

Aug. 18, 1964

J. S. KAMBORIAN ETAL
METHOD OF LASTING FOOTWEAR

3,144,670

Filed Jan. 5, 1961

2 Sheets-Sheet 1

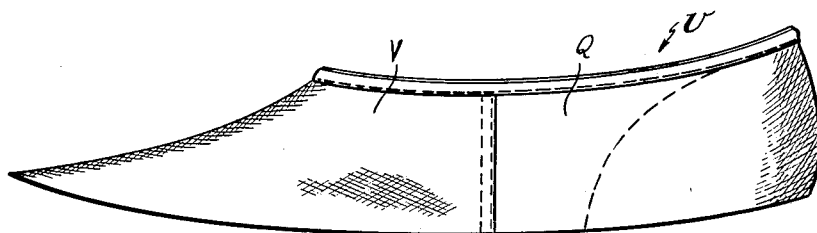


FIG. 1

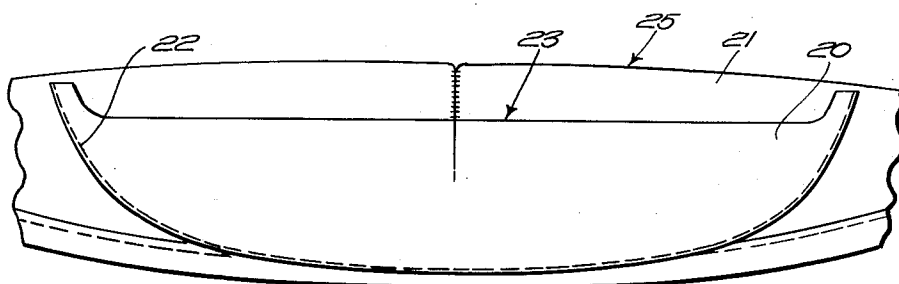


FIG. 2

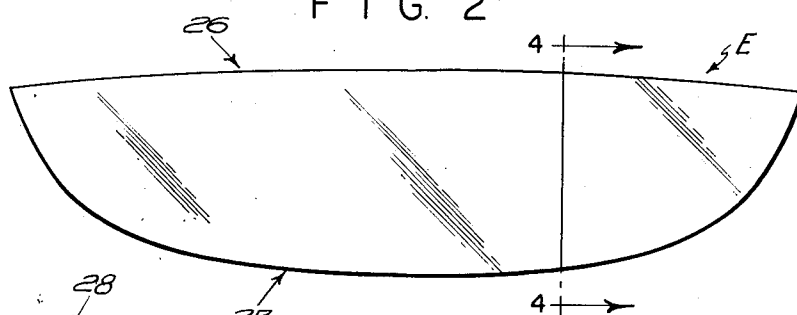


FIG. 3

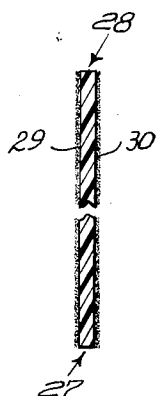


FIG. 4

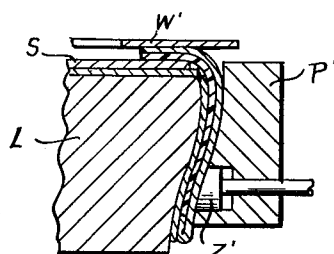


FIG. 9

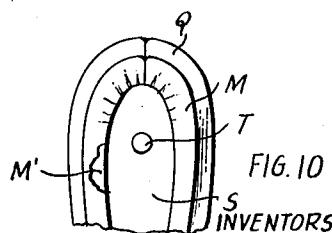


FIG. 10

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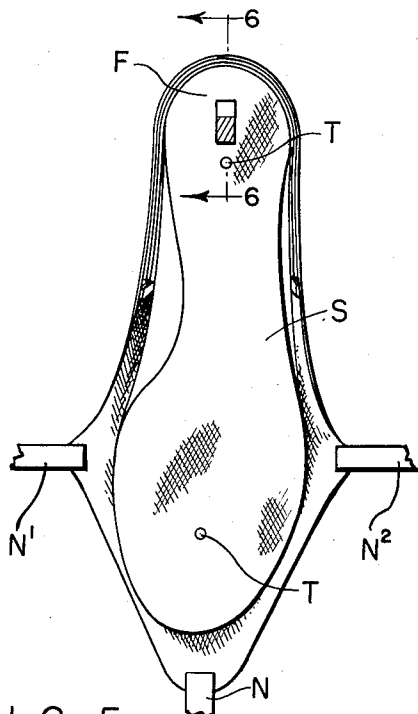


