It should be noted in connection with the description and drawing of the parts just described that the mounting means therefor and the various electrical and pneumatic components and accessories have not been shown in their entirety in order to simplify the drawing.

When the drying board 11 enters the oven 24, it is moving at an appreciable speed on the tracks 12, 13. The tracks 12, 13 are pitched from the inlet end of the oven to the outlet end thereof. The drying boards which are already in the oven are held stationary therein by apparatus 30 at the outlet end of the oven 24. The moving drying board 11, being propelled against the last stationary drying board, causes that board to move toward the adjacent board along the inclined portion of the tracks 12, 13. The force thus imparted is transmitted through the remaining boards in the oven so that the boards are closely packed in the oven 24. The drying board 11 nearest to the outlet end of the oven 24 is, as previously stated, held therein by apparatus 30. Since this is so, all the drying boards within the oven are prevented from moving down the inclined tracks 12, 13 out of the drying oven 24. When it is desired to remove the last drying board 11 from the drying oven 24 as when the skins affixed thereto are dried, apparatus 30 is actuated and the last drying board 11 is forced out of the drying oven 24. The drying board 11 is then moved back to point A by conveyor 32 having drying bars 34, 36. As the then trailing supporting assembly 14 passes and actuates switch 38, the brake assembly 30 is operated as will now be described to remove the next drying board 11 from the drying oven 24.

FIG. 2 shows in detail the elements contemplated by the invention to make apparatus 30 together with schematic representation of the controls therefor. Before describing the apparatus 30 in detail, it should be noted that the apparatus 30 is in position to hold all the drying boards 11 in the drying oven. Thus, switch 38 is in position to energize a solenoid valve 40 so that air from an air supply 42 may pass through an air line 44 to an air cylinder 46 so as to move the piston therein (not shown) upwardly. At the same time, the upper portion of the air cylinder 46 is bled through an air line 48 through solenoid valve 40 and a relief line 50. A rod 52 is connected to the lower end of the piston in the air cylinder 46 and passes through a packing gland (not shown). The rod 52 in turn is attached to a yoke 54. A crank 56 is operated by yoke 54 through a pin 58. The crank 56 in turn is rigidly attached to a shaft 60. A number of journal bearings 62 support shaft 60 above the drying boards 11, each of the journal bearings 62 being mounted on a rigid supporting member 64. Means (not shown) are provided for connecting the rigid supporting member 64 to the overhead tracks 12, 13. On each of the outer ends of the rigid supporting member is mounted a block 66 having a pair of channels formed therethrough as shown. In each of the channels is slidably fitted a holding bar 68, 70, projecting downwardly through the block 66 so as alternately to be engageable with the drying boards 11 as will be described in more detail hereinafter. The upper end of each holding bar 68, 70 is pivotably connected to a rocker arm 72 through a pin 74. The rocker arm 72 is rigidly affixed to the shaft 60 so that rotation of the shaft 60 in turn causes rocker arm 72 to rotate and the holding bars 68, 70 to move alternately upwardly and downwardly. Also rigidly attached to the shaft 60 is a lever 76. A pin 78 connects lever 76 to an arm 80 which in turn is connected by a pin 82 to an actuator 84. A slotted guide member 86 supports one end of the actuator 84, while the second end thereof is supported in a pin bearing support 88, passing therethrough and terminating in a hinged end piece 90.

