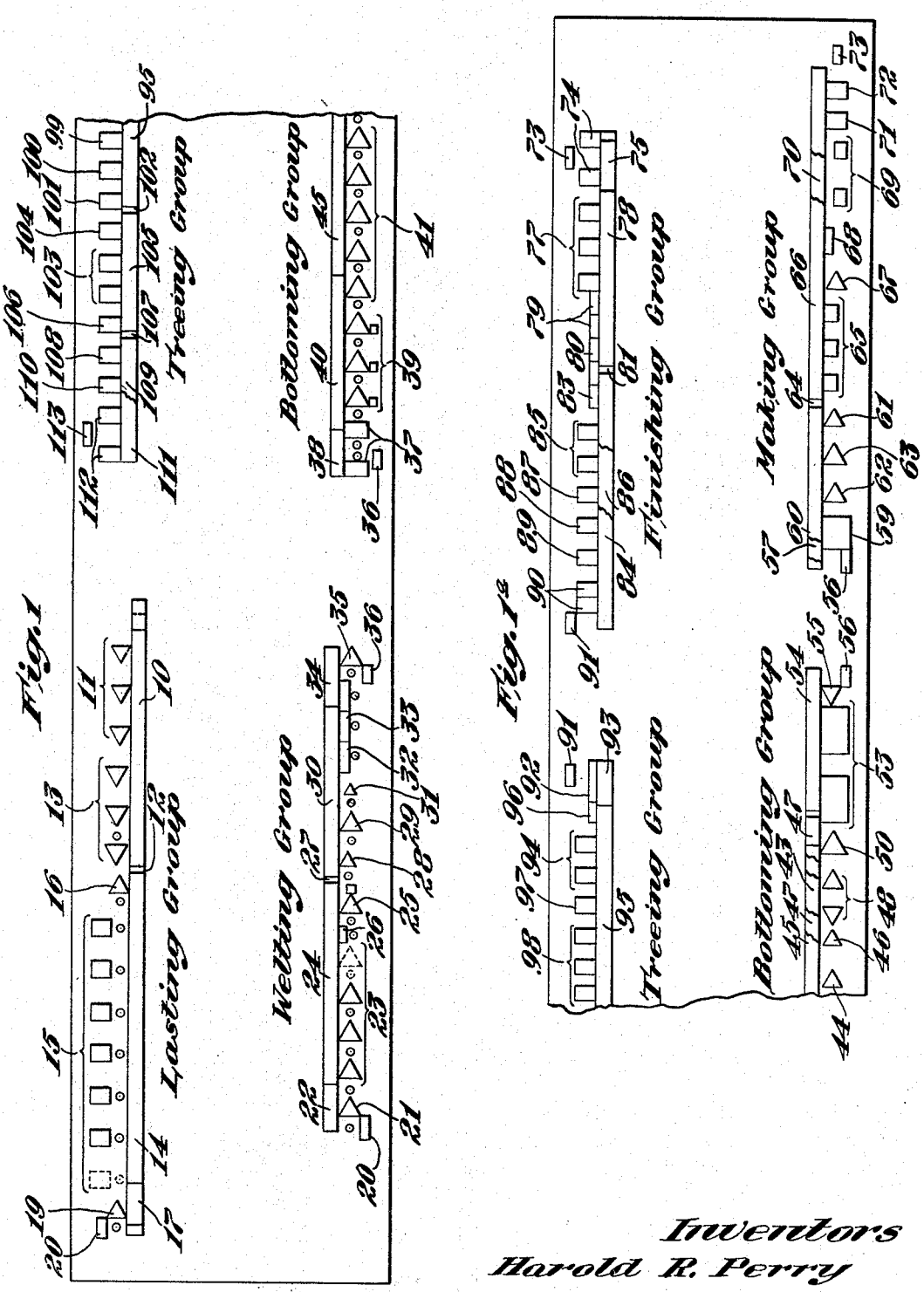
Nov. 2, 1937. H. R. PERRY ET AL 2,097,799

