

1

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PROCESS OF FINISHING A WOOD CORE

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This invention relates to the manufacture and coating of wood heels, although it should be understood that the principles of the invention are applicable to similar items requiring a coating substantially free of imperfections.

In manufacturing heels for ladies' shoes, it is essential that the finish be free of blushing, running and other imperfections in the coating itself, and that the coating conceal defects in the underlying core. A wood core may be sanded to a relatively smooth surface but it is impractical to remove all of the tool marks, scratches or other indentations prior to application of the covering. Consequently, it has been necessary to cover the wood core with a sheet of pyroxylin. A piece of nitrocellulose is cut to size, softened, stretched about the core, and secured thereto, as by spot pasting at the margins that meet over the breast wall. As the sheet hardens, it draws tight about the core to form a perfectly smooth surface, underlying irregularities being concealed. On the other hand, the attachment of such a sheet is a slow manual operation, and the attachment is not too secure. Another difficulty commonly encountered is the tendency of the finish to chip, fray or otherwise become detached. In order to resist scuffing and the like, the finish must be fairly tough, but a tough coating is not easily secured to the wood core.

It is therefore an object of the present invention to provide an improved process for manufacturing shoe heels and the like. More specifically, the invention includes among its objects the provision of a process for applying a tough durable decorative coating to a wood core; the provision of a process that may be carried out with automatic machinery; the provision of a process whereby the covering is firmly secured to the wood core over the entire area and in such a way as to conceal tool marks and other defects in the core; and the provision of a process that permits handling of the wood core up to a final spray coating without regard to the ultimate color of the heel.

In accordance with the present invention, briefly stated, a wood block is cut and sanded to the desired shape using conventional machinery of a type known to those skilled in the art. As an initial step in the application of the finish, the core receives a tacky, adhesive film preferably applied by dipping. It should be understood, however, that this initial coat is not a so-called sanding sealer and is not sanded. In particular, the invention contemplates that the initial dip coating will be a plasticized vinyl acetate solution, an overplasticized nitrocellulose solution, or a material of similar character. This initial coating is permitted to dry to an extent such that it will not lift or wash from the core in subsequent dippings, but it may be tacky, a two hour dry being sufficient under most conditions.

Thereafter, a relatively thick intermediate or filler coat of nitrocellulose or a similar tough film-forming material is built up, as by repeated dippings. The number of dipping operations required to achieve desired thickness, such as ten-thousandths of an inch, depends upon the character of the coating material, but the dipping viscosity should be on the order of forty seconds (No. 4 Ford cup).

2

A cold or room temperature dipping lacquer is made up with a nitrocellulose base, substantial quantities of plasticizer and soft resin, and a thinner relatively rich in solvent. This lacquer differs from the conventional in having a relatively large amount of plasticizer and small amount of resin, and also in the use of a soft resin instead of a hard resin. One-fourth or one-half second nitrocellulose is preferred, despite some loss in film strength as compared with high viscosity types. The additional solvent needed to disperse high viscosity cellulose results in a dipping agent requiring application of numerous coats. A lacquer having approximately equal parts plasticizer and soft resin and somewhat more nitrocellulose in solution (with a solids content of about twenty-five percent) will usually produce a filler coat of the desired thickness in three or four dips.

Alternatively, the dipping solution may have a higher solids content, such as would produce a room temperature viscosity of 100 seconds (No. 4 Ford cup), the solution then being heated to achieve proper dipping viscosity. This procedure permits savings in solvent and results in thicker coats for each dip. Another possibility offering further savings in solvent and dipping time is a hot melt, such as that disclosed in my copending application Serial No. 466,847, filed November 4, 1954, and now Patent 2,875,093, of which this is a continuation-in-part. Dipping is preferably carried out by machine, the arrangement being such as to recycle the cores with a thirty to sixty minute drying period between dips, and gradual temperature reduction is recommended when using heated coating agents.

Normally, the filler coat will be clear, and a spray lacquer is applied thereto to form a relatively thin final coat. This final coat may have the additional function of in part softening the filler and producing a tautening effect, thereby levelling any irregularities in the surface of the filler. Such an effect is achieved by using a thermoplastic base differing in solubility from that of the filler, together with a special solvent combination. One solvent component is a low boiler having high solvent action on the base of the final coat and relatively low solvent action on the base of the filler, whereas another solvent component is a relatively high boiler having a softening effect on the thermoplastic base of the filler.

