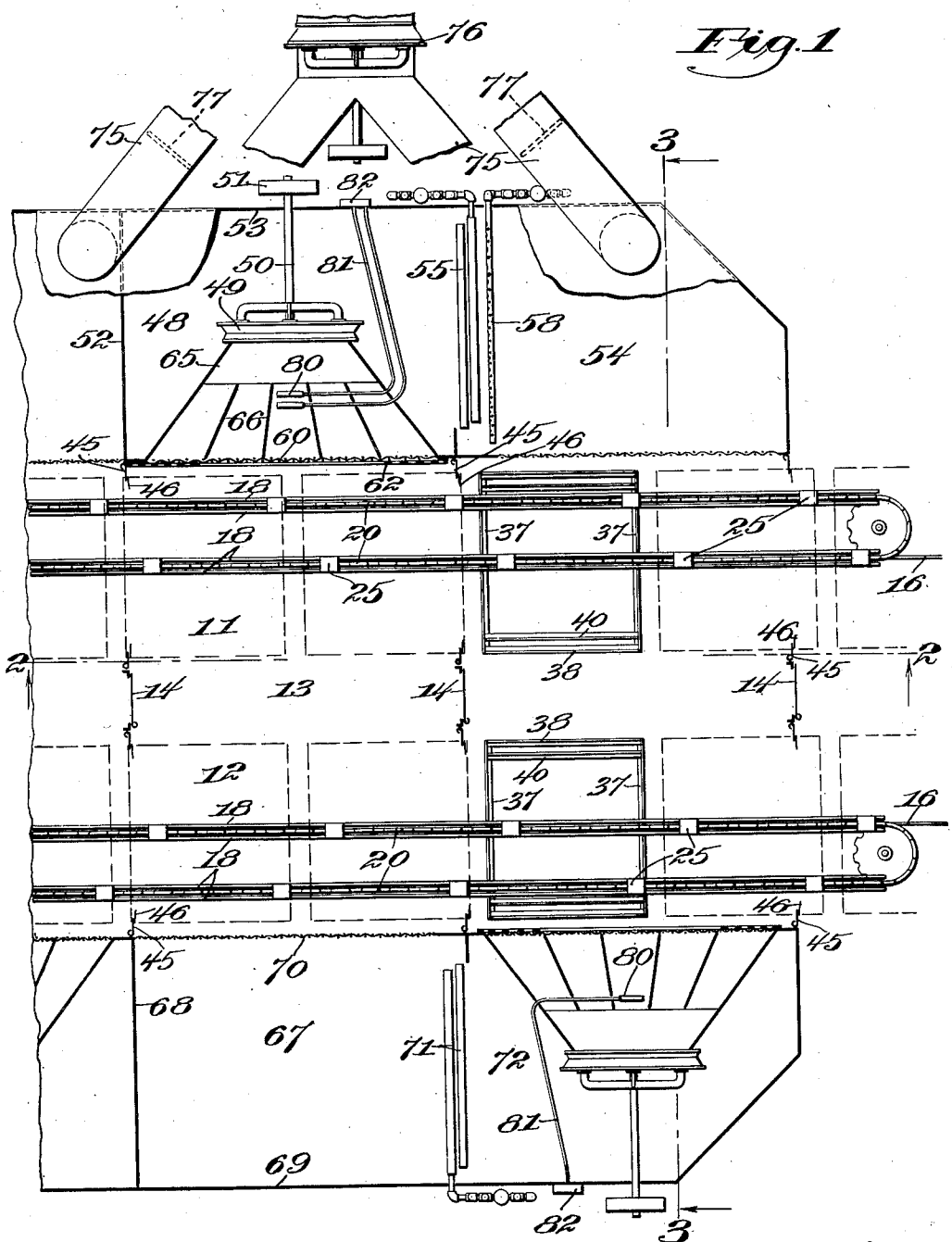
Nov. 1, 1932. K. E. BELL 1,885,505

DRIER

Original Filed March 10, 1926 3 Sheets-Sheet 1

Fig. 1



