Feb. 20, 1962 G. J. CROWLEY 3,021,543

METHODS OF MAKING SHOES

Filed Feb. 1, 1960 2 Sheets-Sheet 1

Fig. 1

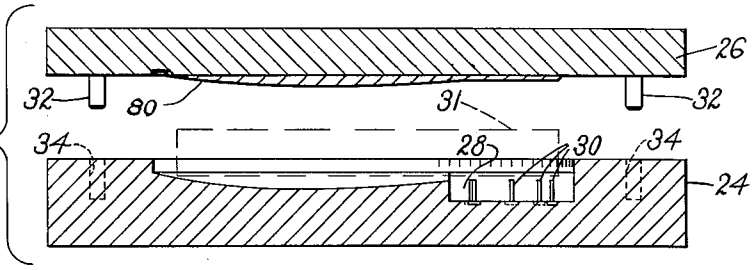


Fig. 2

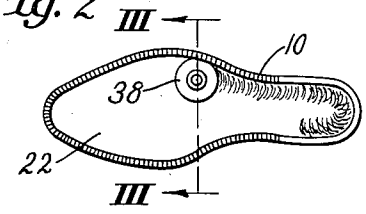


Fig. 3

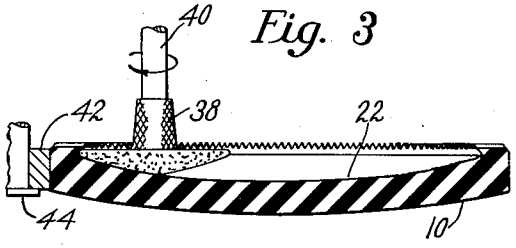


Fig. 4

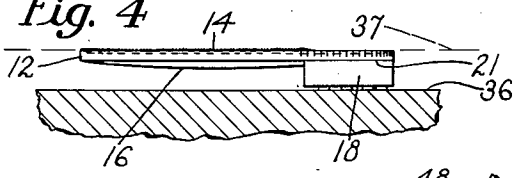


Fig. 5

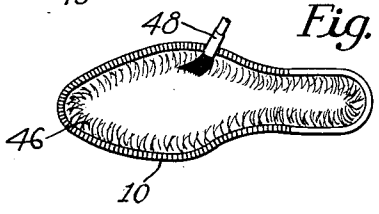


Fig. 6

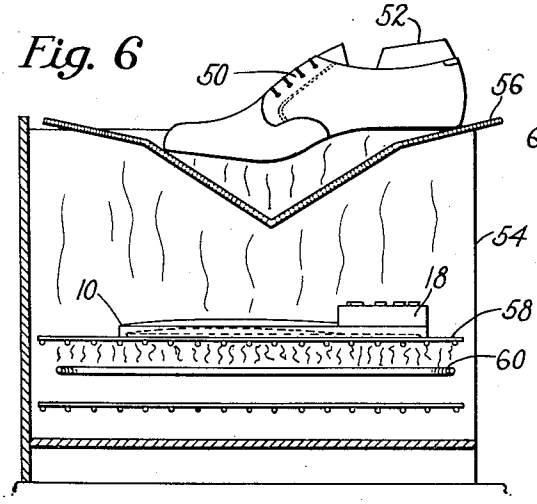
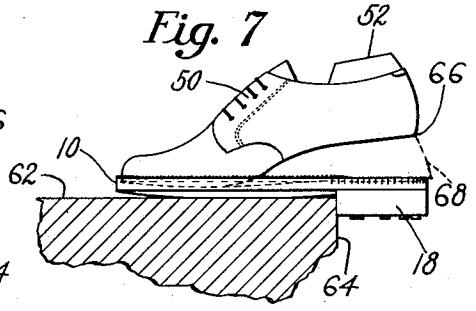