MANUFACTURE OF SHOES

Filed Sept. 6, 1934 4 Sheets-Sheet 1



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MANUFACTURE OF SHOES

Filed Sept. 6, 1934 4 Sheets-Sheet 2

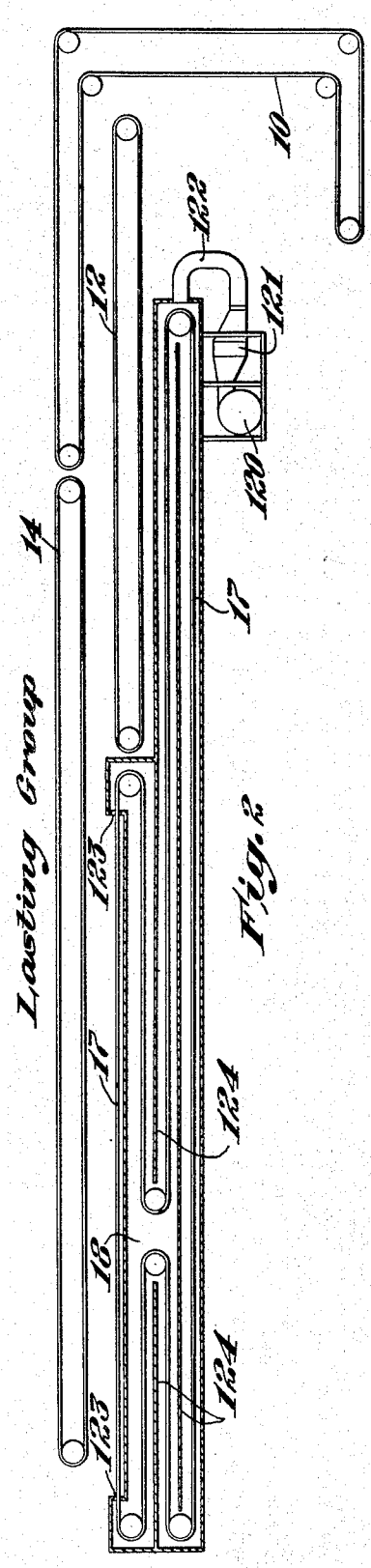


Fig. 2

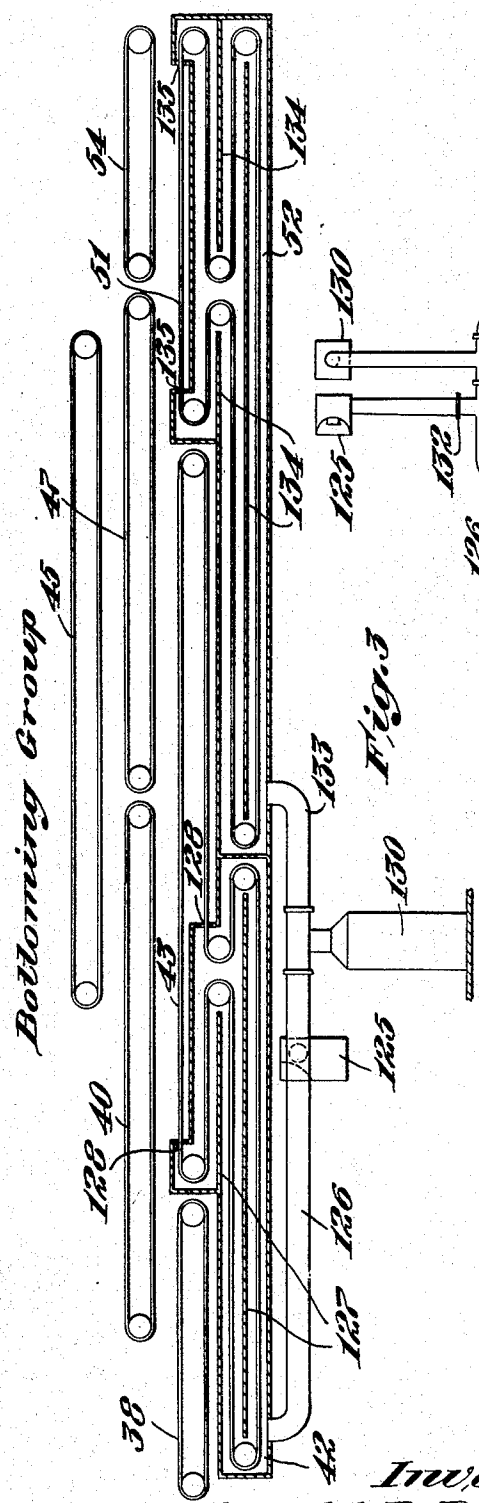


Fig. 3

Fig. 6

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MANUFACTURE OF SHOES

Filed Sept. 6, 1934 4 Sheets-Sheet 3

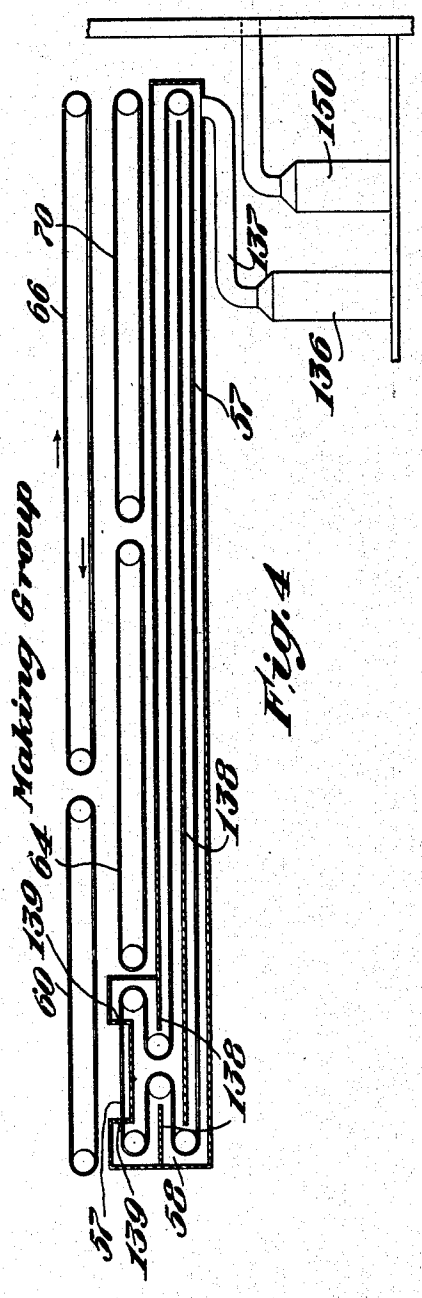


Fig. 4



Fig. 5

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MANUFACTURE OF SHOES

Filed Sept. 6, 1934 4 Sheets-Sheet 4

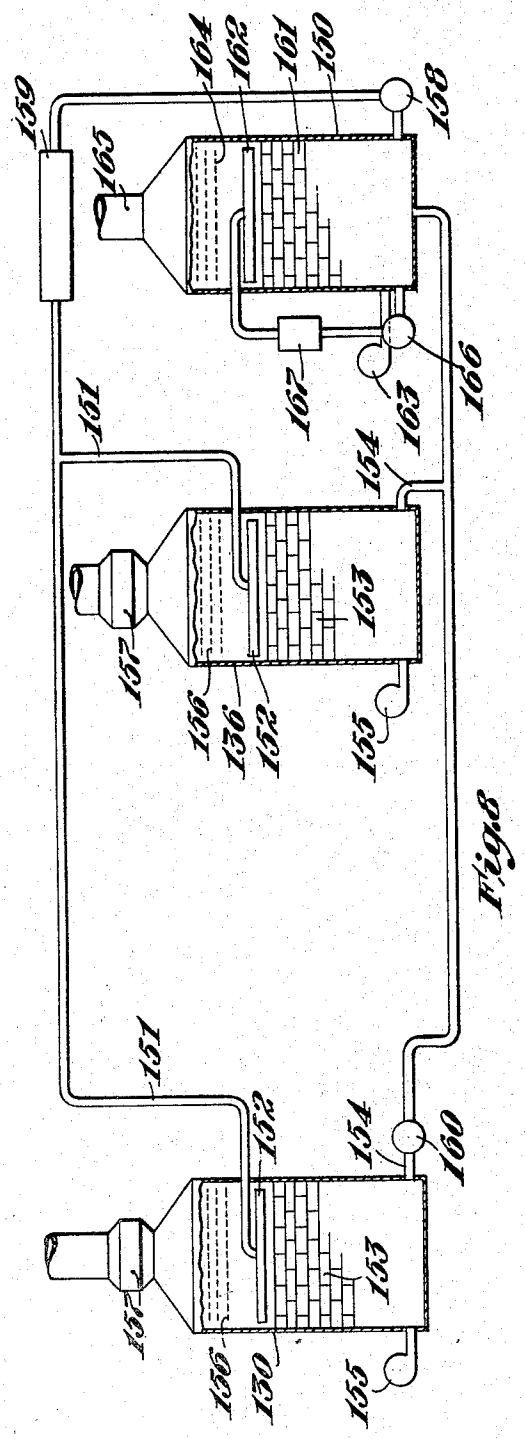


Fig. 6

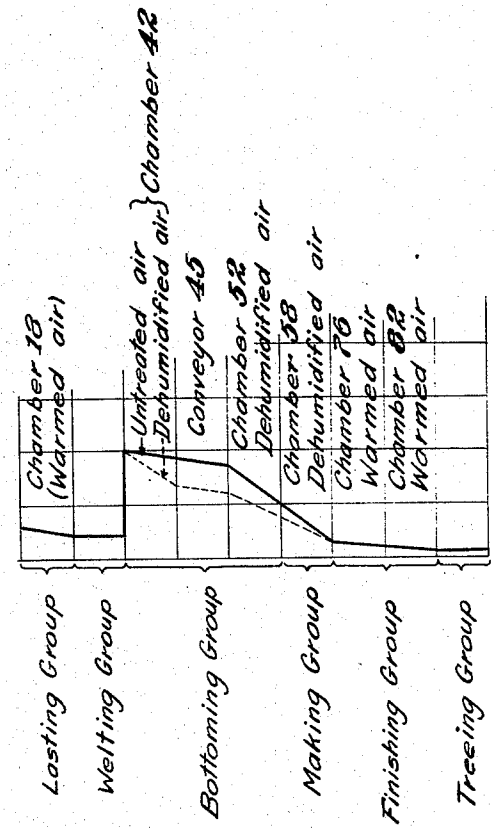


Fig. 7

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UNITED STATES PATENT OFFICE

2,097,799

MANUFACTURE OF SHOES

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Application September 6, 1934, Serial No. 742,890

3 Claims. (Cl. 12—142)

