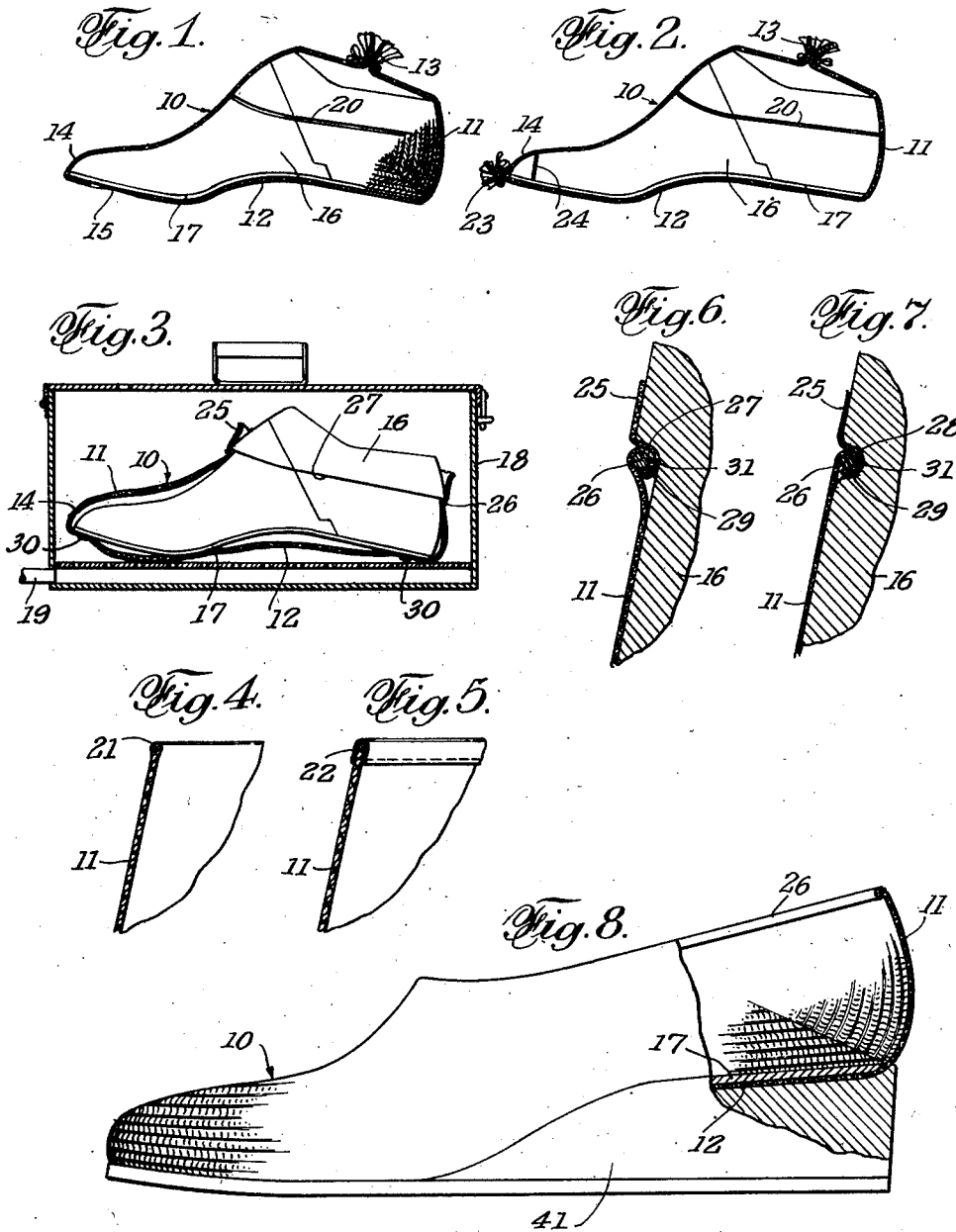


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METHOD FOR PRODUCING KNITTED SHOE
UPPERS OF SHRINKABLE YARN
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METHOD FOR PRODUCING KNITTED SHOE UPPERS OF SHRINKABLE YARN

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This invention relates to shoe construction and more particularly to a method for producing shoes having knitted, woven, crocheted or similar textile fabric uppers. While the uppers employed in the present method may be fabricated as indicated in the various ways above mentioned, at the present time, they are most advantageously knitted. Accordingly, this term will be hereinafter employed to also include mesh or net fabric regardless how the same may be produced.

In attempts to satisfactorily produce a knitted shoe upper, many difficulties have been encountered and, up to the present time, have not been solved. A prerequisite for obtaining a satisfactory shoe upper is that the same properly conform to the last on which formed without wrinkles and unduly thick bulges at certain parts, good appearance and comfort being highly important.

