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J. GLASSMAN ET AL
METHOD OF MAKING SHOE SOLES

3,186,013

Filed July 9, 1962

2 Sheets-Sheet 1

FIG. 1

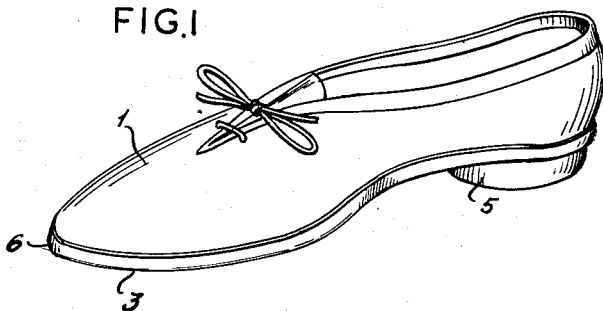


FIG. 2

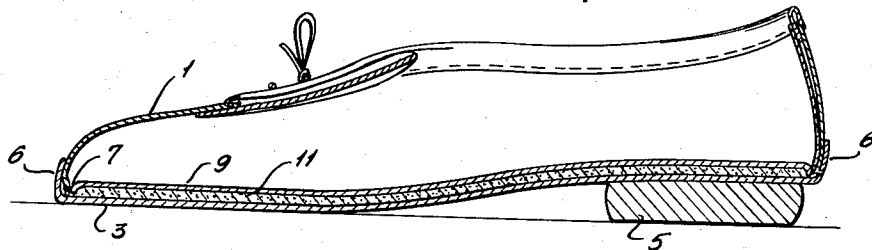


FIG. 3

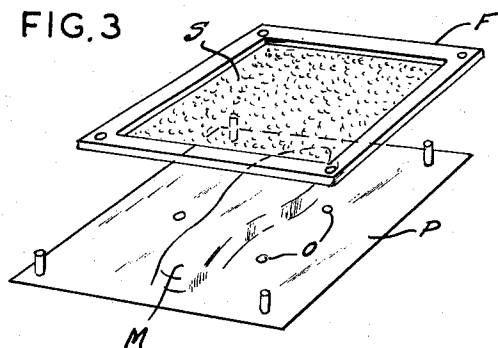


FIG. 6

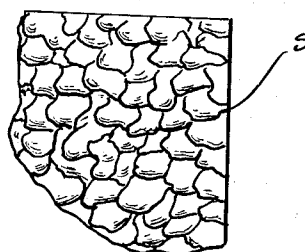
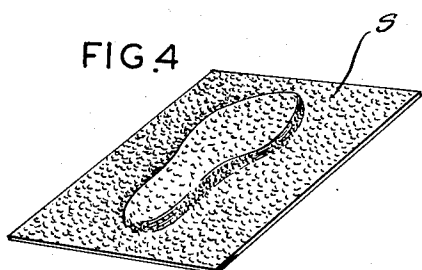