The operation of the brake assembly 30 may be more easily understood by reference to FIGS. 3A, 3B, and 3C along with FIG. 2. Thus, in FIG. 3A, the holding bars 68, 70 are shown in the same position as they are in FIG. 2. That is, holding bar 70 is depressed so as to hold the drying boards, designated also as P, Q, R, and S in the drying oven. When switch 38 is actuated, either manually when starting or by a holding assembly 14 during operation, solenoid valve 40 is energized through a second pair of contacts in switch 38 so as to exchange the function of air lines 44, 48. This in turn causes pressure to build up on the top of the piston within air cylinder 46 and releases the air pressure under the piston. As a result rod 52 moves downwardly taking with it yoke 54 and causes crank 56 to rotate in a clockwise direction. Shaft 60 also rotates, moving rocker arm 72 likewise to move holding bars 68, 70 in the block 66. By proper adjustment of the dimensions of the various elements, as will be evident to those having skill in the art, it is therefore possible to cause the holding blocks 68, 70 to assume the positions shown in FIG. 3B. At the same time actuator 84 is moved rearwardly by its associated lever system, pulling the hinged end piece 90 over the last drying board, as P, in the oven. When the holding bars 68, 70 arrive at the position shown in FIG. 3B it is evident that the drying board nearest the oven is free to move, but that the remaining drying boards are held in position. In fact, the last board, as P, does move a slight distance on the tracks 12, 13 when the holding bar 70 is elevated. However, it has been found to be advantageous to position the actuator 84 so that the hinged end piece 90 assumes the position illustrated in FIG. 3B. Subsequently, when switch 38 is returned to its original position, as by releasing it or after the passage of a drying board, actuator 84 is moved so as to force the last drying board, as P, out of the drying oven into proximity with driving bar 36 on conveyor 32. At the same time, holding bars 68, 70 are returned to the position illustrated in FIG. 3C and the drying boards, as Q, R, S then remaining in the oven slide down the inclined tracks 12, 13 and are held in position by holding bar 70. The just described provision for positive ejection of the last drying board in the oven allows a smaller pitch to the tracks 12, 13 within the oven (with a subsequent lessening of shock and vibration) and at the same time obviates any chance of jamming due to improper or slow ejection of the last drying board. The shape of the lower end of the holding bars 68, 70 is important to the operation of the apparatus 30. The curved ends of the holding bars 68, 70 allow separation of a drying board even though the drying board does not move a distance equal to the thickness thereof.

A moment's thought will make it clear that the drying board must move only a distance equal to at least one half the thickness of the drying board. Such decrease in required movement of drying boards as compared to other known apparatus is extremely important. When one considers that the total weight of the drying boards in a drying oven may range from 9 to 12 tons or even more, then the necessity of decreasing accelerating and decelerating forces becomes self-evident. Although the invention has been described with particular emphasis on the main essential elements of the invention, many modifications will be evident at once to those skilled in the art. For example, pressure controls in the air lines may be used to great advantage; shock absorbers and limiting devices to prevent unduly large amounts of rotation of the operating shaft may be incorporated; or even a hydraulic system may be substituted for the pneumatic system. Therefore, in view of the many obvious modifications which may be made without departing from the spirit of the invention, the scope and spirit of the appended claims only should limit the invention.

The invention claimed is:

1. In drying apparatus for skins in which drying boards bearing skins to be dried are supported, in a parallel relationship, on a pair of parallel inclined tracks within an oven, holding and release apparatus, comprising:

(*a*) a first and a second holding bar assembly adjacent to the outlet of the oven, one such assembly being affixed to one of the tracks and the other such assembly being affixed to the other track;

(*b*) each of the holding bar assemblies including:

(1) a first and a second holding bar sequentially disposed in the direction of travel of the drying boards, the distance between each first and second holding bar being greater than one half the thickness of a single one of the drying boards but less than the thickness thereof; and

(2) means for alternately moving the first and second holding bar of each holding bar assembly only in a direction normal to the direction of travel of the drying boards; and,

(*c*) means responsive only to movement of drying boards without the drying oven to actuate the means for alternately moving the first and second holding bar.

2. In drying apparatus as in claim 1 wherein the means for alternately moving the first and the second holding bar including a rocker arm pivotally connected between the first and the second holding arm, an operating shaft rigidly attached to the rocked arm intermediate of the first and the second holding bar and means for rotating the shaft to rotate the rocker arm and to cause the first and the second holding bar alternately to move into engagement with the drying board nearest the outlet end of the drying oven and the drying board there abutting.

3. In drying apparatus for skins in which a plurality of drying boards are supported in parallel relationship on a pair of inclined tracks within a drying oven and are successively removed from such oven and moved into an end-to-end relationship in a self-timed sequence, a combined holding and timing device, comprising:

(*a*) a first and a second holding bar sequentially and movably disposed along the pair of inclined tracks, the distance between the uphill sides of the first and the second holding bar being greater than one half the thickness of a single one of the drying boards but less than the thickness of one thereof, the first holding bar initially engaging the most downhill one of the drying boards within the drying oven; and,

(*b*) control means, responsive only to the motion of successive ones of the drying boards without the drying oven simultaneously

(i) to move the first holding bar out of engagement with the most downhill one of the drying boards within the drying oven and

(ii) to move the second holding bar into engagement with the second most downhill one of the drying boards within the drying oven, and then consecutively

(iii) to mechanically eject the most downhill one of the drying boards from the drying oven and

(iv) to return the first and the second holding bar respectively to their initial positions to retain the ones of the plurality of drying boards then remaining in the drying oven by engagement of the first holding bar with the then most downhill one of the drying boards.

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