March 7, 1961 M. S. BROMFIELD 2,973,531

METHOD FOR MULLING SHOE UPPERS

Filed Sept. 3, 1959

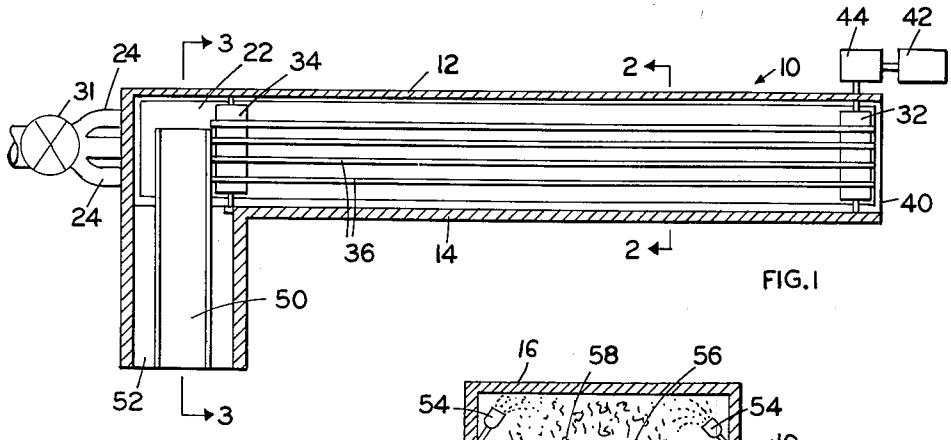


FIG. 1

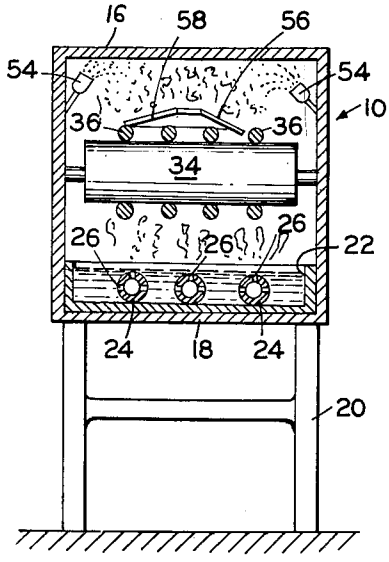


FIG. 2

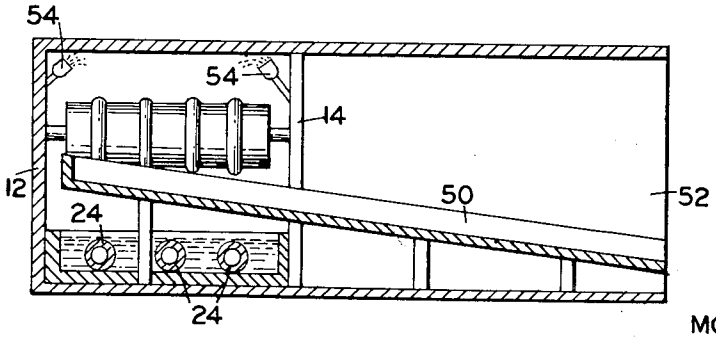


FIG. 3

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2,973,531

Patented Mar. 7, 1961

2,973,531

METHOD FOR MULLING SHOE UPPERS

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Filed Sept. 3, 1959, Ser. No. 837,887

5 Claims. (Cl. 12—142)

This invention relates to the art of shoemaking and more particularly comprises a new and improved method for mulling shoe parts.

In factories employing conventional shoemaking methods, shoe uppers are conditioned in mullers for several hours before lasting. The uppers are nested in stacks on racks and after remaining in the muller for at least several hours, the case lots are removed a few at a time in accordance with the demands in the lasting room. The uppers at the ends of the nested stack necessarily receive more moisture than those which lie intermediate the ends, and, therefore, the moisture content of the several uppers within a single case lot is not uniform. Moreover, the moisture content throughout each upper is not uniform because of the nesting characteristics of the uppers. While some parts of each upper are in contact with parts of adjacent uppers and are thus insulated from the heat and moisture of the muller, other parts of the upper are spaced from the adjacent uppers and are exposed to the muller atmosphere. The lack of uniformity is further aggravated because some case lots remain in the muller for but a few hours while others remain in the muller for twenty-four hours or more, and when the uppers are lasted, the moisture in some will have dispersed throughout the material while in others a moisture gradient may exist in the leather.