FIG. 4



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2 Sheets-Sheet 2

FIG. 5

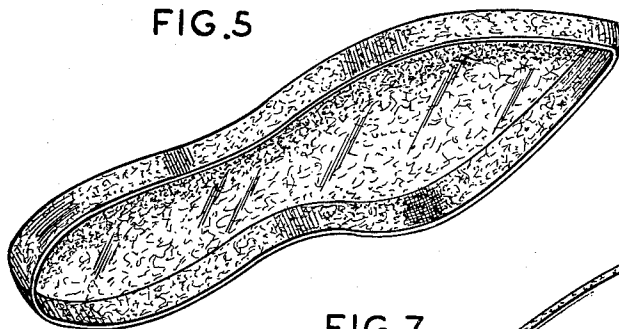


FIG. 7

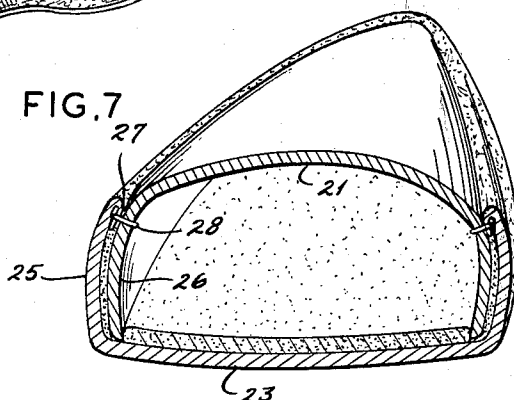


FIG. 8

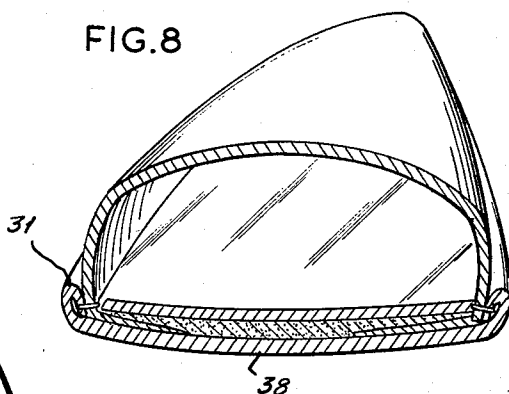
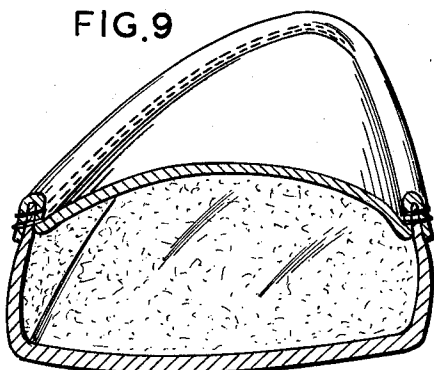


FIG. 9



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METHOD OF MAKING SHOE SOLES

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2 Claims. (Cl. 12-146)

This disclosure is addressed to the manufacture of shoes, and is particularly directed to problems encountered in making light, flexible shoes with thin soles.

Two matters of considerable concern to the shoe industry have been the high cost of hand labor and the limitations imposed upon design or appearance by existing techniques of manufacture. Attempts to create shoes of new design often lead to increased handwork in their manufacture, and the appearance of a shoe is obviously affected by the manner in which the upper is connected to a sole.

A great many shoes are made upon lasts, the upper being stretched over the last and secured to an insole, and the insole then being covered with a flat outsole cut from sheet material. Some manufacturers would like to eliminate the lasting operation and the lasts. Others are interested in light, flexible shoes, but if the thickness of the outsole is reduced in order to minimize weight and stiffness, the thin edge of the sole detracts from the appearance of the shoe. Moccasins and molded leather type shoes avoid the problem of thin-edged flat outsoles, but these shoes require a high degree of handwork in wrapping and shaping the sole. The sole materials are often difficult to shape by hand and problems arise in connecting the upper to such a hand shaped sole.

This disclosure is addressed to these problems, and contemplates the use of a novel sole formed from sheet material of any desired thickness, color and surface pattern and pre-molded off a last by vacuum shaping technique to have an upstanding margin. A sheet of moldable synthetic polymer, such as thermo-plastic vinyl, is prepared in the usual manner to have any desired thickness, color and embossed surface pattern. The sheet is then softened by heating and a foot-like blister is formed thereon by drawing the sheet down upon a mold plate having a raised mold pattern. The mold chills the plastic and sets the shape of the blister. An alternative to the use of thermo-plastic material would be a heat-cured plastic or elastomer formed over a heated mold.

The flat excess material about the blister is then removed leaving a sole with an upstanding margin. An upper of any suitable material is prepared to have lower margins which fit the molded margin of the sole, and the parts are secured together in any of several different ways, depending upon the design effect desired. For example, the upper may be sewn off a last to a sock lining and the molded sole then cemented about the sock lining and bottom margin of the upper. Alternatively, the upper may be sewn and cemented off the last directly to the molded sole. When the upper sole is to be sewn directly to the upper, the parts may be secured together in reversed relationship and then turned. The upper and sole may also be secured together in various other ways, known in the trade or to be developed.