Fig. 7



Inventor

Gerald J. Crowley

By his Attorney

Edward W. Fearing

Feb. 20, 1962 G. J. CROWLEY 3,021,543

METHODS OF MAKING SHOES

Filed Feb. 1, 1960 2 Sheets-Sheet 2

Fig. 8

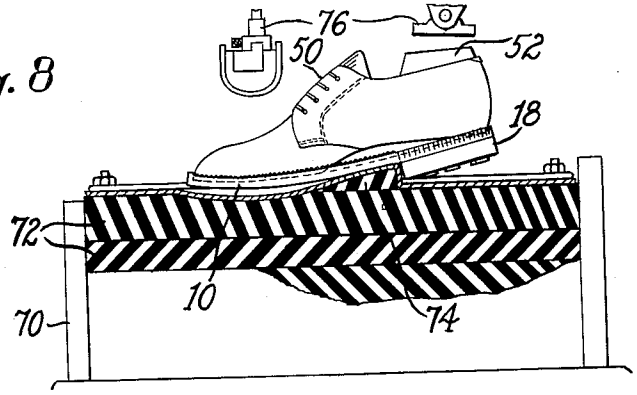


Fig. 9

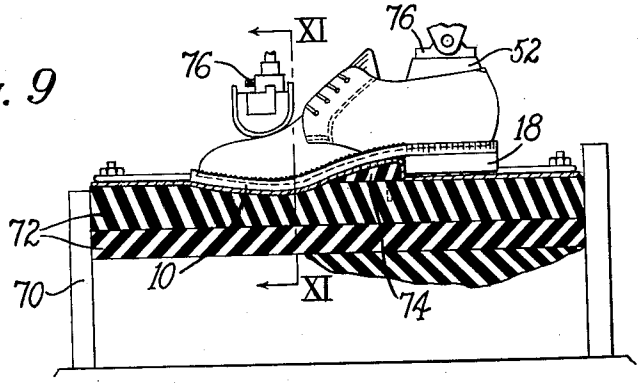


Fig. 10

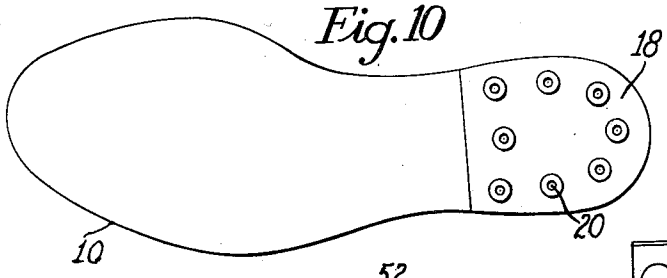


Fig. 11

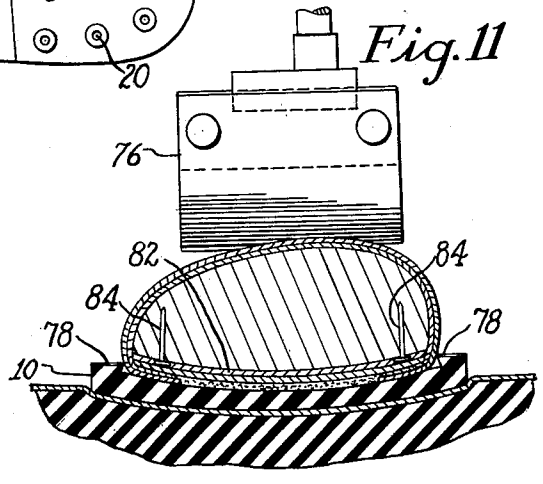
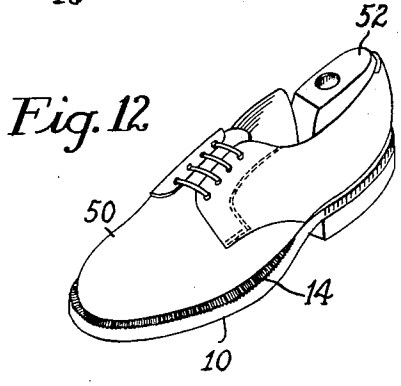


Fig. 12



United States Patent Office 3,021,543
Patented Feb. 20, 1962

3,021,543

METHODS OF MAKING SHOES

Gerald J. Crowley, Quincy, Mass., assignor to United Shoe Machinery Corporation, Boston, Mass., a corporation of New Jersey

Filed Feb. 1, 1960, Ser. No. 5,884
4 Claims. (Cl. 12—142)

This invention relates to improved methods of cement shoemaking employing molded rubbery outsoles.