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DRIER

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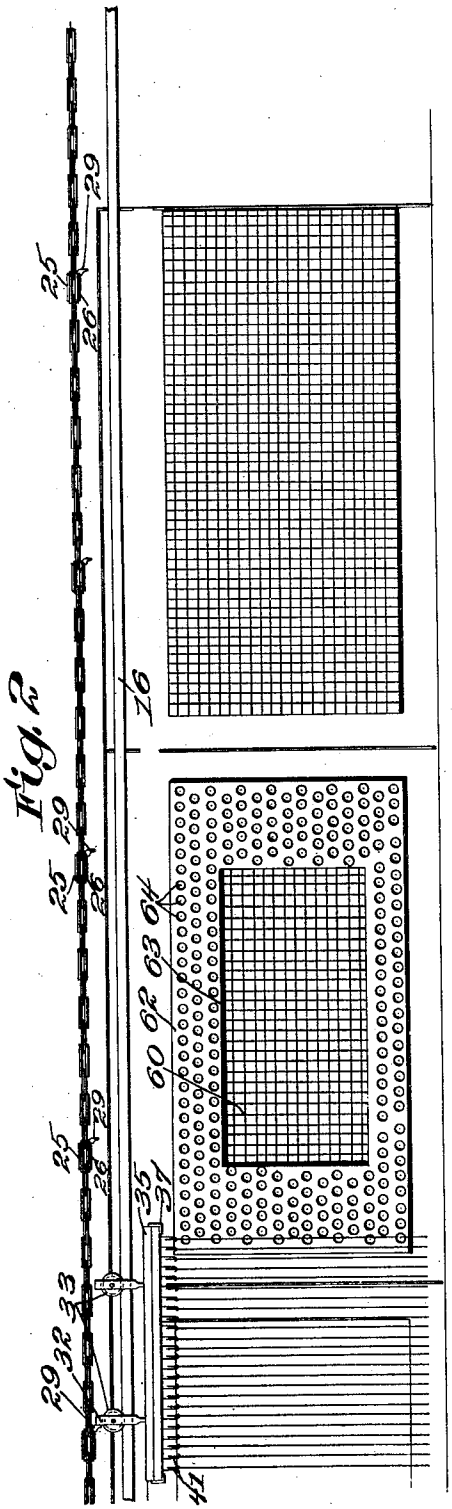