FIG. 5

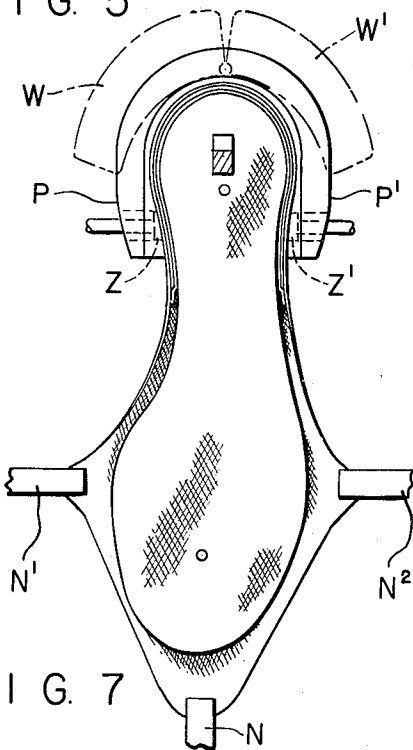


FIG. 7

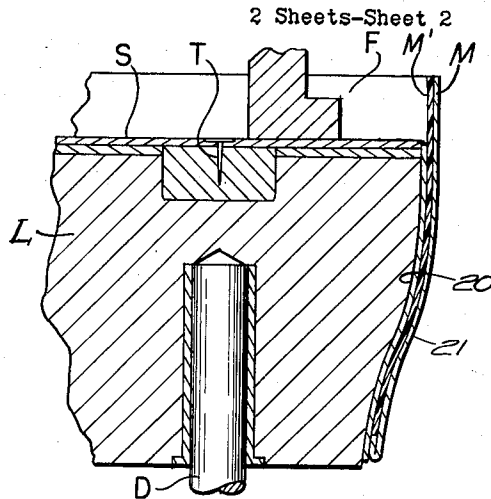


FIG. 6

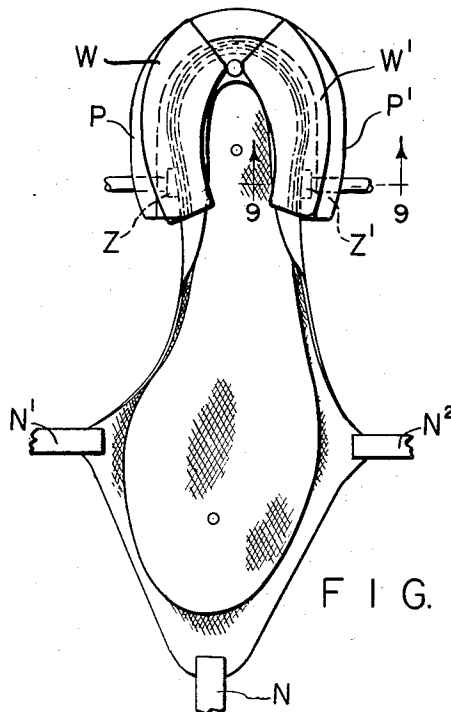


FIG. 8

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3,144,670

METHOD OF LASTING FOOTWEAR

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20 Claims. (Cl. 12-145)

This invention pertains to the manufacture of footwear and more particularly to an improved method of lasting, and to a novel shoe resultant from the practice of said method.

The shoe trade demands that as respects most boots or shoes (at least those intended for outdoor wear), the rear end portion of the upper be relatively stiff and shape-retaining, in order that it may properly hug the wearer's heel and, during wear, keep the shape and neat appearance imparted to it during lasting.

However, prior methods of imparting the requisite stiffness to the heel end or quarter portion of the upper have not been entirely satisfactory. One of the most common procedures is to employ a so-called "molded counter," usually of hard fiberboard or material having similar characteristics and which is premolded to approximately the shape of the heel end of a last before incorporating it in the shoe upper. The provision of such a molded counter involves an operation which is wholly independent of and additional to the lasting of the shoe; the introduction of such a premolded counter into a shoe upper of some types is difficult or even impossible. Further, since it is not practical to provided molded counters for each individual size or style of shoe, it is difficult, when using such counters, to make the quarter of the shoe conform to and retain the exact contour of the last upon which the shoe is made. Thus, shoes so made are often ill-fitting and cause discomfort to the wearer as well as having a poor appearance.

It has also been proposed to stiffen the quarter by the introduction of a substantially flat stiffener of sheet material into a pocket in the counter prior to lasting, such stiffening material, for example, being one which is normally stiff but which may be softened by treatment with a volatile solvent or the like. The stiffener of this type is softened just prior to lasting and, in lasting, is caused to take the shape of the last, but since the material does not, at once, resume its original stiffness, and since it is not practical to prolong the lasting operation until the solvent has evaporated completely so as to permit the stiffener to become hard and shape-retaining, the resultant shoe, when completed, seldom conforms exactly to the last upon which it was made. Stiffeners of sheet material, which are softened just before assembly with the upper are often of lamellar construction, comprising one or more plies of woven textile fabric, and thus have the further disadvantage that it is difficult, even when softened, because of the included fabric, to mold them to conform to the complex curvature of the heel end surface of the last. Moreover, if the stiffener include textile or similar material which is absorbent of moisture, the quarter of the shoe may absorb perspiration during use, resulting in softening and deterioration of the stiffener after a period of time, and the possible development of odor-producing bacteria.

It has also been proposed to introduce a moldable stiffener into the quarter portion of the upper and then subject the entire quarter to molding pressure, prior to assembling it with the insole on the last. This method also has the disadvantage that for accurate results it would require molds corresponding to various sizes and styles of shoe, which would be prohibitively expensive, and ob-

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viously it introduces a step, preliminary to lasting, which slows production and adds to the cost.