The present invention employs the shrinking and thermoplastic properties of fabrics knitted from synthetic yarns, of which a staple fiber spun from a copolymer of acrylonitrile and vinyl chloride, or a fiber of a thermoplastic copolymer of vinyl chloride and vinyl acetate, are examples that are spun into suitable yarns. The yarns produced from these copolymers have many inherent properties, of which imperviousness to water, high strength wet or dry, non-toxic effect on the skin, resistance to mildew and perspiration, non-inflammability, high resilience, and dyeability, render fabrics made of these yarns admirably suited for use as shoe uppers. For the purposes of this invention, the most important property of yarns, as above, and the fabrics made therefrom, is that, from an initially soft pliable state, by the application of heat, the fabrics can be shrunk as much as 50% and, in the process are hardened to a tough yet resilient condition that is form-retaining. Consequently, when such fabrics are shrunk over a last, the resultant uppers are form-retaining and yet are elastic and will change their form only under heat greater than the thermo-setting heat initially used.

In one prior attempt, of which we are aware and which failed and did not successfully reach the market, synthetic resin fabric, comparable to the above, was used as a skeleton or vehicle for chenille yarn that formed the main body of the fabric. Since chenille yarns do not have the shrinking properties of the synthetic yarns, the former bunched up at the vamp and in other places formed thickened and wrinkled portions that were not desired.

It is, therefore, an object of the present invention to provide a novel shoe-producing method that results in a knitted synthetic shoe upper that

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is of uniform thickness and free of wrinkles and bulgy portions.

Another object of the invention is to provide novel method steps for finishing off the upper edge of the upper to enable use of the same without lining or the like.

The foregoing and other objects, features and advantages of the invention will become more clearly evident from the following detailed description of the present novel method, the same having basis on the accompanying drawings, in which:

Fig. 1 shows in section an initially formed upper applied to a last preparatory to shrinking said upper.

Fig. 2 is a similar view showing another form of upper.

Fig. 3 shows still another form of upper on a last in a heating environment.

Figs. 4 and 5 are enlarged fragmentary sectional views showing two ways of finishing off the upper edge of uppers as made from the forms shown in Figs. 1 and 2.

Figs. 6 and 7 are similar views showing two ways of finishing off the upper edge of uppers as in Fig. 3.

Fig. 8 is a side elevational view, partly in section, of a shoe having an upper as formed by the present method.

According to the invention, the shoe upper is initially knitted in the form of a soft and pliable sock 10 from yarn spun from synthetic fibers of the type defined hereinabove, such fibers and yarn being hereinafter designated synthetic resin. The sock thus knitted has a foot-engaging upper portion 11 and a substantially complete bottom or sole portion 12. As shown in Figs. 1 and 2, an upper extension portion 13 is formed on the sock.

The soft sock 10 can be fabricated in various ways and by various means. It may be knitted on a sock-knitting machine in the conventional manner for such items. In such case, the toe portion 14 of a conventionally knitted sock has demarking lines which result from the changes in direction of the wales or courses of the knit. While such a sock may be employed, it is preferred, however, in most instances, to eliminate these lines by leaving a small opening in the sock where such lines may ordinarily be. Such an opening 15 is shown in the form of Fig. 1. This, however, is to be considered as a substantially whole bottom or sole.

It will be realized that the sock may be otherwise produced, whether initially seamless or not, as by knitting the same on flat or circular knitting machines or by hand, or crocheting or weav-

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ing the same. In any case, the result sought is a generally conventional soft sock form that has a substantially whole bottom or sole.

The sock thus produced is made considerably larger in size than the size to which the same is to be shrunk, but is not necessarily made in the full range of sizes in which shoes are made. At present, it is contemplated that four basic sock sizes will provide uppers which are usable over the complete range of stock shoe sizes. The last 16 over which the sock 10 is shrunk controls the size of the upper that is produced.

The considerably larger sock is pulled over last 16. However, before this is done, an insole 17 is positioned against the bottom of the last substantially as shown. The sock is then adjusted and centered on the last and the extension portion 13 is pulled, with reasonable tautness, to make the sock conform to the contours of the last. The excess of material above the last is bunched and tied in the manner suggested in the drawing. The opening 15 may be spanned by synthetic threads or bunched or gathered in the manner of portion 13.

