March 7, 1961 J. J. SILVERMAN 2,973,529

TECHNIQUE FOR MAKING SHOES

Filed Feb. 16, 1955 3 Sheets-Sheet 1

Fig. 1.

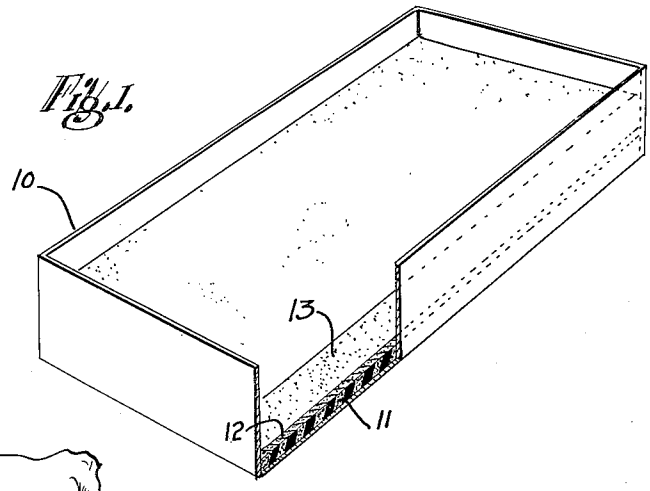
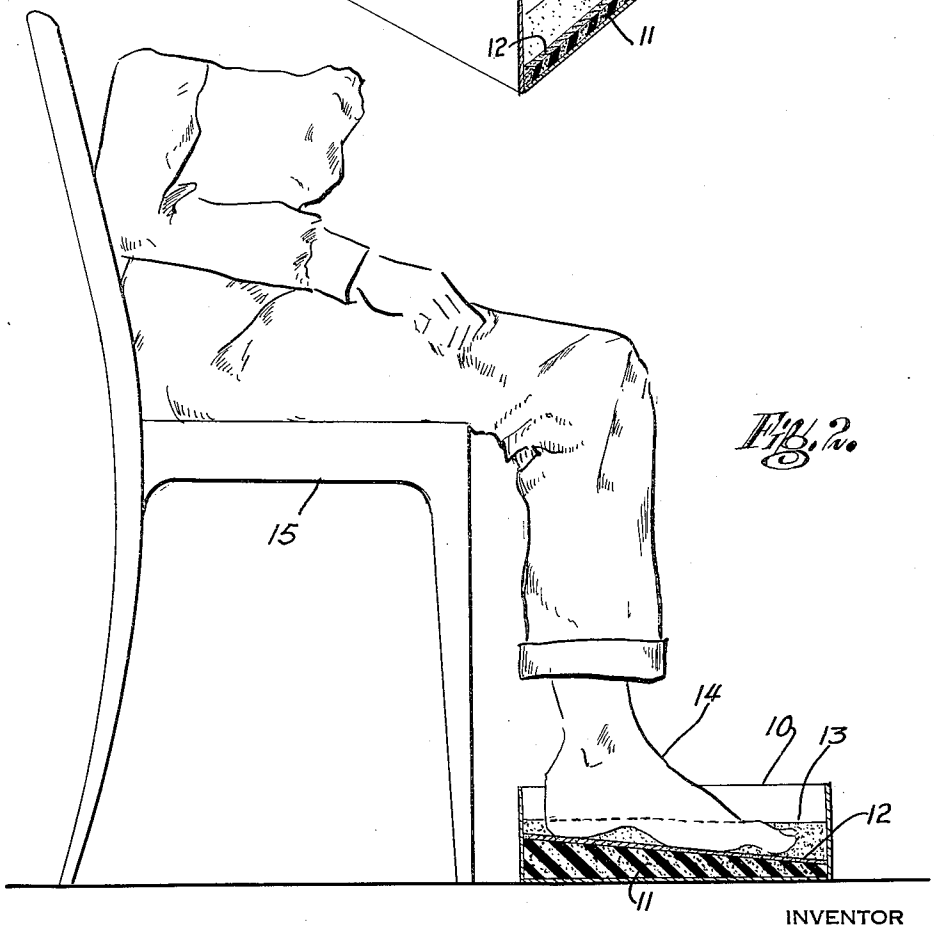


Fig. 2.