Rubber soled cement shoes are manufactured commonly with flat lasted shoe uppers, the uppers being applied to a last with the marginal portions of the uppers carried over the bottom of the last about a ridge forming a break line between the bottom surface of the last and the variously curved contours at the sides of the last. To secure the overlasted marginal portions of the upper in place, the last carries an insole to which the overlasted marginal upper portions are cemented or stapled. Thereafter the overlasted marginal upper portions are roughened and given a coating of adhesive. An outsole blank is then cut out of a flat sheet of uniform thickness rubber material which is similarly roughened and coated with adhesive. The adhesively coated outsole blank is applied to the shoe bottom and presented to a press which acts with a single operation to conform the outsole blank with the cemented surface of the shoe upper supported by the bottom of the last, the requirement for acceptable attachment being a conformity of the smooth blank with the upper throughout that portion supported by the last break line; thereafter the projecting portions of the outsole blank are trimmed off to form a contour bearing a definite relationship with the last break line and the resulting edges finished and set in accordance with acceptable shoemaking practices.

In making rubber soled cement shoes in accordance with the procedures outlined, it has been found that there has been a tendency for a rubber outsole of flat stock, after being conformed with the contour of the overlasted upper, to straighten out and return to its original flat condition as the result of the characteristic commonly known as elastic resistance or memory. Due to this tendency a rubber outsole on a cement shoe may rupture the adhesive bond between it and the overlasted margin of the upper after attachment to the upper or the upper may be deformed as soon as the last is removed following the completion of the shoe. The shoe thus may become unsaleable and defective. This is true even after attachment of a rubber outsole with through and through stitches in addition to the cement.

In some instances attempts have been made to manufacture premolded vulcanized outsoles with finished edges, marginal, and tread surfaces conforming as closely as possible with those along the bottom surfaces of a flat lasted shoe but such attempts have been difficult and expensive, particularly in the provision of a set of vulcanizing molds corresponding to each size and style of shoe operated upon, the bottom surface of each shoe being curved differently from the others both in lengthwise and widthwise directions. Also, to accommodate lengthwise curvature it is necessary to form a two-part mold with its separation plane corresponding to the lengthwise curvature of the shoe, so that a hollow die and a cover plate therefor require curved mating surfaces, which fit together exactly in order to avoid leakage of the rubber molding material forming the outsole.

The primary object of the present invention is to provide an improved method of attaching rubbery shoe outsoles which does not require the use of the costly machinery ordinarily employed in the manufacture of such shoes but by which shoes of equal commercial acceptability are obtainable. The production of shoes employing such outsoles may also be accomplished by utilizing a costly and space-consuming multi-stage injection molding machine which automatically completes the attachment of an outsole in a series of operations performed at varied stages of the machine. A shoe produced by application of the method delineated herein has a physical appearance and structural durability equivalent to a shoe manufactured by an injection molding machine but the improved method facilitates their attainment at a marked economic differential.