The mulling described above is normally conducted in a room having a warm, humid atmosphere. In the more recent developments relating to mulling, steam is employed to accelerate the mulling process. For example, in accordance with one suggested mulling technique, a flow of vapor in the temperature range of 85°–95° F. derived from a steam source is directed against the uppers. The suggested range of 85°–95° F. is far below that which would be injurious to leather, linings and other upper materials. In this mulling method, the exposure time of the upper to the vapor is indefinite, being determined by the demand of the pull-over operator in the lasting room.

To accelerate the conditioning of the uppers and at the same time avoid the formation of water droplets on the surface of the material in greater quantities than can be absorbed by the leather, in another relatively recent development super-heated steam having a minimum temperature in the range of 240–260° F. is used to mull uppers. Proponents of this method suggest that steam temperature may reach as high as 450° F. with certain types of leather. Because this conditioning technique is used as a means of introducing a minimal amount of moisture to the surface for retempering the upper (as opposed to original mulling), the short time in which the leather may be exposed to that temperature without harmful effect is adequate to allow the upper to absorb the quantity of moisture necessary.

With the single exception of the use of super-heated steam referred to above, all mulling techniques with which I am familiar limit mulling temperatures to 140° F. This temperature limitation has been adopted because unless

the time during which the leather is exposed to higher temperatures is short and controlled, the leather fibers and the finish will be damaged. Excessive temperatures and moisture cause shrinking and shriveling of the leather, and the fibers melt at approximately 130° F.

The primary object of my invention is to provide a muller which can introduce an optimal amount of moisture into the surface zones of the upper material in a very short time.

Another object of my invention is to provide a muller which facilitates the control over the amount of moisture introduced into uppers.

The most important feature of my invention resides in a combination of conditions established in a muller which permits an upper to be optimally mulled in a period of approximately three minutes. The muller temperature is maintained and controlled within a range of approximately 140–180° F. and the atmosphere has a relative humidity of substantially 100%. An upper disposed for three minutes in a muller having an atmosphere so conditioned will acquire optimum workability necessary for lasting. Physically, the muller is in the form of an elongated chamber provided with a trough along its bottom containing water. A series of steam pipes extend along the trough through the water and by means of perforations formed in the pipe walls, emit steam which bubbles through the water and creates the high humidity and temperature in the chamber. Also extending through the chamber is a conveyor which carries uppers one at a time through it and exposes the surfaces of the upper material to the atmosphere in the muller. Spray heads in the muller emit a very fine mist in the tunnel and supplement the action of the steam pipes.

These and other objects and features of my invention, along with its incident advantages, will be better understood and appreciated from the following detailed description, read with reference to the accompanying drawings, in which:

Figure 1 is a plan view in section of a muller constructed in accordance with my invention; and

Figures 2 and 3 are cross sectional views taken along the section lines 2—2 and 3—3 of Figure 1, respectively.

For the fullest appreciation of my invention, certain characteristics of leather should be recognized. Many of these characteristics are set forth in my copending application Serial No. 810,807 filed May 4, 1959 entitled Method of Manufacturing Shoes and are restated briefly here. First, after the initial application of moisture to the surface of leather, the stiffness of leather increases as the moisture leaves the extreme fibers and lowers its concentration by dispersing throughout the leather thickness. Second, as the grain of a skin as opposed to the corium limits the workability of the leather, the application of moisture to the grain is most beneficial in increasing the bendability and stretchability of the leather. Third, heat quickens the rate at which moisture may be absorbed into the surface areas of leather and, therefore, it is an important adjunct of moisture in improving workability and stretchability of upper material. Fourth, greater shrinkage of leather occurs in response to rapid drying when the moisture content and concentration in the leather initially is relatively high. As a result, force drying should be performed while the moisture is concentrated in the surface zones, that is, before moisture has had an opportunity to disperse throughout the upper material.

The several characteristics of leather outlined above indicate that mulling moisture should be introduced and confined to the surface zones of the upper material. The mulling method of my invention is particularly designed to introduce moisture to those zones.

The rate at which leather uppers pick up moisture is dependent upon several functions. For example, the

rate of condensation of moisture upon leather depends upon the temperature gradient between the atmosphere and the leather. As the heat of condensation raises the temperature of the leather, the rate at which moisture condenses on the material reduces, and when the gradient is eliminated, condensation stops. In conventional mullers where little or no temperature gradient exists between the atmosphere and the leather, the leather acquires moisture as a result of the loss of heat from the leather to the atmosphere through radiation. The heat lost by radiation is replaced by heat of condensation which causes additional water to condense on the leather. This process is extremely slow and at least several hours are necessary for the leather to acquire significant amounts of moisture. Moreover, the prolonged mulling period affords the moisture initially introduced an opportunity to disperse throughout the material to the detriment of rapid and safe forced drying.