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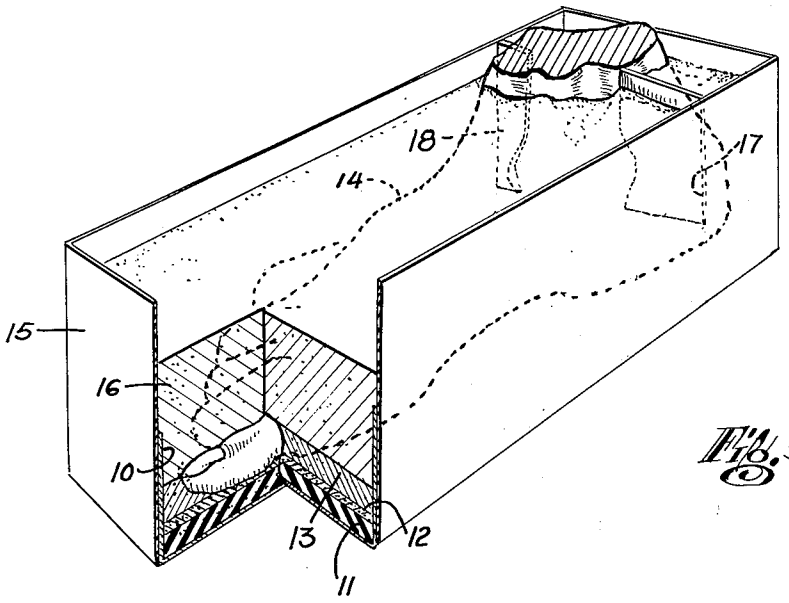


Fig. 3.

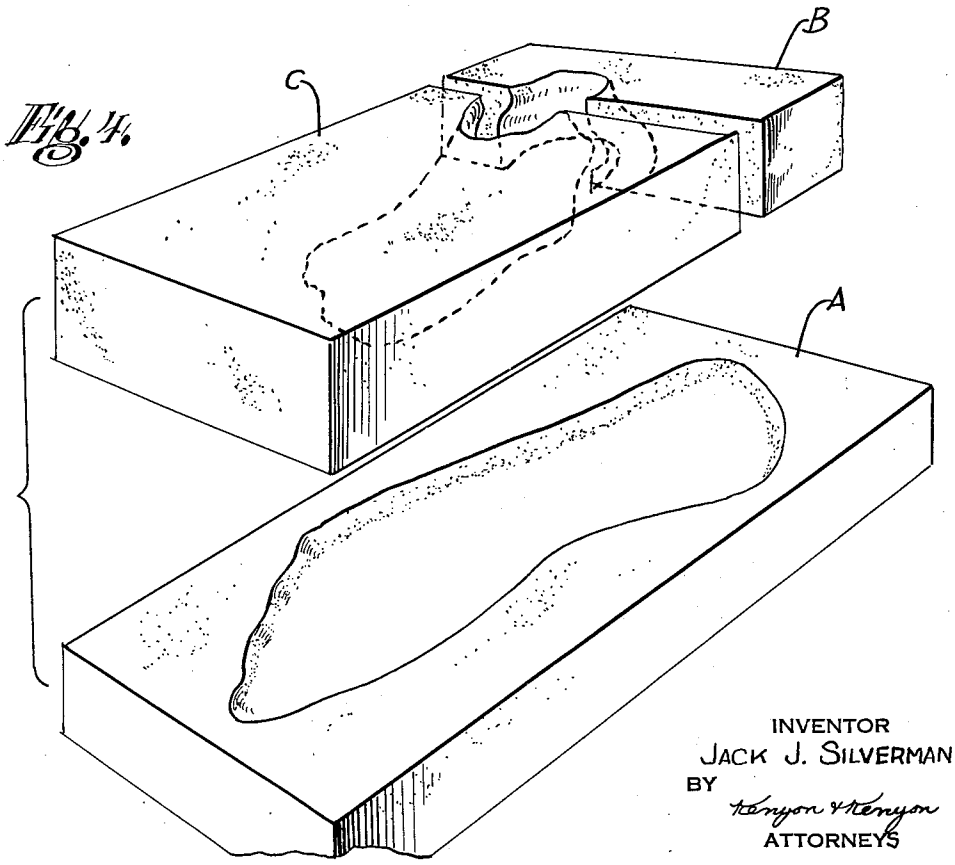


Fig. 4.