In any event, it will be noted the shaped margins of the sole gives the appearance of a sole thicker than the sole material, yet the process avoids the expense and problems heretofore encountered in hand shaping soles on or off a last. The process is particularly adapted to methods of making shoes without lasts and permits a wide variety of design effects, merely by varying the height of the molded margin of the sole and its attachment to the upper. Moreover, the sole is itself economical.

It might be thought such a sole would not be comfortable and would wear poorly, but it has been discovered this is not so. A soft sponge cushion or thin stiffening piece can be sandwiched between the sole and a sock lining to provide economically any desired degree of protection to the foot, and many plastic sole materials, although thin, wear well because of their superior resistance to abrasion. Moreover, the upstanding margin of the sole makes the shoe more resistant to soil or water penetration, hence more durable, as compared with shoes having flat soles. Accordingly, the resulting shoe is inexpensive to manufacture yet has a number of advantages over shoes made in conventional ways.

Other features will be apparent from the following detailed description and accompanying drawings, in which:

FIG. 1 is a perspective view illustrating a shoe made in accordance with this disclosure;

FIG. 2 is a longitudinal section of the shoe shown in FIG. 1;

FIG. 3 is a perspective view illustrating certain apparatus for preparing a sole used in making the shoe;

FIG. 4 is a perspective view illustrating an intermediate step in the process of preparing the sole;

FIG. 5 is a perspective view of a sole prepared in accordance with this disclosure;

FIG. 6 is a detailed enlarged plan view illustrating an embossed surface of the sheet material from which the sole is formed;

FIG. 7 is a cross-sectional view of another type of shoe made in accordance with the disclosure;

FIG. 8 is a view similar to FIG. 7 but showing another type of shoe; and

FIG. 9 is a view similar to FIG. 8 but illustrating a further type of shoe.

Before proceeding to the drawings, it should be understood that a shoe of a given design is made in a gradation of sizes, i.e., different lengths and widths, and there are often variations, such as heel height, comb height or length, and toe or heel shape. The number of gradations prevents adoption of mass production techniques which has been successfully employed in other industries to reduce manufacturing costs. For example, injection molding requires expensive dies, hence will have limited utility in the shoe industry until less expensive dies are developed. Also, many of the materials used in shoes are most economically obtained in sheet form. Accordingly, most shoes are made by cutting parts of a shoe from sheet material and then sewing or cementing the parts together. In most instances, the parts are shaped with the assistance of a last about which the parts are stretched, either by hand or with lasting machines. In those instances where a last is not used to shape the shoe, it is customary to find a considerable amount of handwork involved in the manufacturing process, which leads to high costs and lack of uniformity. Finally, many people within as well as outside the industry have certain prejudices or beliefs, not necessarily so, which have hitherto favored, if not dictated, certain types of constructions for and method of making shoes.

For example, it has been thought that a street shoe should be made to have and hold a predetermined shape, even though the foot tends to force it into another shape. Accordingly, last made shoes have been widely favored, although they are costly and limit design possibilities. It has also been thought that a nice thick leather outsole is the most comfortable and durable type of sole one can have, although such a sole restricts design and is difficult to shape.

It is a thesis of this disclosure that a better shoe is made with a thin, light, flexible outsole of soft material, such as plastic or elastomer. Many such materials have

been found to wear better because of superior resistance to abrasion. The desired degree of protection for the foot is then provided by a separate sole portion, which can be a resilient sponge material or a more rigid stiffener or both. In addition, this disclosure contemplates the use of economical sheet material in forming the outsole but molded independently of the upper and a last so as to provide a degree of control over the shape of the shoe. Indeed, it is possible to eliminate the last completely or limit its use merely to laying the outsole. The disclosure further contemplates constructions for and methods of manufacture which permit a wide range of interesting designs and savings in manufacturing costs, especially in hand labor.