This invention relates to the manufacture of shoes and other footwear and more particularly to the progressive manufacture of footwear which includes at several stages the definite control of the moisture content of the work in progress.

In the manufacture of shoes it is a well known practice to increase or decrease the moisture content of the work in order to facilitate the performance of certain operations thereon. The reduction in moisture content designated briefly as "drying" or "conditioning" has usually been carried out by allowing the work in progress to stand in the work room for a number of hours until enough moisture has evaporated. This is objectionable because of the length of time required for drying the shoes in progress and the consequent delay in completing the manufacture of the shoes particularly when several such drying stages are required before the shoes are completed.

Moreover the drying attained by allowing the work to stand in the factory is very inaccurate. The condition of the work is roughly determined merely by its "feel" or appearance and the amount of drying varies in accordance with the humidity of the room in which the work stands. Furthermore the length of time during which the work is drying would be limited by the amount of floor space available for storage or might be cut short by an operator, in haste to start the succeeding operation.

The primary objects of this invention are to provide drying periods at various points in the progress of the work of the length found to produce the most satisfactory results on the work; to supply at such periods substantially the amount and type of drying required by the work according to its moisture content and the treatments for which the work is being prepared; to prevent any operators from reducing the length of the drying periods; and, in brief, to insure accurate drying of the work as it progresses toward its completion.