Fig. 2

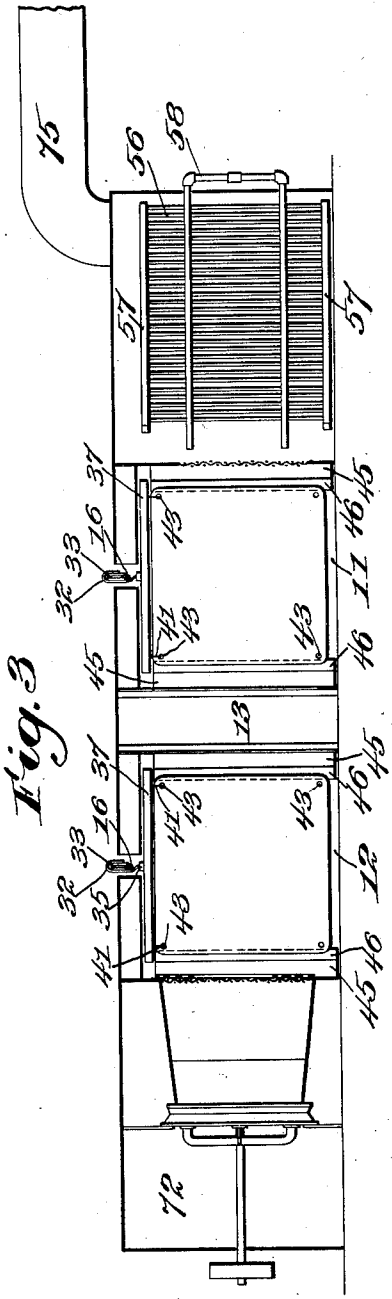


Fig. 3

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Fig. 4

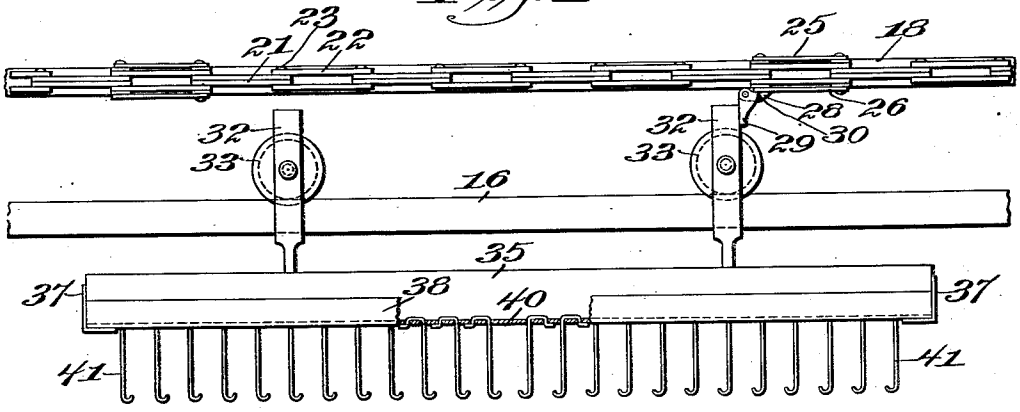


Fig. 5

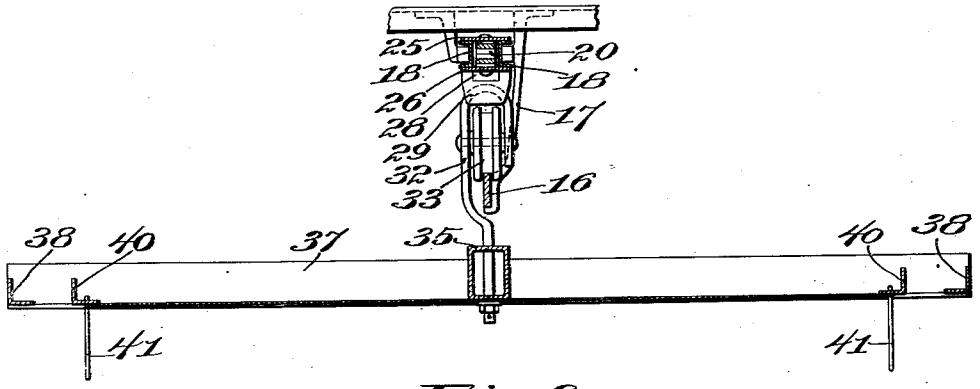


Fig. 6

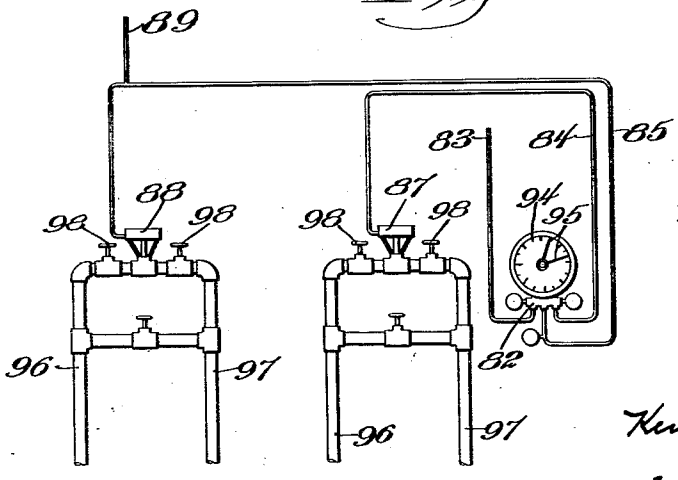
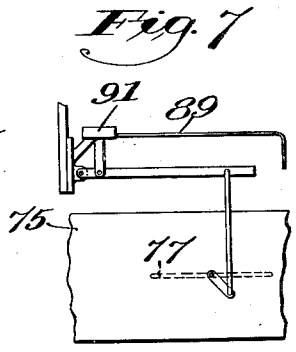


Fig. 7



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UNITED STATES PATENT OFFICE

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DRIER

Application filed March 10, 1926, Serial No. 93,644. Renewed August 23, 1929.

The present invention relates to drying apparatus and more particularly to what is known as a tunnel drier where the material to be dried moves progressively through a drying chamber or series of chambers until it finally emerges in properly dried condition on the opposite side or end of the apparatus from where it entered.