Other features of the invention will be in part apparent from and in part pointed out in the following detail description taken in connection with the accompanying drawings, in which:

Fig. 1 is an oblique view of a heel, which is to be finished according to the process disclosed herein;

Fig. 2 is a detail sectional view of the heel and its finish, the thickness of the several coats being exaggerated; and

Fig. 3 is a diagrammatic vertical sectional view of a machine for in part practicing the process disclosed.

Referring now to Fig. 1 of the drawings, there is shown a wood core 1, which has been shaped as a heel for a lady's shoe. The upper portion 3 forming the seat may be concave and bears certain size and style indicia stamped or printed thereon after shaping. The opposite end 5 is referred to as the top, and the breast wall is designated 7, the sides 9 and back 11 being rounded as indicated. In manufacture, a tight grained wood, such as northern hard maple, is shaped on automatic wood cutting and sanding machinery, which may be readily adjustable so that different sizes and styles can be formed.

Such a core may be covered with fabric or leather, or more commonly, the finish is a colored lacquer, but conventional finishing procedures are not satisfactory, either from the point of view of durability or decorative quality. The smooth surface and tight grain of the wood core present difficulties in firmly securing a lacquer coating.

Also, there will be defects in the grain of the wood and tool marks, which must be concealed by the finish. Accordingly, it has been customary to shrink a sheet of spot-pasted pyroxylin about the side, back and breast walls of the wood core, so as to form a base for the final colored lacquer. When properly applied, such a sheet provides a smooth decorative surface, and the toughness of nitrocellulose together with the substantial thickness of the sheet (ten-thousandths of an inch being a standard adopted by the industry) assures a fair degree of durability. On the other hand, there are disadvantages. The sheet cannot be secured to the core over its entire area, spot pasting being employed, hence the finish is subject to peeling, fraying, or other forms of detachment. Also, moisture may penetrate at the ends of the core and attack the adhesive. Another important consideration is that of cost, the attachment of the sheets being a relatively slow manual operation.

These objections are herein overcome by a process which involves the steps of dipping the core to form a relatively thin initial coat of special adhesive characteristics, thereafter dipping the core to form a relatively thick filler or intermediate coat of high strength, and finally spraying the core to form a thin outer coat of the desired color, this outer coat also having a levelling action on the filler coat.

The initial coat 13 is formed of highly adhesive material, preferably one that becomes tacky or tends toward cobwebbing at some stage during its drying. As such, the initial coat is to be distinguished from conventional sanding sealers, which do not adhere properly with the tight-grained smoothly-sanded wood from which heels are made and which must not clog sand paper. A dilute organic non-aqueous solution is applied so as to form a thin film, for example, one-thousandth of an inch or less. The film is then permitted to dry for a time sufficient to prevent lifting from the core during subsequent dipping operations. In other words, the primary object is to free the solvent from the wood so that the film is adhered to the core. Subsequent dipping operations may soften the film, in order to provide a good bond with an overlying coat, but not to the extent of detaching the initial coat.

A recommended coating agent for this purpose is plasticized high-viscosity vinyl acetate, such as Vinyllite Ayat. Ten to twenty percent by weight of the solids content is plasticizer, such as dibutyl phthalate or tricresyl phosphate. The solution should be fifteen percent or less solids, and the drying period may be two hours. A standard lacquer thinner might be used, for example, 10% butanol, 20% butyl acetate, 10% ethyl acetate, 30% xylene and 30% toluene. A final consideration is cold checking, but this is avoided, as will be understood by those skilled in the art, if the elasticity of the initial coat approximates that of the overlying coat.

The desired result may also be achieved using an over plasticized nitrocellulose or ethyl cellulose lacquer, such as one containing two parts plasticizer for each part cellulose. Dibutyl phthalate and castor oil are exemplary plasticizers. In this case, the initial coat would remain tacky and might tend to be of different elasticity from the overlying coat, but the plasticizer tends to bleed, thereby avoiding a sharp discontinuity in elasticity between coats. Latex has the desired adhesive effect, but non-migrating plasticizers must be used in subsequent coats and difficulties may be experienced with solvents, water not being compatible with nitrocellulose.

The second step in the process is that of building up a relatively thick, tough filler or intermediate coat 15 by dipping, the ultimate thickness of which may be about ten-thousandths of an inch. Although the filler 15 corresponds to the pyroxylin sheet of previous processes in providing a smooth durable finishing surface, it entirely covers the wood core and is more firmly secured.