These and other objects of this invention will appear from a consideration of the following description of an installation in a department for making men's welt shoes embodying this invention and of the accompanying drawings which form a part of the description and in which

Figs. 1 and 1*a* together show, in diagrammatic plan view, a typical installation embodying this invention;

Figs. 2, 3, 4 and 5 are schematic side elevations partly in section illustrating the lasting, bottoming, making and finishing group of the installation shown in Figs. 1 and 1*a*, in each of which groups are provided one or more drying periods;

Fig. 6 is a schematic plan view on a reduced scale of a portion of the bottoming group shown in Fig. 3;

Fig. 7 is a chart illustrating the amount of moisture in a shoe at various stages in its manufacture; and

Fig. 8 is a diagrammatic view illustrating one form of dehumidifying plant which may be employed to carry out this invention.

The department for the manufacture of men's welt shoes by the installation shown in Figs. 1 and 1*a* is divided into six groups commonly designated by the terms lasting, welting, bottoming, making, finishing and treeing as indicated by legends on the drawings. Each group includes a plurality of overlapping conveyors by which the shoes in progress are delivered to and removed from the various operator stations following substantially the disclosure in the patent to Perry No. 1,948,127. The successive progress of the shoes through the various groups of this installation will be described briefly, it being understood that upon arrival at each station the shoes are treated by an operator in the manner indicated.

The uppers and lasts are assembled on the floor below the lasting group and sent by the racks of the conveyor **10** to the pulling over operators at the group station **11**, by racks on the conveyor **12** to the side lasting operators at the group station **13**, and by racks on the conveyor **14** to the bed lasting operators at the group station **15**, the shoes during this stage of the journey travelling past and being removed from and returned to the conveyor **14** by the butt tacking operator at station **16**. The bed lasting operators place the shoes on the conveyor **17** which carries them through a drying chamber **18** supplied with warm air to the toe trimming operator at station **19** who after completing this operation places the shoes on a floor rack **20** by which the shoes are moved to the welting group.

The shoes are removed at the welting group from the racks **20** by the tack pulling operator at station **21** and placed upon conveyor **22** for delivery to the welt sewing operators at the group station **23**. The welt sewing operators place the shoes upon the conveyor **24** by which they are carried to the inseam trimming operator at station **25** past the tack pulling and toe wiring operator at station **26** by whom the shoes are taken from and returned to the conveyor **24**. The shoes are placed by the operator at station **25** on the conveyor **27** from which they are removed and re-

placed by the welt butting operator 28 and from which they are finally removed by the inner sole tack pulling operator at station 29. That operator places them on the conveyor 30 by which they are rendered successively accessible to the welt beating operator at station 31, the shank sticking operator at station 32 and the bottom filling operator at station 33. The operators at stations 31 and 32 remove and return the shoes to the conveyor 30, the operator at station 33 however after removing the shoes places them on the conveyor 34 by which they are carried to the welt and inseam cementing operator at station 35 who places them after treatment on a floor rack 36.

In the bottoming group the soles which have previously been moistened in any suitable manner are secured to the shoes removed from the racks 36 which have been treated in the welting group. The sole laying operators at the group station 37 place the shoes so treated upon the conveyor 38 by which they are carried to the rough rounding and channel opening operators at the group station 39 which operators place the shoes on the conveyor 40 for transportation to the sole stitching operators at the group station 41. It will be understood that these treatments of the shoes are facilitated by the flexibility of the soles due to the moisture content thereof. However following the sole stitching operation the amount of moisture must be reduced, and this is done by carrying the shoes through a drying chamber 42 by the conveyor 43 on which the stitched shoes are placed. The chamber 42 is supplied with a stream of air which may or may not, as pointed out below, be conditioned, i. e. brought to a predetermined temperature and the normal moisture content reduced to an appreciable extent. The conveyor 43 thereafter presents the shoes to the channel cementing operator at station 44 who then places them on the conveyor 45 on which they are further dried by a passage in the air of the work room for such a length of time as has been found sufficient to render the cement tacky. The shoes are then presented to the channel laying operator at station 46 who places them on the conveyor 47. Under certain conditions (for example, when the soles are not channeled) the channel cementing and laying operations are omitted and the shoes leaving the drier 42 are presented by the conveyor 43 directly to the stitch separating and wheeling operator at station 48. The shoes, placed upon the conveyor 47, are carried thereby to the heel seat nailing operator at station 50 and then placed on the conveyor 51 which carries them through the drying chamber 52 to the leveling operators at the group station 53. The chamber 52 is supplied with conditioned air and the moisture content of the shoe soles further reduced so that they are in the best possible condition for the levelling operation which sets up considerable strain and stress therein. The shoes are then placed by the levelling operators upon the conveyor 54 by which they are carried to the heel seat rounding operator at station 55 who then places them on a floor rack 56.