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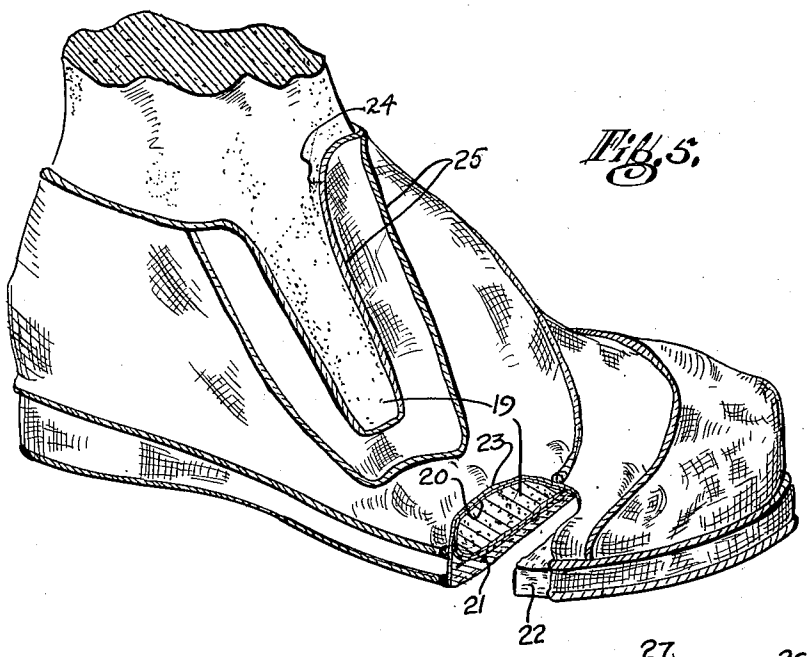


Fig. 5.

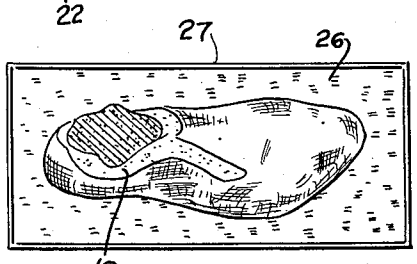


Fig. 6.

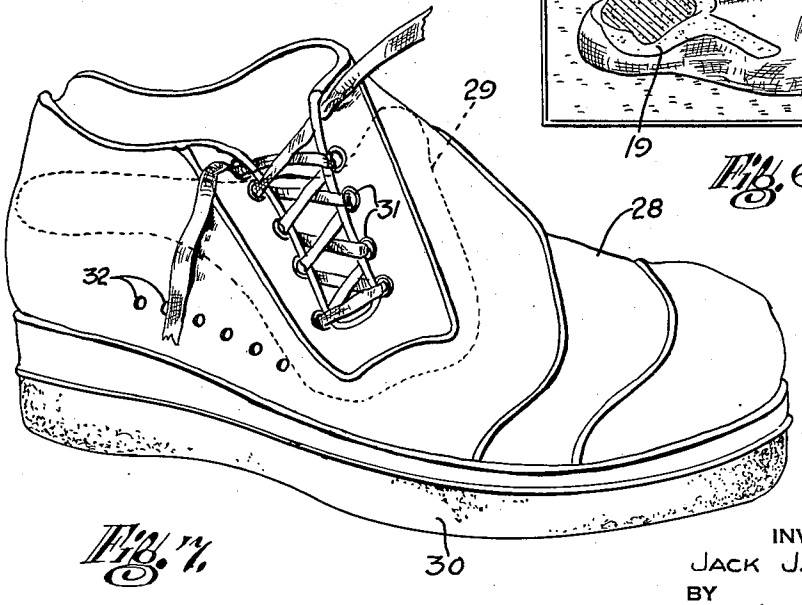


Fig. 7.

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TECHNIQUE FOR MAKING SHOES

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Filed Feb. 16, 1955, Ser. No. 488,658

3 Claims. (Cl. 12—142)

My invention relates generally to improved techniques for fabricating footwear, and more particularly to the custom manufacture of shoes which conform intimately to the natural contour of the individual foot for which they are intended.