According to another object of the present invention there is provided an improved method of outsole attachment which utilizes a unique premolded shoe outsole composed of vulcanized rubber or similar hardened thermoplastic material of the same nature as that employed in prior injection molding techniques. The premolded shoe outsole used in the improved method described herein is constructed with a tranverse curvature conforming with the widthwise curvature of a shoe bottom, but with no lengthwise curvature. When so constructed, it has been found that the resistance to lengthwise curvature during the attachment of an outsole to a shoe is substantially less than the resistance to widthwise curvature, so that the lengthwise curvature may readily be obtained wholly during the attaching operation. An outsole so molded has the advantage that a central upper receiving recess may also be molded into it and a wide variation of outsole lengths may be compensated for by properly applying and attaching the outsole to the shoe. When such an outsole is attached in accordance with the improved method a fairly wide variation between outsole and shoe bottom lengths may be accommodated. The elimination of lengthwise curvature also permits the use of simplified molds separable along a single flat plane and, thus, results in substantial cost reduction. After attachment of such outsole to a shoe no further trimming, heel attaching or edge finishing operations are required.

Another difficulty encountered when cement attaching rubber outsoles to lasted shoe uppers is in smearing the exposed surfaces of the upper and sole with adhesive, so that considerable time and effort are required in cleaning after manufacture.

Further objects of the invention are to provide a method of manufacturing a shoe having a molded rubber outsole in which all of the surfaces of the outsole and upper exposed in a shoe after manufacture may be kept free of smear from displaced adhesive more readily than in prior methods of shoe manufacture, without the necessity for making a set of expensive molds sufficient in number to enable an extremely close fit by utilizing a separately molded sole of proper size for each size of shoe.

These and other features of the invention as hereinafter described and claimed will readily be apparent to those skilled in the art from the following detailed specification and drawings, in which:

FIG. 1 is a lengthwise sectional view of a mold employed in the practice of the present invention;

FIG. 2 is a plan view on a reduced scale of an outsole formed by the mold shown in FIG. 1, indicating a manner of roughening the outsole before application of adhesive;

FIG. 3 is a sectional view on an enlarged scale of the outsole shown in FIG. 2 taken along the line III—III;

FIG. 4 is a view in side elevation and on a reduced scale of the outsole shown in FIG. 2 indicating the natural unstressed position of the forepart of the outsole after being taken from the mold of FIG. 1;

FIG. 5 is a further plan view of the outsole shown in FIG. 2 illustrating the manner of applying cement;

FIG. 6 is a sectional view of a cement activating and sole plasticizing heater utilized before attaching the out-

sole in accordance with the present invention to a shoe;

FIG. 7 is a sectional side view of a support on which the outsole is located and a shoe in the process of preliminarily fitting an outsole to a shoe in accordance with the method of the present invention;

FIG. 8 is a sectional side view of a pad box in an outsole attaching machine to which the preliminarily fitted sole and shoe are presented;

FIG. 9 is a similar view of the pad box shown in FIG. 8 and a shoe thereon during the process of permanent outsole attachment;

FIG. 10 is a bottom plan view of the outsole of FIG. 4;

FIG. 11 is a sectional view on an enlarged scale along the line XI—XI of FIG. 9; and

FIG. 12 is a perspective view of a completed shoe manufactured in accordance with the method of the present invention.

In the manufacture of cement shoes utilizing outsoles of rubber or similar rubber-like material, such as vinyl plastic or polyvinyl chloride of thermoplastic nature, substantial savings in labor and equipment are possible in the use of outsoles combined with heels in a single finished premolded and vulcanized or otherwise hardened condition. The only difficulty encountered in the use of premolded and vulcanized outsoles is in fitting a particular outsole to the shoe for which it is intended. If an outsole is made to exact size and a shoe to which it is to be attached is likewise made to exact size, then the two will interfit accurately with good results. However, the degree of accuracy required is seldom attained in actual practice and, consequently, premolded vulcanized outsoles to be utilized without further trimming or finishing operations have heretofore never reached any substantial degree of commercial utility.

In accordance with the features of the present invention, it is possible to utilize a complete premolded outsole with integral heel attached, in which outsole no lengthwise curvature is molded into the outsole, but an amount of transverse curvature is molded into the outsole to insure that it will conform accurately with the widthwise curvature of a shoe bottom to which it is to be attached. In so doing a number of advantages accrue in the process of manufacture which otherwise would be impossible to attain and the outsole may be fitted to a shoe bottom with greater manufacturing tolerances than have been possible heretofore to accommodate the inequalities and variations commonly occurring during mass production procedures.

