SHOE MAKING BY MOLDING WITH AN ADHESIVE


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16 Claims

ABSTRACT OF THE DISCLOSURE

A shoemaking process in which plastic material is molded directly onto the bottom of a shoe and the union between the molded-on material and the shoe is improved by disposing a very thin sheet of heat-activatable adhesive on the attaching surface of the shoe before the molding material is formed. The heat of the molding material activates the adhesive to improve the union of the molding material to the shoe.

FIELD OF THE INVENTION

This invention relates to an improvement in direct molding of shoe soles onto shoes and particularly to a shoemaking process in which the strength of bond between the sole material and the shoe is improved.

An increasingly important method for making footwear is the direct molding of plastic material onto the bottom of a shoe upper. This process offers the advantage that the sole is formed with an attaching surface directly complementary to the bottom of the shoe upper at the same time that it is joined to the shoe upper. With many shoe upper materials the union between the shoe upper and the molded-on sole is not sufficiently strong. To overcome this weakness, adhesive or primer solutions have been applied to the bottom of the shoe upper before molding on the sole. Although this improves the union between the sole and shoe upper, it is a time consuming operation both in the application of the material and in the time required for drying of the primer or adhesive. Also, particularly with shoe constructions in which the sole material comes well up at the sides of the shoe upper, there have been difficulties in applying the primer or adhesive far enough up the side of the shoe upper to insure adhesion without getting primer or adhesive on portions of the shoe upper which will be exposed in the final shoe.

It is an object of the present invention to provide a shoemaking process for direct molding of soles to shoes in which the delays and difficulties of applying primer or adhesive are avoided and a superior union of the molded-on sole to the shoe is obtained.

To this end and in accordance with a feature of the present invention, a thin sheet of heat-activatable adhesive is disposed on the attaching surface of a shoe and hot plastic sole forming material is molded against the bottom of the shoe to activate the adhesive and establish a firm bond between the molded-on sole and the attaching surface of the shoe.

An improvement of a shoe and a direct molded-on sole is secured according to the present invention through action on a thin adhesive sheet by hot sole-forming material forced into the mold for forming the sole. The hot sole-forming material moves along the attaching surface of the shoe in contact with the adhesive sheet held on that surface and both heats the adhesive to an activable state and brings the activated adhesive into wetting engagement with the attaching surface to provide adhesion to that surface. When the sole-forming material and the adhesive are cooled and hardened, the sole is joined firmly to the shoe.

The invention will be described in conjunction with the accompanying drawings forming part of the disclosure.

In the drawings,

FIG. 1 is a plan view on a reduced scale of an unlasted shoe upper of the string lasted type showing an adhesive sheet in the form of a web of adhesive fibers secured to the shoe upper;

FIG. 2 is an elevational view of the shoe upper of FIG. 1 in string lasted condition with edge portions of the sheet adhesive projecting outwardly and showing the preheating of the shoe bottom and web material; FIG. 3 is an elevational view on a larger scale with parts broken away of the last shoe upper of FIG. 2 assembled against a sole-forming mold with portions of the sheet adhesive projecting past the joint between the shoe upper and the mold;

FIG. 4 is an angular view of a shoe upper with a sole molded thereon showing the removal of projecting adhesive sheet;

FIG. 5 is a section of a portion of a completed shoe taken on the line V—V of FIG. 3 in the plane of the junction between the sole and the shoe upper and showing the distribution of the adhesive in the finished shoe;

FIG. 6 is a bottom view of a cement lasted shoe on a last showing an adhesive sheet secured to the bottom of the shoe upper with its edges projecting past the edges of the attaching surface of the shoe; and

FIG. 7 is a bottom view of a shoe upper showing a composite unit including adhesive sheet secured to the bottom of the shoe.

Successful operation of the present method calls for holding a thermoplastic adhesive sheet 10 such as a web of adhesive fibers, close to the attaching surface 12 of a shoe 14 during the step of introducing hot sole-forming material to mold it against the attaching surface of the shoe. The adhesive sheet may be secured in any suitable manner e.g. adhesively or mechanically and different shoe constructions provide opportunities for specially advantageous means of securing it. For joining an adhesive fiber web 10 to a shoe 14 of the string lasted type, the web 10 may be stitched in place by the stitching 16 which provides a loop for the lasting string 18 as shown in FIG. 1. In a modification, not shown, an inextensible reinforcement may be secured to the web, preferably adjacent one edge to aid in uniform feeding of the web for stitching to provide uniform density of adhesive along the attaching surface. The adhesive fiber web 10 is of very open construction so that when such a shoe 14 is placed on a last 20 and lasted by tightening the lasting string 18, the web 10 can compress or extend in the plane of the web to remain flat and does not interfere with the lasting operation.