The present invention avoids such difficulties, as those above suggested, primarily by the employment of a material which, at the inception of the lasting of the quarter portion of the shoe, is readily moldable so that it may be conformed accurately to the complex curvature of the heel end of the last, but which, at the completion of the heel-seat lasting, is hard, stiff and shape-retaining. Preferably the material employed is in sheet form and at room temperatures hard and stiff, but such as becomes soft and moldable when heated to a predetermined temperature less than that which would injure the upper and which automatically and suddenly freezes or returns to its original hard and stiff condition when the temperature drops below that at which the material first softened. Desirably, the sheet material employed should be homogeneous and devoid of inclusions of textile threads or similar substantially inextensible elements, so that when the sheet is in moldable condition it is readily stretchable in any direction. While a preferred material is herein specifically described, it is to be understood that the stiffener may be made of any material having the above desired characteristics. One further important characteristic of the stiffener, which is employed in accordance with the present invention, is that when it is in moldable condition it should be sticky so as to adhere to other elements of the shoe when pressed into contact therewith. It is within the scope of the invention to employ as the stiffening element a sheet of material, for example, a thermoplastic resin, which, when heated to moldable temperature, not only becomes soft and moldable, but also itself becomes sticky. Alternatively, and as herein more specifically described and illustrated, the sheet material, while thermoplastic, does not itself become sticky when heated to the molding temperature, but to provide the desired adhesive characteristic is externally coated with a material which forms a good and permanent bond with the sheet itself and which becomes sticky at substantially the same temperature as that at which the thermoplastic sheet becomes moldable. According to this invention, this stiffener element is placed in a pocket provided in the quarter before assembling the upper with the insole and is then heated to molding temperature, and the lasting of the quarter and heel-seat is completed just as the stiffening material returns to the stiff condition.

As practiced, the invention provides an improved method of lasting footwear such that the number of operations is reduced; the time consumed in lasting is less; and a better shoe is produced than when customary prior practice is followed. In accordance with this method the heel end of the shoe is stiffened and completely lasted before the forepart and sides are lasted, the stiffening of the quarter being a concomitant to the lasting operation. Among other improvements, the novel method eliminates the usual step of driving one or more tacks into the rear end of the upper during the assembly operation. This not only reduces cost but also avoids disfiguring tack holes in the finished shoes. The invention further contemplates the assembly of the upper and insole with the stiffening material for the quarter and the heel-seat lasting all in a single operation, while also providing for adhesively bonding the lasting margin of the quarter to the insole, thereby eliminating the use of customary heel-lasting tacks and providing a smoother and more level heel-seat than when tacks are employed, and reducing the cost for material and labor. In accordance with the invention, the stiffening medium is itself directly bonded to the insole, thus supplying anchorage in addition to that provided by the lasting margin, for uniting the quarter to the bottom structure of the shoe.

In attaining these novel and desirable characteristics, the invention involves the use of an upper whose quarter portion has a liner defining a pocket for the reception of stiffener material; the introduction into said pocket of a stiffener which is normally stiff and shape-retaining, but which, when heated above a predetermined temperature, becomes moldable, although resuming its normal stiffness when cooled to a temperature below said prescribed temperature, the stiffening medium being placed in the pocket and then heated until it is moldable. The preferred stiffening medium is a piece of sheet material of such dimensions that, when placed in the pocket, one of its margins overlaps the lasting margin of the quarter, so that when, in lasting, the margin of the quarter is wiped-in over the inner sole, a marginal portion of the stiffener medium will likewise be wiped-in, so as to lie between the wiped-in quarter margin and the insole and, being adhesive, provides a bond for permanently uniting the in-wiped quarter margin and the insole. The invention further includes the assembly of the upper (with its included heated stiffener) with a last having an insole mounted thereon; the application of tensioning pull such as to draw the quarter portion of the upper about the heel end of the last; the application of pressure to the exterior of the quarter portion so as accurately to conform the quarter and the included stiffener to the contour of the last; the wiping-in of the lasting margin of the quarter over the insole while introducing some of the heated stiffening material between the lasting margin and the insole; and lowering the temperature of the stiffening material while the upper is being tensioned, subjected to pressure and wiped-in, whereby, at the completion of the wiping-in step, the stiffening material has become stiff so as to retain the shape which was imparted to it while it was moldable and adhesively bonds together the quarter and quarter lining and the lasting margin and the insole.

Other objects and advantages of the invention will be pointed out in the following more detailed description and by reference to the accompanying drawings wherein:

FIG. 1 is a side elevation of a conventional shoe upper in readiness for lasting in accordance with the present invention;

FIG. 2 is a fragmentary elevation illustrating the interior of the quarter portion only of the shoe upper and showing a lining element which, together with the outer ply of the quarter, defines a pocket for the reception of a stiffener element;

FIG. 3 is a plan view of a stiffener element such as may be employed according to the present invention;

FIG. 4 is a section to larger scale on the line 4—4 of FIG. 3;

FIG. 5 is a diagrammatic plan view showing an insole mounted upon the bottom of an inverted last, with the upper assembled with the last and insole (but not tacked to the last), and nipper devices whereby tension may be applied to the toe and forepart portions of the upper for drawing the quarter portion of the upper snugly about the heel end of the last;

FIG. 6 is a fragmentary section on the line 6—6 of FIG. 5, showing the relative arrangement of the outer ply of the quarter, the stiffener element and the quarter lining when assembled, as shown in FIG. 5;

FIG. 7 is a view similar to FIG. 5, showing pressure-applying elements which have been moved relatively to the assembled upper and last so as to apply pressure to the outer surface of the quarter such as accurately and closely to conform its constituent parts, including the stiffener, to the contour of the last;

FIG. 8 is a view similar to FIG. 7, but illustrating a later step of the operation which consists in wiping-in the lasting margin of the quarter and that margin of the stiffener which initially extends above the level of the insole;

FIG. 9 is a fragmentary diagrammatic section on the line 9—9 of FIG. 8; and

FIG. 10 is a fragmentary plan view, showing the heel-seat of the shoe after lasting, according to the present invention.