Referring more particularly to the drawings, outsole adapted for use in the present invention is shown at **10** in FIGS. 2 to 5, inclusive, and 10. In these figures the outsole is shown in its molded condition before it is attached to a shoe, all of the surfaces including an edge **12**, a flat raised marginal surface **14**, and a tread surface **16**, being complete without requiring any further finishing operations after attachment to the shoe. The outsole also has molded integrally therewith a block heel **18** formed with suitable configuration on its tread surface and imitation nail holes **20** and a score mark **21** to simulate a separately attached heel (FIG. 4).

To assist in fitting the outsole to a shoe and to reduce the likelihood that cement will be squeezed out from between the outsole and the shoe during the attaching operation, so as to smear exposed surfaces of the outsole and upper, the entire length of the outsole from the heel to the toe is formed with a central recess **22** of a length and width slightly less than that of the shoe bottom to which it is to be attached. The inner surface of the central recess **22** in a direction widthwise of the outsole is formed with a concave curvature corresponding to the transverse curvature of a shoe bottom to which it is to be attached. In a lengthwise direction no curvature is molded into the sole except that which is incidental to the widthwise curvature.

The advantages gained by the ability to utilize this

form of sole construction described above are readily apparent when taking into consideration the problems involved in manufacturing a series of molds for different styles and sizes of shoes. By eliminating the lengthwise curvature of the sole it is possible to utilize metal blocks formed of flat bar stock for the molds without special outside machining, as would be required if a lengthwise curvature were molded into the outsoles, the essential separating plane of each mold being conveniently retained in unmachined condition along the original flat surfaces of the bar stock and being made to coincide with the flat marginal surface **14** on the outsole. Thus, a simple two-part mold comprising a hollow die **24** (see FIG. 1) and a cover plate **26** may be employed to produce an outsole adapted for use in the method disclosed herein. Both the die and the cover plate have flat mating surfaces, the plane of which coincides with that of the raised marginal portion of the outsole being molded. The hollow in the die is provided with a heel cavity **28**, the bottom surface of which is provided with suitable configuration to imitate a nailed-on heel. For this purpose a series of pins **30** are mounted to project upwardly from the heel cavity to simulate nail holes. To provide rubber material a biscuit **31** is inserted between the die and cover plate and heat and pressure applied to the mold parts. To assist in properly alining the cover plate **26** with the hollow die **24** during molding, two or more dowel pins **32** project downwardly from the cover plate **26** into openings **34** in the die.

The outsole described above has a rigidity corresponding approximately with that of a leather outsole so that a completed shoe utilizing the outsole will display the same characteristics and conform with accepted requirements of leather shoe construction. When the outsole is laid with the tread of its heel against a table or other flat surface **36**, as shown in FIG. 4, and pressure is applied from above on the heel portion of the outsole, the marginal portion of the outsole rises into a plane **37** parallel to the table surface **36**. Advantage is taken of this characteristic of the outsole to maintain its upper raised marginal surface **14** in a single flat plane to assist in fitting the outsole to the shoe bottom.

In order to attach an outsole to the botom of a flat-lasted shoe in accordance with the present invention, the concave inner surface of the recess **22** is roughened by utilizing a convexly curved roughing tool **38** attached to a rotating spindle **40** in a roughing machine. To guide the outsole during the roughening operation, its edge is engaged with a gage roll **42** rotatably mounted on a screw **44** in the machine, a roughened band **46** extending entirely around the edges of the inner surface on the recess **22** being formed by the roughing tool **38**. After being roughened the band **46** has cement applied to it by a brush **48** or any other suitable means. Similarly, an inturned area of a flat-lasted shoe upper **50** supported on a last **52** is roughened and has cement applied thereto, it being borne in mind that the widthwise curvature on the surface of the recess **22** is the same as the transverse curvature of the last supported portion of the inturned upper **50**. After the cement has become partially cured both the cemented outsole and shoe are introduced into an activating heater formed by an enclosure **54** having a shoe support **56** and a sole supporting grid **58**. Both the shoe and the sole are introduced into the activating heater with the cemented surfaces facing downwardly toward an electrical heating unit **60**, the majority of the heat being transferred to the sole and the shoe by radiation. The purpose of inserting the sole and the shoe in the activating heater is two fold. It not only actuates the cement but also plasticizes the entire outsole and for this reason the outsole is laid on the grid **58** much closer to the heating unit **60** than the shoe. Also, the heat is applied for a longer period of time to the outsole than is common with general cement shoe manufacturing practices in order to raise the temperature of the outsole to 180°