In the science of podiatry it is now recognized that many foot difficulties are traceable to abuses arising from the use of shoes which are ill-fitting and fail to provide proper support. The nature of machine production is such that conventional ready-to-wear shoes are made to correspond to an idealized last having no human counterpart, rather than to the unique contours of the individual wearer. The range of variation in human foot shapes is so great that standardized width and length sizes in mass-produced shoes can at best only approximate the needs of the individual wearer. The fact that the plantar area of the foot has a depth of curvature and a contour which is different for each individual is disregarded in the machine-made shoe. Moreover, the fact that toes are intended by nature to perform a gripping action is altogether disregarded in conventional shoe design which takes no account of the function of digital members.

It is known to make so-called contour shoes which closely conform to the individual foot of the wearer. However, the processes heretofore practiced for this purpose are so elaborate and laborious as to render the cost of the product beyond the reach of a person of ordinary means. Not only are such shoes far more expensive than standard store shoes, but they are generally cumbersome, excessively heavy and unsightly in appearance.

In view of the foregoing, it is the principal object of the present invention to provide an improved and simplified technique for making natural contour shoes quickly, efficiently and at a substantially reduced cost.

More particularly, it is the object of my invention to provide a new process for forming a positive last which corresponds to the configuration of an individual foot in the static state, and which may be adjusted to make allowances for dynamic changes of the foot in action. The geometry of the last made in accordance with the invention is with reference to the natural angular position of the foot relative to the ground support therefor.

Still another object of my invention is to provide a new technique for molding a shoe about a last, whereby the resultant shoe conforms internally to the contours of the last. A shoe constructed in accordance with the invention is exceptionally light and sturdy, and presents an attractive appearance.

For a better understanding of my invention, as well as other objects and further features thereof, reference is made to the following descriptions thereof to be read in conjunction with the accompanying drawing, wherein like elements in the several views are represented by like reference numerals.

In the drawings:

Fig. 1 shows in perspective the rectangular box used to make the negative cast.

Fig. 2 is a side elevational view partly in section showing an individual foot placed in the box.

Fig. 3 is a perspective view showing the casting box as extended to form the upper sections of the cast.

Fig. 4 is a perspective view showing the three sections of the cast separated from each other.

Fig. 5 is a perspective view illustrating the first steps in forming the shoe about a last, the last covering being partly cut away to reveal various details of the shoe.

Fig. 6 is a plan view showing the placement of the covered last in an impressionable bat.

Fig. 7 is a perspective view of the finished shoe with the last removed therefrom.

Making the last

In carrying out my invention, it is necessary first to make a positive last which conforms to the shape of the individual foot, and thereafter to mold a shoe to the contours of the last, whereby the resultant shoe properly accommodates the wearer's foot.

Referring now to Fig. 1, the first step in the making of the last involves the formation of a negative cast by the use of a relatively shallow rectangular box **10**, which may be of cardboard, tin or other material. The overall dimensions of the box depend on the foot size of the individual for whom shoes are being prepared. Placed on the bottom of box **10** is a rectangular mat **11** of soft sponge rubber having a slope in the longitudinal direction to simulate the elevation of the heel relative to the sole. The degree of incline of mat **11** depends on the desired height of the heel; for example, the incline is made greater where a woman accustomed to a high heel is involved.

A layer of sand **12** about a quarter inch in depth is poured on top of mat **11** to separate the mat from the plaster to be poured thereon and to act as a buffer for the plaster. Wet plaster **13** is then poured over the sand. The plaster is constituted by plaster of Paris mixed with water to a cream-like consistency and thereafter carefully strained by a suitable mesh to remove all lumps. The straining of the plaster is of great importance, for otherwise the last will be rendered imperfect.

As shown in Fig. 2, the prospective wearer, whose foot **14** is shown, is made to sit on a chair **15**, with his foot inserted in box **10**, the foot sinking into the soft plaster to form an impression therein. Care is taken to see that no more than leg weight is imposed on the foot, this being accomplished either by adjusting the height of the chair seat or that of the box relative to the seat. In addition, the leg must be in vertical alignment with the box, this being accomplished by tying the leg of the wearer to the chair leg or by other suitable means such as a brace.