Referring to the drawings, the character U (FIG. 1) designates a shoe upper which may be of any conventional type or style, but which, as illustrated, comprises the quarter portion Q and the vamp portion V. In FIG. 2, wherein the interior of the quarter portion is shown, the numeral 20 designates a lining element of any material appropriate for the purpose. This liner 20 is united to the outer ply 21 of the quarter by a seam 22 which extends along that edge of the quarter which, in the completed shoe, is at the top and along the opposite ends of the liner 20, but leaves the lower edge, as 23 of the liner (the upper edge shown in FIG. 2), free from the outer ply 21 of the quarter, whereby said outer ply and the liner define between them a pocket for the reception of a stiffener element. As shown, the edge 23 is spaced below the edge 25 of the quarter, that portion of the quarter which is shown exposed (FIG. 2) above the edge 23 of the liner constituting the lasting margin of the quarter. The pocket, between the outer ply of the quarter and the lining is of a shape and dimension to receive a stiffener element such, for example, as illustrated at E (FIG. 3). This stiffener element, as here shown, has a substantially straight edge 26 designed to register approximately with the edge 25 of the quarter and an edge 27 which corresponds in contour to that of the seam 22.

The specific characteristics of the material constituting the stiffener element are of primary importance in the practice of the present invention. Referring to FIG. 4, the numeral 28 designates a homogeneous sheet of resinous material which, at normal temperatures, is hard and stiff. In order to function in accordance with the present invention, this material should be thermoplastic and become flaccid and moldable when heated to a predetermined temperature, but should be such as to resume its initial stiffness, quite suddenly, when the temperature drops, even to a small amount, below that at which the material first becomes moldable.

One material which possesses the above characteristics is so-called High Impact Polystyrene which is polystyrene modified by the incorporation of a material, for example rubber, such as to reduce its normal brittleness. Polystyrenes of this type are well-known and commercially available. Reference to material of this type under the name of "Impact Type Polystyrene" may be found on page 155 of Modern Plastics for September 1959, published by Breskin Publications, Bristol, Connecticut. Such materials have an impact strength of from 0.5–11.0 according to the standard A.S.T.M. method of testing and a flexural strength of the order of 5,000–10,000 p.s.i. The particular material recommended for the present use, at room temperatures, has a Rockwell hardness of the order of M35–70, but is moldable within a temperature range of from 180° F. to 295° F., and when moldable, is easily stretchable in any direction. However, after heating to moldable condition, when the temperature again drops to 180° F. it reverts almost instantly to its initial stiffness and hardness so as to retain any shape which may have been imparted while it was in moldable condition. Care should be taken to avoid heating the material above substantially 295° F. since excessive heating may adversely affect the adjacent materials in the shoe.

For use in the practice of the present invention, the material is employed in sheet form, the thickness of the sheet to be used being determined in accordance with the degree of stiffness desired. A range of from 0.010 to 0.040" appears to cover most requirements and, in fact, a range of from 0.020" to 0.025" is sufficient for most ordinary footwear.

The above sheet material is not appreciably tacky or

adhesive within the above temperature range. However, it is desirable, in accordance with the present invention, that the stiffener constitute a binder for uniting certain of the shoe parts and accordingly the sheet material is coated, preferably on both sides, with a substance which does become temporarily sticky when heated to a temperature within the above range. For specific example, such a material may be prepared by mixing certain available plastics in substantial accordance with the following table:

Percent by Weight	Material	Source
52-----	Piccolastic E100-----	Pennsylvania Industrial Chemical Corp.
29-----	Piccolastic A5-----	Do.
5-----	Paraffint RG-----	Moore & Munger.
14-----	Pliolite VTL-X-----	Goodyear Tire & Rubber Co.

The above constituents are melted and thoroughly mixed and then applied in molten condition, as a coating to the polystyrene sheet material 28, as shown at 29 and 30 (FIG. 4), this coating setting and becoming dry and hard when cool and adhering firmly to the polystyrene sheet without cracking or flaking off, even when the sheet is bent. In this condition the coated stiffening material may be die-cut to the desired shape, as illustrated, for example, to form the stiffener E (FIG. 4). When the stiffener, thus prepared, is heated to a temperature within the above range, the coating material becomes sticky at substantially the same temperature at which the polystyrene becomes moldable and constitutes effective means for bonding the polystyrene to adjacent parts.

It should be noted that the stiffener thus provided, except for its coating of adhesive, is a homogeneous sheet of plastic and devoid of any inclusions of textile fiber or other elements which would interfere with its being stretched in any direction while in moldable condition or which would be absorbent of moisture when incorporated in a shoe.

Assuming that a last L (FIGS. 5 and 6) of suitable size and style has been prepared by securing an insole S, as by means of tacks T, to its bottom surface, as is common in the customary assembly operation; that a shoe upper U has been provided having an interior pocket at its quarter portion; and that a stiffener E of appropriate shape and size has been prepared, as above suggested, the operator places the stiffener in the pocket of the quarter and then, by applying heat, raises the temperature of the stiffener to the point at which it becomes moldable; this temperature, for the above-described materials, is quite sharply defined and critical. However, to provide the requisite time for performing the succeeding operations the temperature may be raised above this point, for example, to approximately 290° F. The operator now takes the upper in one hand and the last in the other (according to customary assembly practice) and slips the heel end of the last into the quarter portion of the upper, adjusting the rear end of the upper relatively to the last, as is customary in the assembly operation, until the longitudinal axis of the upper coincides, as nearly as may be, as experience dictates, with the longitudinal axis of the last. Then, still holding the last and upper by hand in this relatively adjusted position, the operator places the last upon a suitable support, for example, a last spindle D (FIG. 6) of customary type and causes pulling force to be applied to the margin of the forepart portion of the upper, for example, by means of nippers (of which three, N, N' and N² are here illustrated) which may be, for example, generally similar to those commonly used in the pulling-over operation, the force first being directed forwardly so as to remove wrinkles in the upper and to strain the quarter portion of the upper snugly about the heel of the last and to initiate the moulding of the stiffener to the con-