The filler preferably has a nitrocellulose base because

of the advantages in fast drying and high strength, but there are differences from conventional nitrocellulose lacquers. Heretofore, it has been customary to use a hard resin in amounts generally greater (by weight) than the cellulose, and plasticizer in amounts less than the cellulose. According to this invention, soft resin is used in substantial quantities to achieve a plasticizing action. Moreover, a substantial amount of chemical or solvent-type plasticizer is used. For example, plasticizer and soft resin may be used in about equal parts, and the total of plasticizer and soft resin may be as much or slightly greater than the amount of nitrocellulose.

The nitrocellulose preferably is of relatively low viscosity (one-fourth or one-half second). Although a higher viscosity grade would be desired because of the greater strength, high viscosity nitrocellulose requires considerable solvent, and many dips would be necessary to build up a filler of the desired thickness. Also, the ratio of solvent to diluent differs from conventional practice. A standard thinner has forty percent solvent whereas I prefer sixty-five percent solvent.

Accordingly, the solids content by weight might be forty percent nitrocellulose, thirty percent chemical plasticizer and thirty percent soft resin. Exemplary soft resins are Aroclor 1260 (chlorinated biphenyl of sixty percent chlorine content by weight) and Herculyn (hydrogenated methyl abietate). Satisfactory plasticizers include dibutyl phthalate, tricresyl phosphate and Santicizer M-17 (methyl phthalyl ethyl glycolate). A recommended thinner for the above would be methyl ethyl ketone twenty-five percent, butyl acetate forty percent and toluene thirty-five percent, the latter being a diluent and solvent for the resin.

If a cold dip is to be employed, the dipping solution should be about twenty-five percent solids in order to have a dipping viscosity of thirty to fifty seconds (No. 4 Ford cup). The invention also contemplates hot dipping, which has the advantage of saving solvent and reducing the number of dips required to build a filler of the desired thickness. In hot dipping, the solution might be forty percent solids, which would result in a room temperature viscosity of 100 seconds (No. 4 Ford cup), but the solution is heated to a temperature resulting in a dipping viscosity of about forty seconds, for example, 150° F. Another possibility is a hot melt, as described in my aforementioned copending application.

Automatic dipping machinery may be employed in building up the filler coat. Referring to Fig. 3, there is shown apparatus including a pair of opposed endless conveyors or chains 21 trained about sprockets 23, it being understood there is a conveyor at each side of the machine. The conveyors 21 lead along a vertical path at one end of the machine, which forms a zone L for loading and unloading the machine. The conveyors are driven in the direction indicated so that the articles carried thereby, in leaving the loading zone L, pass into a primary heating zone PH, which may be enclosed at 25 and have suitable heating devices 27, such as infrared lamps. This zone leads directly to an enclosed dipping tank T, and the articles are carried from the tank to a second heating zone SH. Finally, the articles pass to a cooling zone C, and from there to the loading zone L.

Rods 35 extend transversely between the conveyors, and each rod carries spikes 39, which project radially at suitably spaced intervals therealong. The rods are removably held by the conveyors so that they may be readily loaded onto and removed from the machine at the loading zone. In addition, the rods are rotatable and have shieves or sprockets 41 fixed thereto for cooperation with fixed tracks 43, the arrangement being one such as to rotate the rods as they move through the primary heating zone PH, over the dipping tank T, and thence through the secondary heating zone SH.

The initial heating zone PH heats the wood cores 1 to a temperature approximately the same as that of the

5

coating material in the tank T, the latter being heated by means of a jacket 29. The second heating zone SH is designed to maintain the cores at the temperature of the solution as they emerge from the tank. The temperature is held over a short distance (for example, an amount sufficient to provide one complete revolution of the heels) and is then gradually reduced, as the heels are rotated. The conveyors extend along a path immediately over the dipping tank so that the spikes on the rods may dip into the coating solution. This path is of a length sufficient to provide for a complete revolution of each rod 35 and emersion of all heels.

The heating zones PH and SH are not required in the cold dipping process, but a heating zone, such as that shown at SH, is desired in hot dipping in order to prevent premature solidification or freezing of the coating as the cores emerge from the dipping solution. In other words, the gradual reduction of temperatures, which occurs during rotation of the cores, permits the intermediate coating layers to be spread uniformly over the initial adhesive coat.