Temperature also affects the physical characteristics of water, namely, its viscosity and surface tension. The viscosity and surface tension of the water decreases with increases in temperature. Thus, cool water will tend to remain on the surface of leather while warmer water will more readily penetrate.

Relative humidity is a third function which affects the rate at which leather picks up moisture. Obviously, if there is a deficiency of water vapor in the atmosphere of the muller, an elevated muller temperature will raise the leather temperature by simple conduction and the reduced temperature gradient between the atmosphere and the leather will retard the condensation of moisture on the surface of the material.

The muller shown in the drawing optimalizes the several factors controlling the rate of moisture pick up to mull uppers rapidly and concentrates the moisture in the surface zones. The muller is in the form of an open ended elongated duct or chamber **10** having a pair of side walls **12** and **14** and top and bottom walls **16** and **18**, respectively. The chamber may be supported in any convenient manner either from below or above and at any elevation. I have suggested the use of a support **20** for this purpose and it is to be understood that this is merely exemplary of all classes of supports.

Extending through the chamber **10** and lying on the bottom panel **18**, is a trough **22** filled as suggested in Figure 2 with water. A plurality of steam pipes **24** extend longitudinally through the trough and are submerged below the surface of the liquid. These pipes **24** may be connected to any convenient steam source (not shown) and are perforated as suggested at **26** to allow the steam carried by the pipes to bubble through the water in the trough and create a hot, humid atmosphere in the chamber. The quantity of steam flowing through the pipes may be controlled by any form of valve as suggested at **31** in Figure 1.

A pair of pulleys **32** and **34** disposed in the chamber **10** support a plurality of parallel cords **36** which cooperate to form a conveyor. The upper run of the cords **36** forms the conveying surface adapted to carry uppers to be mulled from the inlet end **40** of the chamber to its bend adjacent the other end. I have suggested diagrammatically in Figure 1 that the pulley **32** is driven by a motor **42** through a gear box **44** while the pulley **34** serves as the idler in the mechanism. The idler **34** lies adjacent the top of a chute **50** and uppers conveyed through the chamber by the cords **36** are deposited on the chute at the end of the conveyor run. The chute **50** which slopes downwardly from the end of the conveyor will direct uppers deposited on it out the end **52** of the chamber.

A plurality of nozzles **54** secured above the upper run of the conveyor cords **36** and connected to any convenient hot water source supplement the action of the steam pipes by discharging a very fine mist or spray in the chamber **10**. The number of nozzles or spray heads **54** employed will be determined by the effectiveness of the steam pipes and may be spaced several feet apart along the chamber. The water discharged by the nozzles is generally directed to the upper portion of the chamber and forms a fine mist which falls upon the grain surface **56** of the upper **58** as suggested in Figure 2. Valves (not shown) in the hot water lines feeding the nozzles **54** may control the quantity of hot water discharged as a mist into the chamber. Thus, the temperature within the chamber **10** may readily be controlled within the desired range of 140°–180° F. and the humidity may be maintained at substantially 100% by the hot water valves and the steam valve **31**.

The particular temperature selected for the muller within the range of 140–180° F. is determined by the type of upper material being mulled. Normally, those materials which offer the greatest resistance to the penetration of moisture through their surfaces require the highest temperatures within the recited range. Thus, patent leather uppers are most effectively mulled when the temperature within the chamber is 180° F. Calf leather uppers may be efficiently mulled when the muller is maintained at a temperature of 160°–180° F. Uppers made of kid skin may shrivel when exposed to temperatures in excess of 160° F. and, therefore, the muller is maintained within a range of 140–160° F. for them.

The water discharged by the spray heads **54** augments the moisture pick-up from condensation by mechanically spraying small water particles. It is particularly desirable that the particles be directed mainly to the grain side of the leather upper. If the soft fleshy parts of the leather are allowed to pick up appreciable quantities of the sprayed moisture, the stretch characteristics of different portions of the skin will be exaggerated. For example, the soft fleshy areas of the skin which normally are more stretchable than the bony areas absorb moisture more rapidly and the stretch differential of these portions is exaggerated when equal amounts of moisture are directed to them. Thus, the nozzles are so oriented that the moisture discharged is directed primarily to the grain of the leather upper.