F., or higher. Heating the outsole to this temperature no only plasticizes the outsole but also causes it to expand both widthwise and lengthwise, so that it is more nearly capable of fitting the bottom of the shoe even though the outsole is of slightly smaller size within the raised marginal area about the recess 22.

When the outsole reaches the desired temperature its flat forward portion is laid on a fitting bench 62 having a front vertical surface 64 against which the breast of the heel 18 is engaged. The forepart portion of the shoe then is brought directly over the toe end of the recess 22 and the tip of the shoe toe inserted in the recess. As soon as the tip of the shoe toe is inserted in the recess, the heel end of the shoe is depressed projecting the forepart of the shoe bottom into the recess with the result that the shoe and outsole assume the positions of FIG. 7, the parts being temporarily secured in these positions by the adhesive. It now remains for the operator to fit the heel end of the shoe within the rearward end of the recess 22.

To fit the heel end of the shoe in the recess 22 requires more than a simple manipulation of the parts, since the outsole obviously is somewhat shorter than the measurement taken along the curved bottom surface of the shoe running from the tip of the toe to a corner of the upper 50. The rearward corner of the upper, being supported by the heel break line of the last 52, is indicated at 66 and this corner must be brought into the recess 22. Under normal conditions if an attempt were made to flex the outsole into conformity with the curved shoe bottom the corner 66 would follow a path indicated by a line 68, which would extend considerably beyond the rearward end of the recess 22.

In order to fit the corner 66 at the heel end of the shoe in the rearward end of the recess 22 in this step of the invention the plasticized outsole is stretched by a relatively easy application of forwardly directed force on the heel end of the shoe while the toe end of the shoe is temporarily secured by the cement within the forward end of the recess 22, the heel 18 being held against the flat vertical surface 64 of the fitting table. The corner 66 then having been inserted within the recess 22 the straight central portion of the outsole bridges across the inwardly curved shank of the shoe between the corner 66 and the ball of the shoe. This is the relationship of the shoe and the outsole indicated in FIG. 8.

After having inserted the toe of the shoe and the rearward corner 66 of the heel within the recess 22 of the outsole, the temporarily secured shoe and outsole are introduced into a sole attaching press having a pad box 70, shown in FIG. 8. Within the pad box 70 is a series of pads 72 and a wedge 74 conforming with the space between the heel 18 and the shank portion of a completed shoe. When first introduced into the press the shoe rests principally on the shank wedge 74. As soon as the attaching operation is started the pad box 70 is raised to bring the shoe into engagement with the toe and heel abutments 76 which compresses the shoe aganist the pads 72. The pressure of the pads against the tread surface of the outsole, which remains heated to a plasticizing temperature, causes the outsole to expand further both widthwise and lengthwise. Even though the portions of the shoe and outsole along the shank are not in contact with each other and although an accurate fit of the shoe bottom defined by the last break line underlying the corner 66 formed by the upper as it overlies the shoe bottom does not fit accurately within the recess 22, the expansion of the outsole at this time improves the fit of the parts and insures accurate conformity of the recess in the outsole with the shoe bottom. The application of pressure by the pressing pad 72 besides expanding the outsole to conform with the shoe also forms a permanent attachment through the cement applied to the shoe and the outsole. This is the condition of the parts illustrated in FIGS. 9 and 11.