Where several dippings are required in building up a filler coat of desired thickness, the rods 35 may cycle about the machine several times, the coating material drying between dips. Accordingly, the conveyors 21 are operated at a speed such as to provide a drying period of thirty to sixty minutes. The rotation of the rods as they cooperate with the track 43 should be slow, so as to prevent a centrifugal effect upon the coating material, while at the same time sufficient to insure an even flow of the material without formation of ridges. A rotational speed of approximately two revolutions per minute is satisfactory.

The final coating 17 is applied with a spray gun, any conventional lacquer being suitable, provided it is compatible with the filler 15. In most instances, the filler will be colorless and the final coating will contain pigments for producing the desired color. This procedure is desirable from a manufacturing point of view inasmuch as the same material may be used for forming the filler 15 regardless of the ultimate color. Where a large number of heels are to be of the same color, however, as in the case of black heels, the coloring pigment might be incorporated in the intermediate coating, although this has disadvantages, in that the size and style indicia may be hidden and the intermediate coating weakened somewhat by the pigment.

Whereas conventional spray lacquers may be employed, it is preferable to utilize a lacquer having certain contracting characteristics, because some of the surface irregularities of the wood may not be entirely hidden by the filler. In that event, the spray lacquer should penetrate and in part soften the intermediate coating, and should skin over and contract while the filler remains soft. Although an underplasticized high-viscosity (30 to 50 seconds) cellulose nitrate lacquer could be used, the coating would be very thin, hence I prefer to employ a mixture of cellulose nitrate and cellulose acetate.

For example, the spray lacquer could be made with a solid content by weight of twenty-five percent pigments, fifteen percent cellulose acetate, twenty-five percent nitrocellulose (medium viscosity type, such as five second or one-half second), twenty-five percent plasticizer and ten percent hard resin. Satisfactory plasticizers are Santicizer M-17 (methyl phthalyl ethyl glycolate), Aroclor 1254 (chlorinated biphenyl of fifty-four percent chlorine content by weight) and diethyl phthalate. The hard resin necessarily should be compatible with the cellulose acetate, but otherwise any suitable resin may be employed, such as the saturated or lacquer type Rezyls (polybasic acid-polyhydric alcohol resins), and Santolites (aryl sulfonamide-formaldehyde resins).

The thinner for the above may be made up with ten percent ethyl lactate, thirty percent acetone, forty percent methyl Cellosolve, ten percent alcohol and ten per-

6

cent toluene. The acetone is a lower boiler solvent for the cellulose acetate, which evaporates quickly so that the acetate dries rapidly and skins over while the underlying film remains relatively soft. Such an underplasticized film produces a tautening action, and since the other relatively high boiler solvents do not resoften the skin, the softened underlying portions of the film are leveled. In other words, the solvents control the tautening action, the adjustment being such that the coating does not pull or separate at the edges, yet is sufficient to properly level the finish. Necessarily, the solvents should in part penetrate and soften the intermediate coating, when the intermediate coating is to be leveled with a spray finish of this character. In spraying the heel, it may be impaled upon a vertical rod, which is then rotated while the spray gun is directed horizontally to cover the breast wall 7, sides 9 and back 11. Also, the final coating is sprayed relatively wet or heavy in order to achieve the desired leveling action and provide sufficient hiding power.

From the foregoing description, those skilled in the art will understand the function of the various steps and ingredients, and appreciate the advantages thereof. It is to be realized, however, that many modifications and variations will present themselves to those skilled in the art without departing from the spirit of this invention or the scope thereof as set forth in the appended claims.

Having thus described the invention, what is claimed and desired to be secured by Letters Patent is:

1. The process of finishing a wood core to form shoe heels and the like, comprising the steps of coating the core with a dilute solution whose major non-volatile constituents form a film of a tacky adhesive character, drying the core for a time sufficient to prevent lifting of the resulting film and without sanding the base coat, dip coating the core in a bath whose major non-volatile constituents are thermoplastic substances forming a relatively tough thick hard film, and thereafter spray coating the core with a solution whose non-volatile constituents include thermoplastic substances which differ in their reaction to solvents from that of the second coat, said spray solution including volatile components, one of which is a low boiler having relatively strong solvent action of said thermoplastic substance of the final coat in comparison with the thermoplastic substances of the intermediate coat and another of which is a relatively high-boiler having solvent action on the thermoplastic substances of said intermediate coat, thereby to produce a leveling action on the intermediate coat.