tour of the last. The last is then moved relatively to a hold-down foot F, or equivalent device, thereby to clamp the last firmly to the spindle and then the nippers are moved in a direction such as to draw the upper snugly about the forepart portion of the last, and adjust the top edge of the upper relatively to the last. Then a U-shaped pressure-applying pad, having the arms P and P' (FIG. 5) (which may be similar to those commonly used in the customary heel-lasting operation) is moved relatively to the last (with the upper mounted thereon), so as to press and conform the quarter (with its included stiffener in moldable condition) closely to the exterior rear surface of the last. To insure such conformation of the upper to the neck portion of the last (that is to say, the upper part of the heel end of the last), which is relatively narrow transversely, as compared with the lower part of the last and whose outer surface is usually somewhat concave, the present invention contemplates applying pressure independently to that part of the quarter which embraces the neck portion of the last as, for example, by means of one or more auxiliary pads Z and Z' (FIGS. 5, 8 and 9), carried, for example, by plungers slidable, for instance, in bearing bores in the pads P and P' and which are actuated, either simultaneously with the advance of the pads P and P', or subsequently thereto by the application of force to said plungers in any convenient way. Immediately following the application of the compressive force by the pads and while the upper is still held under tension by the nippers, wiping devices W and W' (FIG. 8), which may be of the general type employed in end lasting, are moved relatively to the last so as to wipe the lasting margin M (FIG. 6) of the quarter and, concomitantly therewith, the upper margin M' of the stiffener E, over onto the heel end portion of the insole. Remembering that the surfaces of the stiffener E are at this time adhesive, it is apparent that during the application of compressive force by the pads and the turning of the lasting margin of the quarter over onto the insole, the stiffener E will adhere both to the inner surface of the ply 21 of the quarter and to the liner 20, thus bonding these parts firmly together, and further, that the wiping-in of the upper margin M' of the stiffener over onto the insole S introduces (between the insole and the lasting margin of the quarter), an adhesive bonding medium which becomes very effective, as the adhesive sets, firmly to unite the lasting margin M of the quarter to the insole S. Since the wipers are unheated, that is to say at a temperature less than that at which the heated stiffener material resumes its original stiffness, the wiping action results in so cooling the stiffener and the adhesive that it sets before wiping is complete.

As already pointed out, the stiffener itself is of a material which, after having been heated to moldable condition sets and resumes its initial stiffness suddenly when the temperature drops below that at which the stiffener first becomes moldable, for instance within a few seconds.

By employing a stiffening medium having the characteristics above described, and an adhesive of the composition suggested, and assuming that the stiffener, after introduction into the quarter pocket, is now heated to a temperature within the predetermined range, it is readily possible to carry out the above-described steps of assembling, tensioning, compressing, and wiping, within a period, for example, about 20 seconds, such that the wiping is completed just before the temperature of the stiffener reaches the "freezing point," that is to say, suddenly becomes stiff, with the result that immediately after the completion of wiping, the quarter portion of the shoe is hard and shape-retaining, the adhesive coating is set and has bonded together the outer ply of the quarter and its liner, and the lasted-in margin of the quarter is securely and firmly bonded to the insole, so that the stiffening and lasting, including the heel-seat lasting of

the quarter has thus been accomplished in a single operation and without necessitating the driving of a tack or tacks into the back of the shoe upper or the use of tacks in the heel-seat lasting, the elimination of the heel-seat tacks resulting in a smoother and more level heel-seat than usual. Now, the wipers W, W', the pressure pads P, P', and the auxiliary pads Z, Z' may be retracted, the nippers N, N' and N² opened to release the upper and the spindle D and foot F so relatively moved as to permit removal of the last with the shoe from the spindle. The shoe, with its heel end portion completely lasted and stiffened and with its upper accurately assembled with and bonded to the insole is now ready for toe and forepart lasting according to any desired procedure.

While, as above described, the desired adhesive characteristic of the stiffener is obtained by coating the sheet material with a suitable adhesive substance, it is contemplated, as already suggested, that a sheet material having the requisite normal stiffness and which reverts suddenly from the moldable state to the stiff state, in response to temperature drop, may become available which, itself, becomes sticky at the molding temperature, and it is to be understood that the use of such a material in the practice of the present process is within the purview of the invention. It is also obvious that stiffening material, such as above described, may be employed for stiffening other portions of the shoe upper, for example the toe end of the upper and, when so employed, may be introduced into the upper and treated in a manner which is the full equivalent of the procedure above described.

It is further to be understood that, in its broader aspects, the invention contemplates the provision of adhesive for bonding the lasting margin of the quarter to the insole other than by the introduction of an integral portion of the quarter stiffener itself between the insole and lasting margin, for example, by inserting a piece of adhesive material, independent of the stiffener element, but of the horse-shoe shape of the wiped-in margin of the stiffener element, as above described, between the lasting margin and insole just before the inception of in-wiping.

While herein certain specific materials, temperatures, dimensions and process steps have been referred to by way of example, it is to be understood that such references are merely intended as illustrative of a practical method and that the invention is inclusive of any and all modifications as fall within the terms of the appended claims.