As a means for further defining the outline of the recess 22 in the outsole, to assist in roughening the surface of the recess to prevent spread of the cement during the attaching operation and to improve the fit of the shoe within the recess 22, the raised marginal surface of the outsole surrounding the recess is formed with an inturned fin-like lip 78 (see FIG. 11), especially along the forepart of the outsole. About the heel of the outsole the lip 78 is less sharp than about the forepart, since there is less flexure of the shoe along the heel and less opportunity for smearing cement on exposed surfaces.

To produce the fin-like lip 78 and the recess 22 the cover plate 26 has secured to its under surface a filler in the form of a plate 80 having rounded edges and graded thicknesses from its edges to its central area, the dimensions of the plate being smaller than the hollow in the die 24.

After the pressure on the tread surface of the outsole has been released by the pad 72 in the attaching press, the outsole tends to contract bringing the lip 78 into close, firm contact with the corner of the upper surrounding the break line of the last, the lip 78 serving to restrict the contracting movement of the outsole and to be compressed by the upper somewhat in forming a close fit therewith. The result of the entire process, therefore, is to produce a shoe illustrated in FIG. 12 having its upper 50 and outsole assembled together with the raised marginal surface 14 imprinted with imitation stitch indentations and hugging closely to the upper without leaving any appreciable crevice within which foreign materials, water or other liquids may enter to disturb the fundamental construction or the appearance of the shoe.

For the purose of reinforcing the corner of the upper supported by the break line of the last, the last has mounted on its tread surface a metal sheet 82 formed with abrupt edges and secured in place by nails 84. The sheet 82 not only reinforces the corners of the upper but also tends to stabilize the last against distortion from swelling and other causes which affect the shapes of all wooden articles.

An adhesive which has been found extremely effective for use in the manufacture of the shoe described is of the self-curing type containing an isocyanate combined with a tackifier and a curing agent. Preferably the adhesive is compounded to require a suitable heat activation commensurate with the plasticizing requirements of the outsole. For this purpose an adhesive of the nature disclosed in an application for United States Letters Patent, Serial No. 812,599, filed May 12, 1959 in the names of John L. Perkins et al. is employed with good advantage. The percentages of mixtures with such adhesive may be varied slightly and the times of drying and curing varied in accordance with characteristics of the material from which the outsole is formed and with which the adhesive is utilized to accomplish satisfactory plasticizing and activating simultaneously.

It will be appreciated that the advantages of the present invention are derived from the use of outsoles composed of any rubbery material, such as natural rubber, vinyl or polyvinyl chloride plastics, capable of being premolded with a glossy skin not requiring further finishing operations. Some of these materials obviously do not require heat vulcanization to become hardened but being entirely thermoplastic in their natures expand and soften perceptibly when their temperatures are raised to that required to activate the adhesive applied thereto. Under these conditions the equivalent of vulcanization is a cooling to a temperature where the molded shapes of the soles are retained with sufficient rigidity for practical use.

Certain features of the invention, herein disclosed form the subject matter of divisional applications, as follows: Serial No. 117,712, relating to Premolded Outsoles, and Serial No. 117,713, relating to Mold for Making Premolded Outsoles, both applications being filed on June 16, 1961.

The nature and scope of the invention having been indicated and exemplary steps having been described together with an illustrative embodiment of the invention, what is claimed is:

1. The method of manufacturing a cement shoe having an upper supported on and conformed to a last, a premolded thermoplastic outsole having a central recess shaped to conform with the widthwise curvature on the bottom of the last supported upper but not with the lengthwise curvature on the bottom of the upper, the forepart of the outsole extending in a relatively flat plane and the recess in the outsole being of smaller dimensions than the bottom of the upper, which method comprises applying a pressure sensitive adhesive to the inner surface of the recess in the outsole, heating the outsole and adhesive to increase substantially the plasticity of the outsole and simultaneously to activate the adhesive, stretching the plasticized outsole lengthwise to engage the toe and heel portion of the shoe upper within the recess of the outsole, securing the parts temporarily and applying a thicknesswise attaching pressure to the outsole to cause the outsole to expand in directions widthwise and lengthwise of the shoe while the outsole is heated to its plasticizing temperature.