The object of the present invention is to devise an apparatus of the above type which shall be of inexpensive construction, economical of operation, and capable of producing in quick and efficient manner the desired drying effects.

A further object is to provide a drier of the above type which is particularly adapted for the drying of leather.

To the above ends the present invention consists in the apparatus hereinafter described and more particularly defined in the claims.

In the accompanying drawings which show what is considered now to be the preferred form of the present invention, Figure 1 is a top plan view of the discharge end portion of an apparatus embodying the present invention, with the top thereof broken away to show the interior construction; Fig. 2 is a vertical, longitudinal section on line 2—2 of Fig. 1 looking in the direction of the arrow, showing the conveyor track and chain and a loaded carrier; Fig. 3 is a transverse, vertical section on line 3—3 of Fig. 1 looking toward the left, showing the relative arrangement of blowing fans, carriers, and heater coils; Fig. 4 is an enlarged detail of the conveyor track and chain and one of the carriers in side elevation; Fig. 5 is an enlarged transverse view of the same partly in section; and Figs. 6 and 7 are details showing the controls for the heaters, the live steam supply, and the exhaust duct dampers.

Briefly, the apparatus herein illustrated and described comprises two tunnels or chambers extending side by side, each provided with an overhead track and traveling chain, and carriers for holding and transporting through the tunnels the leather to be dried, each hide or skin being stuck or otherwise secured to a sheet of fibre or other "board." These boards are suspended vertically from the carrier crosswise of the tunnel, substantially closing the latter and preventing the flow of air lengthwise of the tunnel.

The drying is accomplished by means of currents of heated air of the proper temperature and humidity which are directed across the tunnels from one side to the other between the vertically supported boards which are presented edgewise to the air currents.

Fans placed alternately on opposite sides of the pair of tunnels circulate the air in a more or less of a closed path through the boards and over the leather alternately in one direction and then in the other while the boards are carried through the tunnels. The air is heated by steam heaters or radiators in the circulation path and the proper humidity is maintained by means of steam pipes through which live steam may be discharged. Both heaters and steam pipes are automatically controlled by suitable devices responsive to changes in temperature and humidity.

An exhaust duct is provided with an automatically controlled damper for exhausting a portion of the air, fresh air being supplied by leakage at the entrance door or opening.

Referring now to Figs. 1 and 3, the tunnels are indicated at 11 and 12 extending horizontally side by side and separated by an open space or corridor 13 to permit the passage of a workman through the apparatus. This corridor is provided with transverse doors or curtains 14 for the purpose shortly to be explained, but is open at each side into the adjacent tunnels. Secured to the top of each tunnel and extending throughout the length thereof is a single track or rail 16 carried by a depending hanger 17. Above the track and carried by the hanger are a pair of guides or rails 18 spaced a slight distance apart for supporting the traveling conveyor or chain 20. This chain consists of link bars 21 and 22 connected together by pins 23 in the well known manner. At the spaced intervals the links are provided with the auxiliary upper and lower plates 25 and 26 of greater width than the links. These plates engage the tracks or rails 18 and support the chain or conveyor. The bottom auxiliary

links 26 are provided with extensions 28 upon which are pivoted the driving dogs 29 for advancing the carriers through the tunnels. These dogs are provided with a stop shoulder 30 so they cannot yield rearwardly, but are free to swing forwardly, thus permitting the carriers to be pushed or moved by hand through the tunnel when the chain or carrier is stationary.

The carriers for supporting the leather consist of a pair of hangers 32, each carrying a grooved wheel 33 which runs upon the track 16. These hangers in turn carry a hollow, longitudinal member 35 having at each end a transverse member 37 of angle iron, and these transverse members are connected at their extremities by angle iron side members 38.

Supporting devices for supporting the boards upon the carrier consist of angle irons 40 resting at their ends upon horizontal portions of the front and rear transverse portions 37 and carrying the closely spaced depending hooks 41 which, for convenience in loading and unloading, are turned half one way and half the other, as shown in Fig. 4.