An adhesive sheet 10 useful in the method of the present invention may be a network of very small cross section elements such as fine fibers or filaments 22 of thermoplastic adhesive material with substantial open spaces between the elements. The fibers 22 may be in woven or nonwoven relationship. A particularly satisfactory web is made up of fibers laid down in crossing relationship with the fibers joined to each other at the points of intersection so that the web itself is an integral unit capable of being handled as a sheet. The fibers should be at least about .002" in diameter and preferably are from about .003" to about .010" in diameter. It is important that the web 10 be free from large gaps and ordinarily the gaps 24 between fibers should not exceed 11/4" and preferably not exceed 1/4". The fiber sheet 10 should provide a quantity of adhesive corresponding to at least about 30 grams per square yard, preferably from 40 to 80 grams per square yard and this quantity of adhesive...
may be made up either as a single layer of web or as two or more layers of web.

As an alternative adhesive sheet 10, there may also be used a thin film of thermoplastic polymeric resin adhesive. The film may be continuous or may have openings, for example, perforations or slits, provided the total amount of adhesive is at least 30 grams and preferably 40 to 80 grams per square yard. The film of adhesive may be secured to the bottom of the shoe by the same procedures used with the adhesive fiber web, i.e., adhesively or mechanically. While the film of adhesive is effective it lacks the ability to compress or stretch easily in the plane of the sheet so that it is less readily laid down in the curving path dictated by the outline of the shoe than is the fiber web.

As the adhesive of which the sheet is formed, it is preferred to use high molecular weight thermoplastic synthetic polymer resins, for example, relatively high molecular weight polystyrenes, polyamides, polyesteramides, and thermoplastic polyester glycol urethanes or polyether glycol urethanes. Other normally solid thermoplastic resinous materials capable of melting in a condition for wetting and adhering to shoe upper materials and of hardening to provide a strong bond may be used. Ordinarily the adhesive should have an activation temperature below, suitably at least about 25° F. below the temperature at which the sole forming material is introduced into the mold. For example, where a vinyl plastic sole material is injected at 350° F., the melting point of the adhesive may be about 275° F. Adhesives with still lower melting points may be used. Also, with suitable preheating, adhesives with higher melting points have been employed.

Best adhesive union of the shoe 14 and the molded-on sole 26 is obtained by preheating the attaching surfaces 12 of the shoe 14 and the adhesive sheet 10 or web 10. This optional preheating is carried out conveniently as shown in FIG. 2 by subjecting the attaching surface 12 of the lasted shoe upper and the adhesive sheet to a radiant heat source, for example, infrared lamps 30, for a brief period.

A convenient guide as to the extent of this preheating for adhesive fiber web is to heat until the adhesive web 10 reaches a temperature at which it softens and wilts. For example, with a web 10 of which the adhesive has a melting point of 280° F. this preheating may involve exposure to an infrared heater at a space of three inches for a period of about 15 seconds. It may be desirable, particularly where the final finish is adhesive systems, to provide an opaque, e.g. sheet metal, mask to restrict the radiant heating to the attaching area only, and where this is done, there is even less tendency for spew of molding material to adhere to the shoe.

When the attaching surface 12 of the upper 14 and the adhesive sheet 10 have been preheated, the lasted shoe upper 14 is promptly assembled with a sole-forming mold 32. As shown in FIG. 3, in which the sole mold 32 is the so-called high bite type in which plastic material is molded to a substantial height around the sides 34 of the shoe upper 14, the shoe upper 14 presses against the edge 36 of the mold 32 to form a seal with the adhesive sheet 10 between the shoe upper 14 and the mold edge 36. Even when an open sheet such as the fiber web is used the thickness of the fibers 22 of the web 10 is such that the presence of the web at the joint 38 between the shoe upper 14 and the mold edge 36 does not disrupt the seal between them.