2. The method of manufacturing a cement shoe having an upper supported on and conformed to a last, a premolded thermoplastic outsole having a central recess shaped to conform with the widthwise curvature on the bottom of the last supported upper but not with the lengthwise curvature on the bottom of the upper, the forepart of the outsole extending in a relatively flat plane and the recess in the outsole being of smaller dimensions than the bottom of the upper, which method comprises applying a pressure sensitive adhesive to the inner surface of the recess in the outsole, heating the outsole and adhesive to increase substantially the plasticity of the outsole and simultaneously to activate the adhesive, stretching the plasticized outsole to engage the toe and heel portion of the shoe upper within the recess of the outsole, securing the parts temporarily, applying a thicknesswise attaching pressure to the outsole to cause the outsole to expand in directions widthwise and lengthwise of the shoe while the outsole is heated to its plasticizing temperature, the expansion of the outsole causing the upper to fit within the recess of the outsole, and thereafter releasing the thicknesswise pressure on the outsole to enable it to contract while cooling from the plasticizing temperature.

3. The method of manufacturing a cement shoe having an upper supported on and conformed to a last, a premolded thermoplastic outsole having a central recess with a raised marginal surface surrounding it, formed with an inturned fin-like lip, the recess being shaped to conform with the widthwise curvature on the bottom of the last supported upper and being of smaller dimensions than the bottom of the upper, which method comprises applying a pressure sensitive adhesive to the inner surface of the recess in the outsole, heating the outsole and the adhesive to increase substantially the plasticity of the outsole and simultaneously to activate the adhesive, stretching the plasticized outsole to engage the toe and heel portions of the shoe upper within the recess, securing the parts temporarily together and applying a thicknesswise attaching pressure to the outsole to cause the outsole to expand in directions widthwise and lengthwise of the shoe while the outsole is still heated to its plasticized temperature, the lip on the marginal surface of the recess thereby being caused to move outwardly away from the bottom of the upper and the upper bottom to fit within said recess.

4. The method of manufacturing a shoe having an upper supported on and conformed to a last, a premolded thermoplastic outsole having a central recess shaped to conform with the widthwise curvature on the bottom of the last supported upper, but not with the lengthwise curvature of the bottom of the upper, the forepart of the outsole extending in a relatively flat plane, and a heel being connected integrally with the outsole, the recess in the outsole being of smaller dimensions than the bottom of the upper, which method comprises applying a pressure sensitive adhesive to the bottom surface of the recess in the outsole, heating the outsole and the adhesive to increase substantially the plasticity of the outsole and simultaneously to activate the adhesive, applying the tread surface of the outsole to a fitting bench having a front vertical surface with the heel disposed against said vertical surface, inserting the tip of the shoe toe in the recess on the outsole and temporarily securing it by the adhesive, moving the heel end of the shoe downwardly toward the rearward end of the recess while applying a forwardly directed force on the heel end of the shoe to stretch the plasticized outsole sufficiently to bring the rearward corner of the shoe heel within the recess and while the outsole still is heated to its plasticizing temperature, and applying a thicknesswise attaching pressure to the outsole to cause it to expand in widthwise and lengthwise directions and to bring the bottom of the upper into the recess.

References Cited in the file of this patent

UNITED STATES PATENTS

1,438,245	Knight	Dec. 12, 1922
1,537,684	LaChapelle	May 12, 1925
1,861,879	Quinn	June 7, 1932
2,104,583	Daly	Jan. 4, 1938
2,644,179	Kleven	July 7, 1953
2,907,058	Evins	Oct. 6, 1959