The fibre sheets or boards are substantially square and are of a size sufficient to take the largest skin or hide it is desired to dry. The boards are provided at their corners with the holes 43. Since the boards are square and the holes are symmetrically arranged, they may be hung upon the hooks without requiring any turning by the operator.

The boards extend across each tunnel and from the top to bottom except for the necessary clearance space. In order that greater clearance may be provided at each side, yet without causing leakage lengthwise along the tunnel, stops have been provided in the form of narrow doors 45 supported upon vertical pivots close to the path of the traveling boards, with their inner edges extending slightly into such path and having felt or cloth strips 46 along such edges. These doors normally tend, under the action of springs, to stand at right angles to the direction of movement of the boards, but when engaged by the latter spring back maintaining contact with the edges thereof as they pass. These doors are placed on both sides of the tunnel and opposite the curtains or doors 14 in the corridor, and are positioned in the tunnels opposite the partition walls of the chambers now to be described, as shown in Fig. 1.

The devices for supplying heated air and directing it across the tunnels are located at the outer side of each tunnel and comprise a pair of blowers or propeller fans, one on each side of the tunnels and offset from one another lengthwise of the tunnel, radiators or heaters for heating the air before it is acted upon by the fans, and a steam pipe for admitting live steam into the circulating air. These comprise one unit and such a unit is shown in Fig. 1 at the end of the apparatus.

It is to be understood that the apparatus includes several more similar units to give the necessary length of tunnel.

Located in the chamber 48 is a propeller fan, shown more or less diagrammatically at 49, with its shaft and pulley 50 and 51 respectively. The chamber 48 is closed at one side 52 and at the back 53 by impervious walls. Opposite the closed side wall 52 and in the opening between the chamber 48 and chamber 54 is the radiator or heater 55 consisting of two sections of vertical steam pipes 56 and horizontal top and bottom headers 57, connected with a source of steam supply with suitable controlling devices hereinafter to be described. Adjacent the radiator or heater 55 is the live steam pipe 58 provided with a plurality of orifices through which live steam may be discharged from a source of supply, controlled in a manner shortly to be described.

The front wall of the chamber 48 consists of a metal screen of relatively large mesh, as shown at 60 in Fig. 2, to catch and stop any loose material, over which is positioned a metal sheet 62 having a large, central, rectangular opening, as shown at 63, and a multiplicity of small, round apertures 64. The purpose of this sheet is to cause a more even and uniform distribution of the flow of air across the tunnels by partially blocking off the flow of air from the outer radial portions of the fan blades from which, owing to the greater arcuate length and the higher linear speed, the discharge is the greatest, and to assist in such distribution the propeller fan 41 is provided with a flaring discharge casing 65 within which are placed vanes 66.

Opposite the fan chamber 48 is the chamber 67, with one side 68 and the back wall 69 imperforate, corresponding to the chamber 48, and with a screen 70 across its front adjacent the tunnel. A double section heater or radiator 71, identical with the radiator 55 is in the opening between the chamber 67 and the adjacent fan chamber 72 and reheats the air as it passes from one chamber to the other. Fan chamber 72 is identical with the fan chamber 48 with its fan, flaring discharge casing and vanes, screen, and perforate sheet across its front. No live steam pipe is provided on this side of the tunnels as a single pipe is sufficient.

The air from the fan in the chamber 72 is carried across the tunnels into chamber 54 and thence past the steam pipe 58 and radiator 55 where it is humidified and reheated, and back into the fan chamber 48, thus completing the circuit. The corridor doors 14 and the narrow doors 45, it will be noted, are placed substantially in alignment with the partitions of these chambers, thus forming with the particular boards, one of which is always substantially in line with the doors,

substantially continuous partitions which compel the air to travel in the circuit above described.

To provide for the exhaustion of a portion of the circulating air as may be necessary to maintain the proper temperature and humidity, each unit is provided with an exhaust duct 75 leading to an exhaust fan 76 and controlled by a damper 77. Preferably the ducts from adjacent units will be brought together into a common duct from a common fan, as shown in Fig. 1.

The control of the heaters or radiators, the live steam supply, and the exhaust of air is automatic by means of the well known Foxboro automatic temperature controlling devices. These involve, briefly, wet and dry bulb thermometers in the air current, diaphragm-actuated steam valves for the heater and live steam supply, and a diaphragm-actuated damper for the exhaust air. Compressed air is employed for actuating the diaphragms, under the control of automatically operated valves which are in turn controlled by the wet and dry bulb thermometers.