Approximately three minutes are required for uppers to acquire a moisture concentration of 18% or more in their surface zones when exposed to the defined temperature and moisture conditions within the chamber **10**. Thus, the motor **42** which drives the pulley **32** is set to convey uppers placed on the cords **36** through the chamber in approximately three minutes. The speed at which the conveyor travels will of course be determined by the length of the chamber **10**. When used in combination with a conveyor of the size shown in my copending application supra, the chamber may be approximately twenty-four feet long and the conveyor may travel at approximately eight feet per minute. These factors are of course matters of design.

From the foregoing description, it will be recognized that effective mulling of an upper may be carried out in a period which heretofore has been considered adequate only for remulling or retempering of uppers which already have appreciable quantities of moisture in them. Moreover, the temperature range which I have adopted has been avoided in the prior art devices because such temperatures were believed harmful to leather. Furthermore, the saturated atmosphere which I employ in the chamber **10** has been avoided in the prior art devices because it was believed that such conditions would cause water droplets to form on the leather and spot the finish. In effect, I have selected a combination of variables, all of which the prior art suggests should be avoided, to effect a very rapid rate of moisture pick-up in the surface zones and achieve a moisture concentration in those zones of 18–22%. As a result, I have made possible and practical the mulling of uppers on an individual and continuous basis.

Other advantages of my invention will also be appar-

ent from a reading of the foregoing description. For example, while in conventional shoemaking methods, it is difficult to adjust mulling rates to satisfy the requirements of different types of leather, with my invention, the relative humidity and temperature of the chamber, and the mulling time may readily be controlled so that the quantity of moisture introduced into uppers may be controlled. Furthermore, because the uppers are placed singly on the conveyor (as opposed to being nested one above the other), each upper is uniformly mulled and the several uppers directed through the chamber each pick up the same quantity of moisture. As still another advantage of my invention, the moisture introduced to the leather does not have an opportunity to pervade the material because of the very short time required for mulling. The moisture is concentrated in the grain areas at the time the uppers are made available for lasting and if lasted on an individual basis immediately after mulling, the uppers may thereafter be force dried before the moisture has had an opportunity to pervade.

The foregoing description of my invention has been confined generally to the mulling of shoes having leather uppers. Nevertheless, my invention is not confined to shoe uppers made of this material. Regardless of the material used for uppers, the outer fibers of the material are subjected to the greatest stress when the material is lasted, and, therefore, mulling moisture is required at the surface zones. Mulling by my method confines the moisture to the surface zones and, therefore, its application is beneficial to materials other than leather. Furthermore, the atmospheric conditions of the muller will accelerate the rate of moisture pick-up in the surface zones of all types of materials.

Because numerous modifications may be made of my invention without departing from its spirit, I do not intend to limit the breadth of my invention to the specific embodiment illustrated and described. Rather, it is my intention that the breadth of my invention be determined by the appended claims and their equivalents.

I claim:

1. A method of mulling a leather upper, which comprises moving the upper along a predetermined path, generating an atmosphere of 100% relative humidity about and along said path, additionally directing a mist of hot water upon the grain side of the moving upper, and removing the upper from the path when the surface zones of the upper have attained a moisture content of at least 18% by weight and the total moisture content of the upper is substantially less than 18% by weight.

2. A method of mulling an upper which comprises placing the upper for approximately three minutes in an atmosphere having approximately 100% relative humidity and a temperature from 140° to 180° F., whereby the surface zone of the upper material has a moisture concentration of at least 18% by weight while the total moisture content of the upper is substantially less than 18% by weight, and removing the mulled upper from said atmosphere.

3. A method of mulling a leather upper, which comprises placing the upper in an atmosphere having a temperature between 140° F. and 180° F. and 100% relative humidity, additionally directing a fine hot water mist upon the grain surface of the upper, and discontinuing the mulling before mulling moisture has pervaded the upper.

4. A method of mulling a leather upper, comprising subjecting the upper to a hot humid atmosphere for approximately three minutes, the temperature of said atmosphere being from approximately 140° F. to 180° F., while introducing into said atmosphere a fine mist of hot water.

5. A method of mulling a leather upper, which comprises placing the upper in an atmosphere having a temperature above 140° and 100% relative humidity, additionally directing a fine hot water mist on the grain surface of the upper, and discontinuing the mulling before mulling moisture has pervaded the upper.

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