Referring now to FIGS. 1 and 2, there is shown a shoe having an upper 1, an outsole 3 and heel 5. The outsole extends at 6 upwardly from and about the center bottom or actual sole area, and in the instance illustrated, the portion 6 actually covers the lower portion of the upper. Accordingly, the seam 7 at the lower edge of the upper is concealed and protected by the outsole. The upper 1 is sewn at 7 or otherwise secured at its lower margin to a sock lining 9 or other inner sole, and a foot-cushioning intermediate sole portion 11 is sandwiched between the outsole and sock lining. The portion 11 might be a pad of sponge material or a shank stiffening board. The foot-cushioning sole portion 11 is cemented to the sock lining 9 and the outsole 3 is cemented over its inner surface to the intermediate sole portion 11, sock lining 9 and upper 1.

In making such a shoe, the upper (or parts thereof) is cut from leather or other sheet material to predetermined shape and size, using patterns or dies graded to the shoe size. The sock lining is similarly cut to predetermined size. The upper and sock lining are then registered or aligned at their edges or with other guide marks and sewn together off a last. The closed upper is slipped over a last or sole plate, and the sole parts 11 and 3 are cemented thereto. The heel can be applied finally, or the heel can be fastened to the outsole before its assembly with the upper.

As described above, this is a so-called molded leather shoe but such shoes have heretofore been made by wrapping a flat outsole cut from leather or the like about an upper supported upon a last. This disclosure contemplates that the outsole will be formed of plastic or elastomeric sheet material previously molded to predetermined shape and size.

Referring to FIGS. 3-5, the sole material is first prepared or obtained in sheet form of desired thickness (which is preferably greater than one thirty-seconds of an inch but less than three-eighths of an inch) and color with the desired surface pattern (FIG. 6) embossed thereon. A thermo-plastic vinyl plastic sheet is suggested. The sheet S is mounted in a frame F and is shaped upon a mold plate P having a raised sole pattern M formed on or fastened thereto. Openings O are provided in the plate about the pattern, and apparatus (not shown) is connected to draw a vacuum through the openings O when the frame and plastic sheet are placed against the mold plate.

If one uses a thermo-plastic, it is first softened, as by heating with infra-red lamps, so that it will take a permanent set after being drawn tightly against the plate P and mold M. The mold chills the plastic and may be formed of metal. If a heat-cured elastomer is employed, the mold M may be heated to set the shape. Although only one pattern M is shown, normally there would be a number of patterns mounted upon the same mold plate P, thereby increasing the rate of production.

This vacuum forming technique is particularly suited to shoe manufacture because the die expense is low and because there is no undesired deformation of the finish or surface of the plastic, such as would result at the parting

faces of injection molding dies. In this instance, the product produced is a sheet with one or more foot-shaped blisters thereon, as shown in FIG. 4. The flat excess material about the blister is then trimmed off or cut away with dies, leaving the molded sole of FIG. 5. The trimmed excess material can be processed into sheet form for reuse.

A convenient way of making the mold or pattern M involves preparation of duplicate wood lasts in the conventional manner. A sheet corresponding to the thickness of the sole parts 3 and 11 is fastened to the bottom on one mold and the bottom part of that mold is then cut off to form a pattern for making the mold part P. The other last is then used in making the shoe, i.e., laying the outsole.

Turning now to FIG. 7, there is shown another type of shoe having an upper 21 and outsole 23. The outsole 23 has side portions 25 extending well up the sides of the shoe and the upper has a lap margin 26 extending down and cemented to the inner surface of the outsole portions 26. The upper margin 27 of the outsole is folded down within the part 25, and a line of stitching 28 connects the margin 27 of the outsole to the upper.

Such a shoe is conveniently made by turning or molding the outsole to the reversed shape and by skiving a groove in its margin where the part 27 is to fold. The upper is then placed inside out about the reversed sole and aligned so that the edges point outwardly in the same direction, the sole being inside the upper. The lapped areas are cemented together, and the parts are sewn together along a line between the groove and edge of the sole, whereupon the shoe is turned inside out to produce the construction shown in FIG. 7.