These devices are shown more or less diagrammatically in the drawings. For example, the dry bulb thermometers are indicated at 80 positioned in front of each fan and connected through a pipe or conduit 81 with the compressed air valve unit, shown generally at 82 in Fig. 6. This unit comprises a valve casing having suitable valves and ports so that the compressed air from the pipe 83 may be directed into pipes 84 and 85, as required. Pipe 84 leads to a diaphragm-actuated steam valve 87 for the radiators or heaters, while the pipe 85 leads not only to a similar valve 88 for the live steam supply pipe, but also through a connection 89 to the diaphragm 91 for actuating the damper 77 in the exhaust pipe 75 through suitable connections. (See Fig. 7.) The compressed air valve unit 82 is provided with a dial 94, calibrated in degrees, with adjusting hands 95 one for the dry bulb thermometer and the other for the wet bulb thermometer. By adjusting these hands over the dial the operator can vary the temperature at which the compressed air valves are operated from the dry and wet bulb thermometers.

Steam for the heaters and for the live steam is supplied through one pipe 96, as shown in Fig. 6, and after passing the automatic valve, is conducted to the radiator or steam pipe through the other pipe 97. Suitable hand actuated valves 98 are provided so that the supply may be controlled either by hand or through the automatic diaphragm valve.

The operation of the apparatus is as follows: The conveyor chains being in operation and the fan being driven to circulate the air, the wet and dry bulb thermometers operate to control the Foxboro apparatus so that the desired temperature and humidity of drying air will be secured.

Carriers supporting the boards upon which the skins or hides are secured are carried slowly through the drying tunnels in two parallel lines, and as they come opposite the first fan they are subjected to a current of air across the tunnel which passes between the boards and over the skins and abstracts a certain amount of moisture from the skins. As the carriers pass along they come opposite the next fan and are subjected to a current of drying air in the opposite direction. Thus they pass through the tunnels, receiving the dry air first from one side and then from the other until finally they emerge in the properly dried condition.

When the air becomes too moist, due to the absorption of moisture from the leather, the wet bulb thermometer causes the live steam supply to be cut off and the exhaust damper to be opened and this condition continues until the humidity falls and the wet bulb thermometer drops. The exhaust damper is then closed and the live steam turned on until once more the air becomes too moist for proper drying.

Through the dry bulb thermometer the temperature of the circulating air is maintained substantially constant, steam being supplied to and cut off from the radiators as needed to secure this result.

Preferably the adjustments for the temperature and humidity control are not to be the same throughout the length of the drier but a higher temperature and lower humidity will be maintained adjacent the discharge end than at the entrance end.

In the illustrated embodiment of the present invention the radiators for heating the air are so located and positioned that the skins are not exposed to direct radiation from these heating devices, thus avoiding faster drying at the edges and insuring an even and uniform drying throughout the entire skin.

While the above invention has been described in connection with an apparatus for drying leather, it is to be understood that it is not necessarily limited thereto except where so specified in the claims, but may be embodied in other forms and constructions and used for drying other materials.

What is claimed is:

1. A drier comprising a tunnel, means for supporting the material to be dried and for carrying it through the tunnel, chambers arranged in pairs on one side of the tunnel and in communication therewith and with each other and each pair of chambers being separate from adjacent pairs by imperforate partitions, a fan in one of the chambers of each pair for causing the air to flow across the tunnels, an air heater between the chambers of each pair arranged transversely of

the longitudinal axis of the tunnel to expose a minimum amount of radiating surface to the material passing through the tunnel, and means on the opposite side of the tunnel for receiving the air from the fan chamber and returning it across the tunnel to the chamber communicating with the fan chamber whence it came.

2. A drier comprising a tunnel, means for supporting the material to be dried and for carrying it through the tunnel, units having means for heating and moistening the air for causing it to flow across the tunnel and back in a substantially closed circuit, and for exhausting the moist air, partitions separating the units, and means extending into the tunnel substantially in line with the partitions for closing the space between the sides of the tunnel and the material passing through the tunnel.