We claim:

1. That method of making shoes which comprises as steps: assembling with the quarter portion of a shoe upper a normally hard, stiffening sheet of thermoplastic material, applying heat to reduce the stiffening material to a soft, moldable condition, introducing the heel end of a last having an insole attached thereto into the quarter portion of the upper, applying stress such as to strain the quarter portion of the upper about the heel end of the last and conform it closely to the contour of the last and, while maintaining such conforming stress, wiping-in the lasting margin of the quarter portion together with a margin of the stiffening sheet, over onto the insole and continuing to maintain said conforming stress and holding said margin in wiped-in position until the stiffening sheet has cooled sufficiently to resume its initial hardness.

2. That method of making foot wear which comprises as a preliminary step: providing the quarter portion of an upper with an interior lining as to define a pocket, and inserting within said pocket, prior to the application of conforming stress, a normally hard and stiff stiffening medium which, while in said pocket and prior to the application of conforming stress, is caused to become flaccid and capable of bending in all directions, but which, while said conforming stress is maintained, automatically becomes permanently stiff and shape-retaining.

3. That method of imparting permanent shape-retaining stiffness to the quarter portion of a shoe thereby to

impart permanent shape-retaining stiffness to the quarter portion of the upper while maintaining said quarter portion under longitudinal stress such as to strain it about and conform it to the contour of the heel end of a last having an insole assembled therewith, which comprises as steps: so providing the quarter portion of the upper with a lining as to define a pocket, inserting within said pocket, prior to the application of conforming stress, a stiffener comprising thermoplastic sheet material which is normally stiff, but is moldable above a predetermined temperature, heating said stiffener, to a temperature above that at which it becomes moldable, after it has been inserted in the pocket, and during the maintenance of the conforming stress, permitting the temperature to drop below the temperature at which the stiffener is moldable, whereby said stiffener automatically becomes stiff and operative permanently to maintain the quarter in that shape which is imparted to it by said conforming stress.

4. That method according to claim 3, further characterized in that in placing the stiffener within the pocket in the quarter a margin of the stiffener is arranged to extend above the level of the insole and, while so tensioning the quarter portion of the upper as to conform it to the heel end of the last, the heel seat is lasted in by the use of unheated wipers, thereby concomitantly turning the lasting margin of the quarter and the projecting margin of the stiffener inwardly over the insole while reducing the temperature of the stiffener so that it suddenly sets and retains its lasted-in shape.

5. The method according to claim 3, wherein the stiffener is of a kind such that its opposite faces become temporarily sticky when the stiffener is heated to moldable condition, whereby, during the in-wiping of the lasting margin of the quarter portion, the stiffener is effective so permanently to bond together the quarter and quarter lining as to prevent relative movement of said parts and permanently to unite the lasting margin of the quarter to the insole.

6. That method of lasting the quarter portion of a shoe while concomitantly stiffening it, which comprises as steps: assembling a shoe upper with an insole mounted on a last, the upper having interposed between the outer ply and lining of the quarter a piece of sheet plastic of a shape proper to constitute a quarter stiffener, the piece of plastic being normally stiff, but, after its introduction, becoming flaccid and sticky at its opposite faces, and stretchable, and having a margin which extends upwardly, approximately as high as the lasting margin of the quarter, applying tensioning stress to the toe portion of the upper thereby to tension the quarter portion tightly about the rear end of the last, applying external pressure to the rear of the quarter thereby to conform it, together with the included plastic material, accurately to the contour of the quarter portion of the last, wiping-in the lasting margin of the plastic material and maintaining said tensioning stress until the lasting margin of the plastic material has cooled sufficiently to become stiff and shape-retaining, whereby said plastic permanently retains the shape which has been imparted to the quarter portion of the upper and bonds together the outterply and lining of the quarter.

7. That method of making a shoe having a stiffened quarter portion which comprises as steps: providing a last with an insole mounted thereon, providing an upper whose quarter portion has a lining defining a pocket for the reception of stiffening material, inserting within said pocket a stiffener comprising a homogeneous sheet of synthetic resin which is normally hard and stiff, but which is thermoplastic above a predetermined temperature and which, above said temperature, is freely stretchable in all directions, but suddenly resumes its normal stiff condition when cooled below said temperature, the stiffener being heated to said temperature after insertion in said pocket, loosely assembling the upper with the last, mounting the last upon a support, centering the upper relatively

to the last, and applying tensioning stress to the toe end of the upper such as to draw the quarter portion of the upper snugly about and conform it to the heel end of the last, applying external pressure to the quarter, thereby additionally to conform it, together with the stiffener to the contour of the last, and heel-seat lasting the quarter by means of unheated wipers, and while maintaining said conforming stress simultaneously wiping-in the lasting margin of the quarter and the lower margin of the stiffener over the insole and cooling the stiffener below that temperature at which it is moldable.

8. That method of making shoes which comprises as steps: providing a shoe upper having a pocket for stiffening material in its quarter portion, providing a normally hard, thermoplastic stiffener, placing the stiffener within said pocket and heating said stiffener to make it flaccid and, while the stiffener is still hot and flaccid, assembling the upper with an insole upon a last and conforming the quarter portion of the upper, by the application of tensioning stress and pressure, to the heel end of the last while concomitantly wiping the lasting margin of the upper over onto the insole, bonding the stiffening material to the upper, and exposing the stiffening material to a temperature such that it reverts to its normal hardness and becomes permanently shape-retaining.