FIG. 8 illustrates a shoe similar in construction techniques to but of appearance differing from that of FIG. 7. In this instance the folded margin 31 of the outsole 38 is directed inwardly over the flat bottom part of the sole to give the appearance of a conventional sole.

FIG. 9 illustrates how a moccasin shoe might be made using the molded sole by folding and sewing the margin of a plug-type upper over the inner and outer upper margin of the outsole.

The shoes described are illustrative of the wide utility of the basic process herein disclosed, wherein a plastic sole is molded, as described in connection with FIGS. 3-5. It should be understood that other patents may cover other aspects of these shoes. It should also be understood that there is no intention to limit this disclosure to the particular shoes illustrated. On the contrary, the basic principles herein disclosed may be applied to a wide variety of shoes within the spirit of the disclosure and the scope of the claims.

Experience to date indicates that a solid sheet of polyvinyl chloride polymer blended with acrylonitrile-butadiene-styrene copolymer (ABS) can be vacuum formed into a satisfactory sole. Attempts to vacuum form a sheet backed or reinforced with a woven fabric have not been especially successful, but it is thought a non-woven fabric or reinforcement might be made to work. Vulcanizable elastomers or thermo-setting resins will present a problem in making a sheet which can be handled yet which has not been cured beyond a point where it can be shaped on a sole-forming mold, but it is thought this problem can be resolved.

In most instances, the polymer would be compounded with coloring pigment and other agents, but care should be exercised to avoid plasticizers unduly sensitive to temperature changes, since shoes encounter a wide range of temperatures. Also, the filler and reinforcement, if any, should not interfere with vacuum forming. The necessary information is available from suppliers of polymers.

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

1. In the manufacture of shoe components having a

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plantar portion and an upstanding marginal portion surrounding the plantar portion, the process comprising:

- (a) providing a sheet of thermoplastic synthetic polymer capable of being rendered pliable by heat, conformed while hot to the shape of a mold, and permanently set to the conformed shape, 5
 - (b) providing a vented mold having a plantar surface corresponding substantially to the size and peripheral contour of a last bottom, and having side walls extending substantially perpendicularly from the peripheral margin of said plantar surface, said side walls having a height substantially greater than the thickness of said sheet of synthetic polymer, 10
 - (c) heating the sheet of synthetic polymer to an extent sufficient to render it pliable, and extending the sheet across the plantar surface of, and the vent in, said mold with the edges of the sheet extending beyond the periphery of said plantar surface and overhanging said side walls for a substantial distance, 15
 - (d) applying vacuum on the mold-side of the pliable sheet while maintaining atmospheric pressure on the reverse side thereof to draw the pliable sheet into contiguity with the plantar surface and side walls of said mold, and maintaining said vacuum until the sheet has lost its pliability and has set into conformity with the mold, 20
 - (e) and then trimming away any excess of the sheet outwardly of the portions thereof conformed to the side walls of said mold. 25
2. In the manufacture of shoe components having a plantar portion and an upstanding marginal portion surrounding the plantar portion, the process comprising:
- (a) providing a sheet of pliable synthetic polymer capable of being conformed to the shape of a mold and inherently capable of having its pliability substantially reduced and becoming permanently set by thermic change, 30
 - (b) providing a vented mold having a plantar surface corresponding substantially to the size and peripheral contour of a last bottom, and having side walls extending substantially perpendicularly from the peripheral margin of said plantar surface, said side 35

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- walls having a height substantially greater than the thickness of said sheet of synthetic polymer,
- (c) extending the pliable sheet across the plantar surface of, and the vent in, said mold with the edges of the sheet extending beyond the periphery of said plantar surface and overhanging said side walls for a substantial distance,
 - (d) applying vacuum between the mold and the mold side of the pliable sheet while the reverse side of the sheet is exposed to the atmosphere to draw the pliable sheet into contiguity with the plantar surface and side walls of said mold, and while in such contiguity subjecting said sheet to thermic changes until the sheet has lost pliability and has set into conformity with the mold,
 - (e) and then trimming away any excess of the sheet outwardly of the portions thereof conformed to the side walls of said mold.

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