2. The process set forth in claim 1, wherein said intermediate coat is built up to a thickness of at least approximately ten thousandths of an inch.

3. The process set forth in claim 1, wherein the bath for said intermediate coat is a heated nitrocellulose solution, the room-temperature viscosity of which is approximately one hundred seconds (No. 4 Ford cup), and wherein the core is repeatedly upended by slow rotation within a heated zone after it emerges from said bath, the heat preventing premature solidification of the coating while the rotation causes the unsolidified portion to flow back and forth across the core and produce a gradual even build-up on the core without removal of excess solution.

4. The process set forth in claim 1, wherein said intermediate coat is applied by dipping within a solution, the solids non-volatile content of which is approximately one part nitrocellulose, one part chemical plasticizer and one part non-cellulose resin.

5. The process of finishing a wood core to form shoe heels and the like, comprising the steps of dipping the core within a dilute solution whose major non-volatile constituent is vinyl acetate, drying the core for at least two hours, and dipping the core within a second solution having a dipping viscosity of approximately forty seconds (No. 4 Ford cup) and whose major non-volatile con-

7

stituents are nitrocellulose, chemical plasticizer and a non-cellulose resin.

6. The process set forth in claim 5, wherein the dipping solution of nitrocellulose is about forty percent solids and the dipping temperature approximately 150° F., the core being repeatedly upended in a heated zone as it emerges from the heated solution, thereby delaying solidification of the solids while the unsolidified portion is caused to flow back and forth across the core.

7. In the process of applying a decorative coating to a wood core, the improvement comprises the steps of initially covering the entire core by dipping in a dilute solution whose major non-volatile constituent forms a film of tacky character, thereafter dipping the entire core within a substantially thicker solution whose major non-volatile constituents are thermoplastic substances of relatively harder and tougher character, said second dipping solution being free of undissolved components so as to provide a tough clear film and said second film being built to a thickness of at least approximately ten thousandths of an inch.

8. The process set forth in claim 7, further including a final step of spray coating the core with a solution one of whose major non-volatile components is a thermoplastic substance differing in its reaction to predetermined solvents from the thermoplastic substances of said intermediate coat, said spray solution further including volatile components, one of which is a low-boiler having relatively high solvent action upon the thermoplastic substance of the final coat in comparison with its solvent action on the thermoplastic substances of the intermediate coat, and another of which volatile components is a high boiler having significant solvent action on the thermoplastic substances of said intermediate coat, thereby to maintain the intermediate coat in a softened condition while the final coat solidifies upon evaporation of its low-boiler solvent and produce a leveling action by the tautening action of the final coat.

8

9. In the process of applying a decorative coating to a wood core, the improvement that comprises the step of dipping the core within a lacquer solution having a room-temperature viscosity of about one hundred seconds (No. 4 Ford cup), said solution being heated to a temperature such as to have a dipping viscosity of about forty seconds (No. 4 Ford cup), and passing the core into a heated zone after it emerges from said solution, thereby to delay solidification of the solids, and slowly rotating the core in said heated zone in such fashion as to upend it and cause the unsolidified portion of the coating to flow back and forth over the core so that there is an even gradual build-up of solidified coating composition.

10. The process of finishing a wood core to form shoe heels and the like, comprising the steps of first dipping the core within a solution whose major non-volatile constituents form a film of tacky adhesive character, drying the core for a time sufficient to prevent lifting of the resulting tacky base coat during subsequent dipping, and then dipping the core in a bath whose major non-volatile constituents are resins that form a relatively tough, hard and thick film in comparison with said base coat, said second film being built up to a thickness at least about ten-thousandths of an inch.

11. The process set forth in claim 10 wherein the initial coating is a non-aqueous solution of vinyl acetate.

References Cited in the file of this patent

UNITED STATES PATENTS

1,439,743	Mathes	Dec. 26, 1922
1,883,396	Moss	Oct. 18, 1932
2,106,940	Wood	Feb. 1, 1938
2,276,684	Bright	Mar. 17, 1942
2,322,048	Nadeau	June 15, 1943
2,699,750	Wittkuhns	June 18, 1955
2,772,986	Buck	Dec. 4, 1956
2,774,398	Morin	Dec. 18, 1956