9. That method of lasting an end of a shoe which comprises, providing a shoe upper having assembled therewith an end stiffener which has been heated to a temperature such that it has become flaccid, said stiffener comprising material that is rigid at ambient temperature, becomes flaccid and moldable within a range above a definite predetermined temperature but reverses to its rigid state when cooled below said predetermined temperature, assembling the upper, including its heated stiffener, with a last having an insole mounted thereon, applying such stress to the upper as to cause that end of the upper, with which the stiffener is associated, to conform tightly to the corresponding end of the last and thereby concomitantly molding the stiffener to the shape of said end of the last, inwiping the margin of the upper over the insole while maintaining said conforming stress and only after completion of the inwiping operation and after the stiffener has cooled below said predetermined temperature, releasing the conforming stress on the upper.

10. The method according to claim 9, wherein the upper comprises a liner at that end with which the stiffener is associated, said liner being so united to the upper proper as to form the inner wall of a pocket for the reception of a stiffener, the lower edge of said wall being free from the upper, proper, and being spaced from the lower edge of the upper a distance substantially equal to the width of the lasting margin of the upper and the stiffener being of such dimensions that, when installed in the pocket, its lower edge substantially registers with the lower edge of the upper, proper, whereby the stiffener has an exposed marginal portion substantially coextensive with the lasting margin of the upper, and wherein the inner face of the exposed portion, at least, of the stiffener is adhesive, further characterized in inwiping said exposed marginal portion of the stiffener over the insole, concomitantly with the inwiping of the lasting margin, thereby adhesively bonding the stiffener directly to the insole.

11. The method according to claim 9, wherein the end stiffener consists of homogeneous sheet thermoplastic synthetic resin which, at normal temperature is stiff and of a Rockwell hardness of the order of M35-70, but which is moldable within a temperature range of from 180° F. to 295° F. and, when moldable, is easily stretchable in any direction but which reverts to its initial stiffness and hardness when the temperature again drops to approximately 180° F.

12. The method according to claim 9, and wherein both faces of the lower margin, at least, of the heated stiffener are adhesive, and wherein, after the upper has been assembled with the last, said lower margin of the

stiffener projects beyond the bottom of the last, further characterized in that, while inwiping the margin of the upper, said adhesive margin of the stiffener is so wiped in over the insole as to be interposed between the insole and the lasting margin of the upper whereby both upper and stiffener are bonded to the insole.

13. The method according to claim 10, wherein the pocket for the reception of the stiffener is at the heel end of the upper and wherein each of the opposite faces of the stiffener is adhesive at temperatures above said predetermined temperature, and wherein, after the upper has been assembled with the last, the lasting margin of the upper and the exposed marginal portion of the stiffener both project beyond the last bottom, further characterized in applying tensioning stress to the forepart portion of the upper such as to pull the upper forwardly while concomitantly applying compressive stress to the exterior surface of the quarter portion of the upper thereby conforming the stiffener to the shape of the heel end of the last and concomitantly adhesively bonding the stiffener to the upper proper and to the inner wall of the pocket.

14. The method according to claim 10, further characterized in applying forward pulling stress to the toe portion of the upper while holding the last in fixed position and then applying upward tensioning stress to the toe portion of the upper and maintaining said applied stresses while inlasting the margin of the upper and the exposed portion of the stiffener at the heel end of the upper.

15. That method of lasting an end of a shoe which comprises as steps: providing a shoe upper having an end stiffener assembled with the upper at the interior of that end which is to be stiffened, said stiffener being comprised of a material that is convertible from a flaccid, moldable state to a rigid state; mounting the assembled upper and stiffener on a last having an insole positioned on its bottom with the margin of the upper projecting from the last bottom and with the stiffener in its flaccid state; causing at least one stressing instrumentality to apply force to the upper so as to cause the upper to conform tightly to said end of the last thereby molding the stiffener to the shape of said end of the last; causing a wiping instrumentality to wipe the margin of the upper inwardly over the insole while said stressing instrumentality maintains the conforming stress; and causing said stressing instrumentality to relax its stress on the upper subsequent to the inwiping operation, but only after the stiffener has been converted to its rigid state.

16. That method of lasting the end of a shoe which comprises as steps: providing a shoe upper having an end stiffener assembled with the upper at the interior of that end which is to be stiffened, said stiffener having been heated above a definite predetermined temperature, the stiffener being of a material which is rigid at ambient temperature, becomes flaccid and moldable when heated above said predetermined temperature and reverts to its rigid state when again cooled to ambient temperature; mounting the assembled upper and stiffener on a last having an insole positioned on its bottom with the margin of the upper projecting from the last bottom; causing at least one stressing instrumentality to apply stress to the upper thereby to conform the latter tightly to said end of the last and thereby concomitantly molding the stiffener to the shape of said end of the last; causing wiping instrumentalities to wipe the margin of the upper inwardly over onto the insole while said stressing instrumentality maintains said conforming stress; and causing the stressing instrumentality to release the conforming stress upon the upper subsequent to the completion of the inwiping operation but only after the stiffener has cooled sufficiently to revert to its rigid state.

17. That method of lasting an end of a shoe which comprises as steps: providing a shoe upper having assembled therewith an end stiffener which has been heated above a predetermined temperature, said stiffener being of a homogeneous sheet material that is rigid at ambient

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temperature, becomes flaccid and moldable when heated above said predetermined temperature and reverts to its rigid state while cooling to ambient temperature; mounting the upper and stiffener upon a last having an insole positioned on its bottom with the lower margins of the upper and stiffener projecting away from the last bottom; providing adhesive on both sides of the projecting margin of the stiffener; applying stress to the upper to cause the upper to conform tightly to said end of the last and thereby molding the stiffener to the shape of said end of the last; wiping the margins of the upper and stiffener inwardly over the insole while maintaining said conforming stress undiminished, thereby pressing the margins of the upper and stiffener against the insole and adhesively bonding both the insole and upper to the stiffener; and only relaxing the conforming stress on the upper after completion of the inwiping operation and after the stiffener has cooled sufficiently to revert to its rigid state.