Promptly after assembly of the shoe upper 14 against sole-forming mold 32 hot sole-forming material is forced into the mold to fill the mold. Most commonly, the sole forming material is a heat softened plasticized vinyl chloride polymer or copolymer resin, but other hot flowable resins or materials of synthetic polymer resins and synthetic polymer rubbers may be used. The heat of the sole-forming material completes softening of the adhesive of the sheet to actively adhesive condition in which the movement of the plastic material within the mold can wipe it into more complete engagement with the attaching surfaces of the shoe upper.

When all of the sole-forming material has been introduced into the mold 32, the molded sole 26 and adhesive from the sheet 10 are allowed to cool and the shoe upper 14 is then removed from the mold carrying with it the mold-on outsole 26. As shown in FIG. 4 the portions 20 of the adhesive sheet 10 which project from the joint 38 between the shoe upper 14 and the sole mold 32 remain on the shoe. It has been found that this projecting portion 20 may be removed by a rotary brush 24 formed of stiff fibers or by a hot knife.

As discussed above, the heat and movement of the sole-forming material act to melt the adhesive and spread it into effective engagement with the shoe upper material. FIG. 5 is a section taken in the plane of the junction of the shoe upper 14 and the sole 26 and shows that where an adhesive fiber web is used individual adhesive fibers have been spread out against the attaching surface 12 and that movement of the plastic has pushed molten adhesive ahead of it so that an excellent spreading of adhesive to insure strong union between the sole 26 and shoe upper 14 is obtained.

In molding a sole onto a cement lasted or other conventional lasted shoe, an adhesive sheet or web 10 may be held adhesively or mechanically in position to cover the entire bottom 50 of a shoe upper 52 with portions 54 of the sheet extending past the outer edges 56 as shown in FIG. 6. Molding on of a sole to such a shoe upper involves essentially the same procedure as described above in connection with the string lasted shoe upper 14. That is, the bottom 50 of the shoe upper 52 with adhesive web 10 in place is preferably, subjected to a preheating step, the shoe upper 52 with adhesive web 10 thereon is pressed against a sole forming mold and hot sole-forming material is forced into the mold. The same advantageous result in improvement in the strength of union between the shoe upper and the sole is obtained.

Another procedure for locating an adhesive sheet on the bottom of a shoe upper involves placing a piece of the adhesive sheet 10 of suitable size on a pad having a release type surface, e.g., having a layer of release paper on its surface. The sheet 10 is then subjected to radiant preheating and the preheated bottom of the shoe upper is pressed onto the sheet just prior to the time of assembly of the shoe upper with a sole forming mold. The adhesive sheet 10 adheres at least lightly to the shoe upper and is thus located in proper position to supply adhesive action when the hot sole forming material is forced into the mold.

In a still further procedure (see FIG. 7) for securing adhesive sheet 10 in place, there may be used a center piece 60 of paper or other inexpensive sheet material cut so that it can be placed on the bottom of a shoe upper 62, with its edges 64 extending past the inner edges 66 of the lasted over portion 68 of the shoe upper, but spaced well within the outer edges 70 of the sole attaching surface 72 of the shoe upper. A strip of adhesive sheet 10 is secured to the center piece in a manner such that when the composite of center piece 60 and sheet 10 is secured to the bottom of a shoe upper, portions of the sheet 10 will extend outwardly beyond the edges 70 of the attaching surfaces of the shoe upper. This composite has the advantage over the overall coverage of the shoe bottom with adhesive sheet that it is more economical in its use of the adhesive sheet and also that the center piece 60 will serve to seal the space between the shoe insole 72 and the inner edges 66 of the lasted over portion 68 of the shoe upper 62. Also the center piece 60 serves as a substantially inextensible reinforcement which makes it easier to locate and hold the strip of web on the bottom of the shoe upper.

The present process is useful also to improve the union between inserts and/or facings and the molded
A crystallizable copolyester from condensation and polymerization of a 5:0.4:1:0.9 mol ratio mixture of terephthalic acid, isophthalic acid and dibutyl sebacate with 1.4 butane diol having a moling point of about 280°F was melted and extruded from a plurality of spinernettes as filaments .003 to .005 inch in diameter. The filaments were deposited on a moving carrier in crossing relation to form a web which was then fed to each other at crossing points. The rate of extrusion and the speed of the carrier were coordinated so that the web had a weight per square yard of about 60 grams. On cooling, the web was slit to form strips of about one inch in width.