The treatment of the shoes in the making group begins by transferring them from a rack 56 to the conveyor 57 which carries them through the drying chamber 58. The chamber 58 is supplied by conditioned air and the shoes remain therein for such a period of time that the moisture content particularly of the soles will be reduced to the optimum at which they can be handled most advantageously in the making group and in the sole buffing or burnishing treatment which follows in the finishing group. The shoes are presented by the conveyor 57 to the heel attaching operator at station 59 and placed by that operator on the conveyor 60. The conveyor 60 carries the shoes to the heel breasting operator at station 61 past the top lift slugging operator at station 62 and the heel shaving operator at station 63, the top lift slugging and heel shaving operators replacing the shoes upon the conveyor 60. After heel breasting the shoes are placed on the conveyor 64 and presented to the edge trimming operators at the group station 65 who thereafter place them on the conveyor 66. While in transit on the conveyor 66 the shoes may, if this treatment is desired, be removed by the jointing operator at station 67 and replaced on the upper strand from which they are removed by the edge inking operator at station 68. This operator replaces the shoes on the lower strand of the conveyor 66 so that, due to the direction of movement of the conveyor (see Fig. 4), they travel an appreciable distance before reaching the edge setting operators at the group station 69 thus allowing time for the ink on the edge to dry. The edge setting operators place the shoes on the conveyor 70 from which they are removed and replaced by the breast scouring operators at station 71 and from which they are finally removed by the heel scouring operator at station 72 who places them on a floor rack 73.

At the finishing group the shoes are removed from the racks 73 by the heel burnishing operator of the group station 74 and placed upon the conveyor 75 which carries them through a drying chamber 76 supplied with warm air. The shoes thus dried are presented to a bottom scouring operator of the group station 77 and then placed on the conveyor 78 by which they are carried to a gumming and staining operator at station 79 or to a painting operator at station 80 depending upon the type of shoes in progress. Thereafter the shoes are placed on the conveyor 81 by which they are carried through a drying chamber 82 by which the stain or paint is dried. In cases where the shoes are painted it may be desirable for the conveyor 81 to carry them, following the drying, to the gumming operator of station 79 and in other cases the shoes may be carried by the conveyor 81 to the cutting and paneling operator at station 83. Either operator places the shoes on the conveyor 84 by which they are presented to one of the polishing operators at the group station 85 by whom they are placed on the conveyor 86. The conveyor 86 presents the shoes successively to the bottom wheeling operator at station 87, the last pulling operator at station 88, and the shank nailing operator at station 89 any or all of which stations may be omitted and finally to the bottom stamping operators at station 90 by whom the shoes are placed on a floor rack 91.

The floor rack is moved to the operator at station 92 of the treeing group. If the lasts have already been pulled the operator at station 92 searches for tacks therein and applies the heel pads. The shoes are then placed on conveyor 93 and carried thereby to group station 98 where the shoes are treed on shoe trees and placed on conveyor 95. If the lasts have not been previously pulled the lasted shoes are taken from the rack 91 at station 96, and placed on conveyor 95 by

which they are carried successively to station 94 for treeing on the last, then to station 97 where the lasts are pulled, and to station 99 where the shoes are searched for tacks and heel pads applied and returned to conveyor 95. The shoes, now all in the same condition, are carried by the conveyor 95 past station 100 where they are singed to station 101 where the first filling operation is performed and then placed on conveyor 102 which travelling in the reverse direction to conveyor 95 carries the shoes past group station 103 where any necessary repairs are performed to station 104 where the second filling operation takes place. The shoes are then placed on conveyor 105 and carried thereby to station 106 for the first dressing operation, are transferred to conveyor 107 which carries them to station 108 for the second dressing operation and placed on conveyor 109. That conveyor carries the shoes to station 110 where the laces are supplied and the shoes are placed on conveyor 111 which carries them to group station 112 where the final brushing operation is performed, and the shoes are placed on a rack 113 by which they are carried to another department of the plant.