As indicated by the dashed line in Fig. 2, the level of the plaster is such as to reach a height slightly above the top of the toes. If the plaster level exceeds the desired height, it may be reduced by removing plaster with the fingers or by other means. The plaster **13** is then allowed to set to form the plantar or sole section of the negative mold, the process normally taking about 15 minutes.

After the plaster **13** forming the plantar section has hardened, the top surface thereof is painted with a separating medium, such as soapy water, oil or shellac. Then box **10** is provided with a vertical extension **15**, as shown in Fig. 3, to increase its depth. This may be done by a strip of cardboard wrapped about the sides of the box and held thereon by tape or other suitable means. Additional plaster **16** is now poured over the entire foot up to and including the ankles. Thin pieces of metal or rigid plastic pieces **17** and **18** are inserted in the plaster **16** at either side of the foot and at the center of the ankle, the pieces running down the foot with their bottom edges touching the top surface of plantar section **13**.

After plaster 16 has hardened, extension 15 is removed. To break open the cast, pieces 17 and 18 are struck gently, thereby causing the negative cast to come apart in three pieces. As shown in Fig. 4, the negative cast is constituted by the plantar section A, a dorsal section B and an instep section C, which sections when assembled provide an internal cavity whose dimensions conform to the model foot.

In making the positive last the three pieces A, B and C of the cast are first painted along their adjoining surfaces with a separating medium, and they are assembled and held together by a rubber band or other easily removed means. Wet plaster is then poured into the cavity through the ankle opening in the cast, the cast being entirely filled. After the plaster has hardened, the negative cast is broken apart to free the positive cast which is to be used as the last in the making of a shoe.

Making the shoe

In making the shoe the first step is to cover the entire last, designated by numeral 19 in Fig. 5, with a sheath of material that is firm and strong and yet possesses a degree of yieldability or give. Suitable material 20 for this purpose is monks cloth, felt or chamois. The covering material is preferably of coarse texture to provide a relatively rough gripping surface for the plantar of a wearer's foot. In covering the entire last with a material such as monks cloth it is necessary to overlap certain portions of the material. The overlapped portions are adhered together by latex rubber or a similar adhesive. This covering material becomes the lining of the shoe.

After the last 19 is entirely covered, the plantar or sole portion of the covering material 20 is painted with rubber latex. Then a piece of the same material 21 is cut out about a half-inch larger than the sole of the cast. The piece of material 21 is painted with rubber latex and attached to the under-surface of the last and flapped up on all sides, thereby reinforcing the sole lining.

As shown in Fig. 6 the covered last 19 is thereafter placed on a moldable bat 26 of an adhereable substance preferably consisting of a mixture of rubber latex and very fine wood flour having the consistency of heavy cream, the wood flour including ground cork in pellet size for purposes of lightness. The bat is formed in a tray 27 at least an inch larger than the cast, both in the longitudinal and transverse dimensions. In the bat the heel portion of the last is raised relative to the sole portion by means of a suitable cork post placed in the bat where the heel is to be. Thus the insole ultimately formed has a wedge shape to provide the necessary heel elevation. After the bat has hardened the excess is cut away at the sides thereof up to the vertically projected outline of the cast to form the inner sole 22 so that the contour of the insole-shaped member thus formed conforms to that of the plantar area of the covered last 19. The upper surface of the bat carries the impression of the sole and bottom surfaces of the toes of the covered last, this impression being fixed in the hardened bat, whereby the bat which constitutes the inner sole locks in the bottom curvatures of the foot.

At this point, the entire upper portion of the covered last, and the peripheral edge of the inner sole 22 attached thereto, is further covered with a protective material 23, which material may be the same as that of material 20. Material 23 is adhered to material 20 by means of rubber latex. Preferably a double layer of material 23 is employed to impart the necessary body to the wall of the shoe.

The covering on the cast 19 is then cut below the ankle and a side slit 24 is cut into the covering to provide a shoe lacing area. A decorative cord 25 is now attached to the covering and along the margin of all cut surfaces. A curved line of cord may be applied at various points along the covering for purposes of embossed design effects in the finished shoe.