The strip of resin fiber web was stitched along the lateral margin of a string lasted type canvas shoe upper with the web held in place by the stitching which provided a loop for the lasting string.

The shoe upper was placed on a last and conformed to the shape of the last by tightening the lasting string. At this point the strip of web was spread outwardly to overlie the lasting margin of the shoe upper. The bottom of the shoe upper was subjected to radiant heat at a distance of 2 inches for a period of about 15 seconds which both heated the bottom of the shoe upper and caused the web to wilt into engagement with the bottom of the shoe upper. The shoe upper was then promptly assembled with a sole-forming mold wherein the engagement between the shoe upper and the edges of the sole mold provided a seal with portions of the web pinched between the shoe upper and the mold edge. Promptly after assembly of the shoe upper, hot, plasticized polyvinyl chloride sole forming material at a temperature of 375°F was injected into the mold to fill the mold. The material in the mold was allowed to cool for 70 seconds and the mold was then opened. The sole formed on the bottom of the shoe upper adhered strongly and was not separable without disrupting the shoe upper material.

EXAMPLE II

A 0.003 inch thickness continuous film was formed of the crystallizable terephthalic acid, isophthalic acid and dibutyl sebacate copolyester of Example I and the film was slit to form strips of one inch in width.

A strip of resin film was secured to the bottom of a cement lasted shoe upper with the edges extending outwardly to overlie the lasting margin of the shoe upper. The bottom of the shoe upper was subjected to radiant heat at a distance of 2 inches for a period of about 30 seconds. The shoe upper was then promptly assembled with a sole-forming mold where the engagement between the shoe upper, the film and the edges of the sole mold provided a seal with the film pinched between the shoe upper and the mold edge. Promptly after assembly of the plasticized polyvinyl chloride sole forming material at a temperature of 375°F was injected into the mold to fill the mold. The material in the mold was allowed to cool for 2 minutes and the mold was then opened. The sole formed on the bottom of the shoe upper adhered strongly and was not separable without disrupting the shoe upper material.
8. The shoemaking process according to claim 7 in which said adhesive sheet is a network of small cross section elements with substantial open spaces between the elements and said sheet and the bottom of said shoe upper are preheated before said shoe upper is associated with the mold.

9. The shoemaking process as defined in claim 7 in which the adhesive sheet is a non-woven web of fibers of adhesive, said fibers being arranged in crossing relation to each other and are self-adhered to adjacent fibers to constitute a coherent open sheet, said fiber web is disposed on the sole attaching surface of the shoe upper and the assembly is subjected to radiant heat to preheat the web and attaching surface of the shoe upper.

10. The shoemaking process according to claim 3 in which said web is secured to the shoe upper by stitching.

11. The shoemaking process according to claim 10 in which said shoe upper is of string lasted construction and said web is secured to the upper by the stitches which hold the lasting string.

12. The shoemaking process according to claim 7 in which said adhesive sheet is a network of small cross section elements with substantial openings between the elements and the adhesive and the attaching surface of the shoe upper are heated separately before assembly and positioning in engagement with the mold.

13. The shoemaking process according to claim 12 in which the adhesive sheet is a web of adhesive fibers and is subjected to radiant heat while supported on a release surface and the preheated bottom surface of a shoe upper is pressed against the web to form an at least limited adhesive engagement between said web and said bottom whereby the web is held on the bottom of the shoe upper when said shoe upper is positioned on the sole forming mold.

14. The shoemaking process according to claim 2 in which a strip of said adhesive sheet material is secured about the periphery of a center piece of sheet material, said sheet material having a size and shape relative to a shoe bottom adapted to cover central areas of the shoe bottom with its edges extending past the inner edge of lasted over portions of the shoe upper but spaced well inside the outer edge of the sole attaching surface of the shoe upper, said strip of adhesive sheet material extending outwardly past the edges of the center piece a distance to overlie attaching surfaces of the bottom of the shoe upper.

15. The shoemaking process according to claim 1 in which said shoe component is a tread member, said thermoplastic polymeric adhesive sheet is held on the attaching surface of said tread member and said tread member is deposited in said mold.

16. The process as defined in claim 15 in which said tread member is a leather sole piece and said adhesive sheet is a non-woven web of fibers of adhesive arranged in crossing relation to each other and said fibers are self-adhered to adjacent fibers at points of intersection.

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ROBERT F. WHITE, Primary Examiner
K. J. HOVET, Assistant Examiner

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