From the foregoing description it will be noted that the shoes during their manufacture are subjected to drying operations repeatedly of several different types the duration and function of which vary in accordance with the amount of moisture to be removed. The chart shown in Fig. 7 indicates roughly the relative moisture content of the shoes at various stages during their travel through the groups.

The shoes in the lasting group are carried by the conveyor 17 through a drying chamber 18. Air forced by a blower 120 through a suitable heater 121 and pipe 122 enters one end of the drying chamber and escapes through the apertures 123 by which the conveyor 17 enters and leaves the chamber. The drying chamber includes partitions 124 between the conveyor runs and the air flows through the various compartments both against and with the travel of the shoes. Any moisture in the uppers of the shoes is thus practically eliminated so that they are substantially dry when the toes are trimmed at station 19.

The treatment of the shoes in the bottoming group includes three drying stages. The drying chamber 42 may be supplied with untreated air by a blower 125 through a pipe 126 which enters one end of the chamber, shown in Fig. 3 as at the bottom. The drying chamber 42 is divided by partitions 127 into compartments for the conveyor runs and the air flows through said compartments leaving the chamber at apertures 128 through which the conveyor 43 enters and leaves the drier. In place of untreated air the chamber 42 may be supplied with conditioned air from a unit 130 feeding the pipe 126 through a gate 131 which may be opened or closed as desired. If the air in the plant is dry and cool, as for example in the winter, such air is capable of reducing the moisture content of the shoe soles to such an extent that the channel cementing operation at station 44 can be successfully and satisfactorily performed. When however conditioned air is required in this drying chamber the gate 131 is opened and the blower 125 cut off by closing a gate 132. The conveyor 45 carries the shoes through the work room in order that the cement at the channels be rendered properly tacky. This stage is designated for convenience as open drying. The drying chamber 52 is supplied with conditioned air from the unit 130 through a gate controlled pipe 133 one end of which joins the pipe 126 while the other end enters the bottom of the structure near one end thereof passes through the various compartments formed by partitions 134 and escapes through the apertures 135 by which the conveyor 51 enters and leaves the chamber.

In the making group the drying chamber 58 is supplied with conditioned air from a unit 136 through a pipe 137 which enters the chamber adjacent one end. The air passes through the various compartments in the chamber formed by partitions 138 and escapes from the chamber through the conveyor entrance and exit openings 139.

The drying chambers 76 and 82 of the finishing group are supplied with warmed air by means of a blower 140 and heater 141 through pipes 142 and 143. The air enters each chamber adjacent one end thereof, flows through the various compartments formed by partitions 144 and escapes through the apertures 145 and 146 respectively by which the conveyors 75 and 81 enter and leave the drying chambers. Suitable gates 147 are provided in the pipes 142 and 143 to control the flow of air therethrough.

The particular type or form of air conditioning apparatus employed to supply conditioned air to the drying chambers of the bottoming and making groups constitutes no part of the present invention. That selected for illustration and shown diagrammatically in Figs. 1*a*, 3, 4 and 8 is one employing lithium chloride as a dehydrating agent. Lithium chloride when cool acts by absorption to reduce the moisture content of air or other gas passed therethrough and when heated gives off moisture.

Fig. 8 shows diagrammatically one form of apparatus applicable for the handling of lithium chloride and for the dehumidifying thereby of the air passed to the driers 42, 52 and 58. This unit comprises the air conditioning units 130 and 136 and a unit 150 for regenerating the lithium chloride. Each conditioning unit comprises means for supplying a cooled lithium chloride solution thereto, means for bringing air into contact with the lithium chloride solution for dehumidification, means for heating the air, and means for introducing the heated and dehumidified (i. e. conditioned) air into a drier connected therewith. The solution is supplied to the unit by a pipe 151 and delivered by a head 152 upon a plurality of blocks 153. The blocks 153 serve as baffles to spread the solution into thin layers. After passing over the blocks the solution enters a sump and flows from the unit through a pipe 154. Air in the form of a stream forced into the bottom of the unit by a blower 155 gives up moisture to the solution as it passes in contact therewith, is filtered at 156 and as it leaves the unit passes through a suitable heater 157.