A piece of wet leather 28 (Fig. 7) is now placed over the last covering, the leather having first been brushed with rubber latex. The leather is molded and tooled over the last to form the outer cover of the shoe. The leather is then cut along slit 24, and the last is broken and removed from the shoe. Of course, instead of leather outer materials such as cotton duck or canvas may be used.

A leather lining 29 is now glued to the inner wall of the shoe running round the shoe about one inch from the top as indicated by the dashed line in Fig. 7. The excess leather outer and lining are trimmed down to the fabric lining. Finally, an outer sole 30, formed of sponge rubber or the like, is applied to the bottom. Suitable eyelets 31 for laces are punched along the margin of the slit 24 and apertures 32 are punched along the sides for purposes of shoe ventilation.

The last 19, as above-described, is made to conform to the foot in the shape and size assumed in the static condition. However, inasmuch as the foot in the dynamic state, that is when in walking movement, is slightly extended in length, this factor is taken into account by the addition to the forepart of the last of a small felt pad. The covering of the last is carried on with the pad attached thereto, thereby effectively lengthening the shoe size. This pad is removed when the last is broken.

It is also desirable that the lateral sides of the counter of the shoe be caused to hug the heel of the foot snugly. With this in mind, it is my preferred practice to scrape away the plaster on the lateral sides of the heel portion of the last to an extent of about $\frac{1}{32}$ of an inch, thereby tightening the fit of the shoe at the heel portion.

As explained hereinabove, the first step in making the molded shoe is to cover the entire last with a sheath of material, such as monks cloth or chamois. Alternatively, in accordance with the invention, this first covering may be constituted by a knitted half sock whose size is appropriate to the last. The sock may be made of cotton, wool or of synthetic yarn. Preferably, the sock is of the modern stretchable type formed, for example, of Helanca yarn having a nylon core such that the sock will conform to the dimensions of the last and hug snugly thereon. The remaining steps in the making of the shoe are as previously disclosed.

While the process has been described in connection with a so-called half shoe, it is to be understood that the invention is not limited to this form and may be carried out successfully to produce shoes of the slipper or loafer type as well as full shoes providing an ankle covering.

While there has been shown and described a preferred process in accordance with the invention, it will be appreciated that many changes and modifications may be made thereon without departing from the essential aspect of the invention. It is intended therefore in the appended claims to cover all such changes and modifications as fall within the true scope of the invention.

What is claimed is:

1. In the process of fabricating a shoe conforming to a last having the shape of a human foot, the steps of covering the entire last with a flexible and pliable lining of a nature appropriate to serve as a shoe lining, placing the last so covered on a wet bat to form a plantar impression therein, said bat being of a settable material which in its set form is adhereable to said lining and is of a flexibility suitable as a shoe insole, said bat lying in a tray whose dimensions are greater than the size of said last, permitting said bat to set and adhere to said covered last, and trimming the excess margin from the hardened bat to provide an insole-shaped member.

2. The process of fabricating a shoe conforming to a last having the shape of a human foot, comprising the steps of covering the entire last with a flexible and pliable lining material of a nature appropriate to serve as a shoe lining, placing the covered last on a wet mold-

able bat of adhereable material to form a plantar impression therein, the margin of said bat extending beyond the borders of said last, permitting said bat to set and to adhere to said covered last, said set material being of a flexibility suitable as a shoe insole, trimming the excess margin from the hardened bat to provide an insole-shaped member, further covering the upper of said covered last and the edges of said insole with a protective sheath, covering said protective sheath with a leather outer, and attaching an outer sole to said insole to complete the shoe.

3. The process of fabricating a shoe conforming to a last having the shape of a human foot, comprising the steps of covering the entire last with monk's cloth, applying a reinforcing piece of monk's cloth to the bottom of said covered last and flapping up the sides of said reinforcing piece, placing the last so covered on a bat constituted by a settable material to form an impression therein, said material when set being adhereable to said monk's cloth and having a flexibility suitable as a shoe insole, said bat having a vertical post therein to so limit the last impression as to raise the heel level of the last

relative to the sole thereof, the margin of said bat extending beyond the borders of said last, permitting said bat to set and adhere to said last, trimming the excess margin from the hardened bat to provide an insole-shaped member, further covering the upper of said covered last and the edges of said insole with a protective sheath formed by a double layer of monk's cloth, covering said sheath with a leather outer, and attaching an outer sole to said insole.

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