18. That method of lasting an end to a shoe which comprises as steps: providing a shoe upper having a liner so arranged within one of its ends as to form a stiffener-receiving pocket whose lower edge is spaced from the lower edge of the upper a distance which approximates the width of the lasting margin of the upper, inserting a stiffener sheet within said pocket, the stiffener sheet being of a width such that, when disposed within the pocket, one portion of the sheet is concealed within the pocket while another portion of the sheet projects from the pocket so as to be exposed at the inner side of the lasting margin, said stiffener sheet being of a material that is rigid at ambient temperature, becomes flaccid when heated above a predetermined temperature and reverts to its rigid state in cooling to ambient temperature, and having surfaces which are adhesive above said predetermined temperature; heating said stiffener sheet while within the pocket above said predetermined temperature; mounting the upper and stiffener sheet upon a last having an insole positioned on its bottom with the lasting margin of the upper and the exposed portion of the stiffener sheet projecting away from the last bottom; applying stress to the upper to cause the upper to conform tightly to said end of the last and thereby concomitantly molding the stiffener sheet to the shape of said end of the last; wiping the lasting margin of the upper and the exposed portion of the stiffener sheet inwardly over the insole while maintaining said conforming stress, thereby to fold said lasting margin and exposed portion of the stiffener sheet down against the insole and concomitantly therewith adhesively bonding both the insole and upper to the stiffener sheet; and only releasing the conforming stress on the upper after completion of the inwiping operation and after the stiffener sheet has cooled sufficiently to revert to its rigid state.

19. That method of heel seat lasting which comprises as steps: providing a shoe upper having an attached liner within its heel end to form a pocket whose lower edge is spaced from the lower edge of the upper by an amount which corresponds to the width of the lasting margin of the upper; inserting a counter-stiffener sheet in the pocket with the lower end of the counter-sheet substantially in registry with the lower edge of the upper so that the counter-sheet has an exposed portion projecting out of the pocket which is coextensive with the lasting margin of the upper and a concealed portion lying within the pocket, said counter-sheet being of a material that is rigid at ambient temperature, becomes flaccid when heated above a predetermined temperature and reverts to its rigid state when again cooled to ambient temperature, said counter-sheet having inwardly and outwardly facing

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surfaces which are adhesive above said predetermined temperature; heating said counter-sheet above said predetermined temperature; mounting the upper with its counter-sheet upon a last having an insole positioned upon its bottom and with the lasting margin of the upper and the exposed portion of the counter-sheet projecting away from the last bottom; gripping the toe portion of the upper and applying a pulling stress thereto away from the heel of the last; applying a compressive stress against the heel end of the upper; said stresses serving to cause the heel end of the upper to conform tightly to the heel of the last thereby molding the counter-sheet to the shape of the heel of the last; wiping the lasting margin of the upper and the exposed portion of the counter-sheet inwardly over the insole while maintaining said stresses thereby to fold said lasting margin and exposed portion of the stiffener sheet against the insole and adhesively to bond both the insole and upper to the counter-sheet; and only releasing said stresses subsequent to the inwiping operation, and only after the counter-sheet has cooled sufficiently to revert to its rigid state.

20. That method of heel seat lasting which comprises as steps: providing a shoe upper having an attached liner within its heel end so as to form a pocket which has its lower edge spaced from the lower edge of the upper by an amount which corresponds to the width of the lasting margin of the upper; disposing a counter-sheet within the pocket with the lower end of the counter-sheet substantially in registry with the lower edge of the upper whereby the counter-sheet has an exposed portion projecting out of the pocket which is coextensive with the lasting margin of the upper and a concealed portion within the pocket, said counter-sheet being of a material which is rigid at ambient temperature, becomes flaccid when heated above a predetermined temperature and reverts to its rigid state when again cooled to ambient temperature, said counter-sheet having inwardly and outwardly facing surfaces which are adhesively above said predetermined temperature; heating said counter-sheet above said predetermined temperature; mounting the upper and counter-sheet upon a last supported bottom-up and having an insole positioned on its bottom with the lasting margin of the upper and the exposed portion of the counter-sheet projecting upwardly and away from the last bottom; gripping the toe portion of the upper and applying a forward pulling stress thereto away from the heel of the last; clamping the last against movement; applying an upward stress to the gripped portions of the upper; applying a compressive stress against the heel portion of the upper; wiping the lasting margin of the upper and the exposed portion of the counter-sheet inwardly over the insole while maintaining said stresses, to fold said lasting margin and exposed portion against the insole and adhesively to bond both the insole and upper to the counter-sheet; and releasing said stresses subsequent to the inwiping operation and only after the counter-sheet has cooled sufficiently to revert to its rigid state.

References Cited in the file of this patent

UNITED STATES PATENTS

1,389,678	McFeely	Sept. 6, 1921
2,062,528	Roeder	Dec. 1, 1936
2,333,708	Cushman et al.	Nov. 9, 1943
2,521,981	Kneeland	Sept. 12, 1950
2,684,540	Levy	July 27, 1954
2,723,468	Marcy	Nov. 15, 1955
2,885,699	Ronza	May 12, 1959
2,946,141	Hirlihy	July 26, 1960
2,969,555	Kamborian	Jan. 31, 1961