The solution leaving the air conditioning units 130 and 136 flows into the sump of the regenerating unit 150 and is returned by a circulating pump 158 through a cooling coil 159 to the units 130 and 136. In the apparatus shown the solution is returned to the unit 150 by a pump 160 from the unit 130 and by gravity from the unit 136. When the moisture content of the solution received in the sump of the unit 150 rises above a predetermined amount the unit 150 is automatically set in operation by a control not shown. The unit 150 is similar to the units 130 and 136, having blocks 161, a head 162 by which the solution is sprayed upon the blocks, and a blower 163

by which a stream of air is forced over the blocks in contact with the solution from which the air absorbs moisture, through a filter 164 and then through an outlet pipe 165. The solution is drawn from the sump of the unit by a pump 166, passed through a heating coil 167 and supplied to the head 162. When the solution in the system has given up to the stream of air enough moisture so that its moisture content has fallen below the predetermined amount the control stops the operation of the regenerating unit 150. It will be noted that the circulation of the solution through the unit 150 is independent of that through the units 130 and 136 so that the latter are unaffected by the former whether at rest or in operation.

The air supplied to certain of the driers by the units 130 and 136 is controlled so that it has a temperature never higher than 120° F. and a relative humidity never in excess of 20%, the preferable temperature and relative humidity being respectively not higher than 95° F. and not in excess of 12%. Heretofore it has been proposed to supply air to drying chambers of a much higher temperature than 120° F. and of a relative humidity above 20%. It is a well recognized fact that hot dry air quickly glazes the leather, such glazing not only being injurious to the leather, but acting to close the pores of the leather so that the moisture in the interior of the leather escapes more slowly and the comparatively high humidity is employed to counteract such injurious effects. It should therefore be particularly noted that the conditioned air which is supplied by the units 130 and 136 to certain dryers in which rapid drying of the shoes is required is cool and dry as compared with the higher, more moist air which has been proposed hitherto, and that this cool dry air acts to dry the shoes quickly without having any injurious effects upon the leather.

While certain embodiments of this invention have been shown and described it will be understood that the invention is not limited thereto and that other embodiments may be made without departing from the spirit and scope of the invention as set forth in the following claims.

We claim:

1. The art of manufacturing shoes wherein the shoes are progressively assembled by operations performed at various stations, said shoes in progress containing moisture at the beginning of the assembly operations, characterized in that the shoes are transported by conveyors to and from the stations and that just prior to the arrival of the shoes at certain stations they are conveyed through chambers containing a body of air having a relative humidity of 12% to 20% and maintained at a temperature of 90° to 115° F. whereby the shoes, upon their arrival at such stations, contain that amount of moisture which places them in the most desirable condition for the operations to be performed thereat.

2. The art of manufacturing shoes wherein the shoes are progressively assembled by operations performed successively, said operations including sole laying, sole stitching, heel seating, edge treating and bottom scouring, characterized in that the soles of the shoes are moistened prior to the sole laying operation, that a portion of that moisture is removed subsequent to the sole stitching operation and prior to the heel seating operation, that additional moisture is removed prior to the bottom scouring operation, certain at least of said moisture removals being performed by conveying the shoes in progress through a chamber filled with conditioned air having a relative humidity of 12% to 20% and being maintained at a temperature between 90° to 115° F.

3. That method of treating shoes in the course of manufacture by a plurality of operations which comprises the steps of predrying a body of air by absorption therefrom of moisture to a relative humidity of 12% to 20% while maintaining the air at a temperature of 90° to 115° F., introducing said predried air into a confined chamber at substantially said humidity and temperature and conveying such shoes containing moisture during their progress from one operation to the next succeeding operation through said chamber, whereby the moisture in the shoes is reduced by the predried air in the chamber to the degree required for such next succeeding operation at a temperature which will neither injure the leather nor diminish its porosity.

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