3. A drier comprising a tunnel, means for supporting and carrying the material to be dried therethrough, a fan chamber at the side of the tunnel, a fan therein to cause the flow of heated air transversely of the tunnel, and a perforate partition between the fan chamber and the tunnel, the partition offering less obstruction to the flow of air at its central than at its marginal portion to cause a more uniform flow of air across the tunnel.

4. A drier comprising a tunnel, means for supporting and carrying the material to be dried therethrough, a fan chamber at the side of the tunnel, a fan therein to cause the flow of heated air transversely of the tunnel, and a perforate partition between the fan chamber and the tunnel, said partition having a central opening of relatively large dimensions, and a plurality of marginal openings of small dimensions to cause the air to flow in a more uniform stream across the tunnel.

5. A drier comprising a tunnel, a pair of tracks extending through the tunnel, carriers for supporting the material and carrying it through the tunnel, the tracks being spaced laterally apart and the carriers being of such size that a longitudinal open corridor is formed through the tunnel between the loaded carriers, means for directing currents of heated air transversely across the tunnel alternately in opposite directions along the tunnel, and swinging baffles in the corridor to prevent the flow of air longitudinally of the tunnel while permitting the passage of the operator along the corridor.

6. A drier comprising a tunnel, a pair of tracks extending through the tunnel, carriers for the material to be dried, the tracks being spaced laterally apart and the carrier being of such size that a longitudinal open corridor is formed through the tunnel between the loaded carriers, means for directing currents of heated air transversely across the tunnel, swinging doors in the corridor for preventing the flow of air longitudinally of the corridor, and yielding baffles adjacent the doors for engaging the loads carried by the carriers to prevent the leakage of air between the doors and the loads.

7. A drier comprising a tunnel, an overhead track extending through the tunnel, a carrier mounted to travel along the track, boards for carrying the skins to be dried, means on the carrier for supporting the boards vertically and transversely of the tunnel, a plurality of units for heating air and causing it to flow back and forth across the tunnel horizontally in a substantially closed circuit, said units each comprising two pairs of chambers, a pair on each side of the tunnel, the pairs of each unit being oppositely disposed and separated from adjacent pairs by imperforate partitions, swinging baffles extending into the tunnel in line with the partitions to prevent escape of air longitudinally of the tunnel between the partitions and the boards, a fan in each pair of chambers the fans on opposite sides of the tunnel being offset from one another longitudinally of the tunnel, a heater located between the two chambers of each pair with its major axis at right angles to the longitudinal axis of the tunnel, and means for independently controlling the heaters of each unit.

8. A drier comprising a tunnel, a carrier and means for supporting the same having provision for movement of the carrier through the tunnel, boards to carry the skins to be dried in flat extended condition, supporting devices on the carrier for supporting the boards and skins in substantially vertical position transversely of the tunnel and spaced apart to form air passages therebetween, a plurality of units disposed lengthwise of the tunnel, each unit comprising chambers on opposite sides of the tunnel having side partitions terminating at the sides of the tunnel, and means for delivering heated air across the tunnel from one chamber to the other, the boards holding the skins flat and extended during their passage through the tunnel and cooperating with the partitions to prevent the air flowing lengthwise of the tunnel and to cause it to flow in a substantially closed circuit in each unit and the movement of the carrier with the boards through the tunnel causing the air to flow laterally across the skins first in one direction and then in the opposite direction whereby a substantially uniform drying of different portions of the skin is secured.

9. A drier comprising a tunnel, a carrier and means for supporting and moving the same through the tunnel, supporting devices on the carrier for supporting the material to be dried in substantially flat condition and extending transversely of the tunnel to compel the drying air to pass transversely across the tunnel and to prevent its escape longi-

tudinally of the tunnel, a plurality of units for heating the air and causing it to flow back and forth across the tunnel horizontally in a substantially closed circuit, imperforate partitions separating the units, a longitudinally open corridor extending lengthwise of the tunnel adjacent the path of the material to be dried, and swinging doors in the corridor in line with the imperforate partitions to prevent the flow of air longitudinally of the corridor.

In testimony whereof I have signed my name to this specification.

KENNETH E. BELL.