The lasted sock is then subjected to a shrinking step which is suggested in Fig. 3 wherein a closed receptacle 18 encloses the sock and retains the same for a period of time in an atmosphere of heat. A steam inlet 19 supplies dry or wet steam, as desired, to the receptacle and the heat thereof is effective to shrink the sock tightly around the last, the fibers hardening in the process from their initial soft condition to a hard yet elastic condition. Other heating methods may be used, the same being chemical reaction, open flame, hot or boiling water, etc. In any case, the intent is to activate the synthetic fibers to cause them to retract or relax and, thereby, draw the knitted fabric upper tightly around the form of the last. The time of the heating step may vary according to proportion of the initial size of the sock and the shrunk size and according to the medium employed to effect shrinking. A minute or so is sufficient when steam is used and the shrinking is moderate. Longer time is used where greater shrinking is involved. By employing a heat medium that is of higher temperature, as between 212° and 250° F., the fibers set and retain the set form unless subjected to higher temperatures. The latter is unlikely, of course, under normal conditions.

The degree of shrink in any direction may be controlled as desired by knitting a sock in which the yarns have various weights and denier count in different directions. By varying said count for threads extending in one direction, the degree of shrinkage of such threads may be varied with respect to the shrinkage of other threads having a different denier.

The heating medium may be provided from within the last if the same is suitably perforated, the inlet therefor being applied through opening 15. Thus, shrinkage can be effected from the inside of the sock or from the outside thereof, as desired.

After a few minutes—five or ten—or when the lasted sock is cool enough to handle, the extension portion 13 is removed. As shown in Fig. 1, the last 16 may be provided with a guide groove 20 along which a cutter effects severance of portion 13 from the ultimate upper 11. If desired, the last may terminate along the line of groove 20, in which case, the top of the last will serve to guide a severing cutter.

The upper thus provided may then be relasted

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or left on last 16 and the heel and sole 41 is applied in the usual manner by pasting, cementing, or nailing, as the case may be.

The shoe is now complete except for providing a finish for the contour edge of the upper. As shown in Fig. 4, said edge may be seared with a heated tool to fuse the fibers of the yarn along the severance line to coagulate the same and form a finishing bead 21. This may be done before or after removal of the shoe from the last. Fig. 5 shows another edge-finishing method, the same entailing the application of a binding 22 by stitching, cementing or pasting the same in place. Since binding-applying machines are available, the latter edge-finishing step can be effectively accomplished.

As shown in Fig. 2, if open-toed uppers are desired, the sock is knitted with an open extension 23 at the toe, similar to but smaller than extension 13. In other respects, the shoe is processed as above described except that said extension 23 is severed from the upper as guided by a groove 24 provided in the last. The edge thus formed at the upper toe is bound as suggested in Figs. 4 and 5.

Another way of achieving a finished edge along the upper edge of the upper is shown in Figs. 3, 6 and 7. In this case the sock extension 13 may be materially reduced in length with the result that considerable material is conserved. As shown, the extension 25 is relatively short, being only long enough to enable folding the upper around a tightly applied binding cord or tape 26. This is expedited by providing the last 16 with a downwardly facing shoulder 27 as in Fig. 6 or with a groove 28 as in Fig. 7, said shoulder or groove, as the case may be, retaining the cord along a desired top line. Now, the slack and soft material of the sock may be tucked in behind the cord to form a double fold 29 that spaces the cord from the last substantially as shown. The body of the sock, being much larger than last 16, is loosely draped thereover as shown in Fig. 3. Of course, the size of the sock, relative to the size of the last, is such that the initially slack sock body will shrink tightly over the last, and the size of the opening in upper 11 such that the same is conformed to groove 28 by cord 26. If desired, tacks 30 or other suitable temporary means may be employed to center and align the loose sock on the last. The lasted sock is shrunk onto the last as hereinbefore set forth.

The sock shrinks to the line of the top line as defined by cord 26 and after the last is removed, it is only a matter of trimming away the extension 25, as along a line 31, to leave the upper with a properly finished top line. In Fig. 6, it will be seen that the finishing bead thus formed does not encroach on the shoe opening. While the bead of Fig. 7 does, the encroachment can be kept small by reducing the thickness of the cord.

From the method above disclosed, it will be seen that the shoe provided has an upper 11 and a substantially complete bottom 12, which are integrally formed of a knitted fabric. It will be evident that such a shoe will be form-retaining and, thus, will resist deforming. The thermo-set fabric is stable under all normal conditions, imparting to the shoe strength desirable in such items. The various knitting methods enable incorporation of beauty-enhancing designs in the fabric at no additional cost, a great latitude of employment of open work, etc., being available to the designer.

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Although the present invention has been described with respect to certain preferred methods, and steps thereof, it will be realized that variations may be practiced without departing from the spirit and scope of the invention. Accordingly, we desire to reserve to ourselves such modifications that may fall within the scope of the appended claims.

Having thus described the invention, what we claim and desire to be secured by Letters Patent is:

1. The method of making a shoe upper which consists in providing a knitted sock that has a substantially complete bottom and an upper integral therewith, said bottom and upper being formed of pliable and soft synthetic thermo-setting resin yarn that has the property of shrinking when subjected to heat, mounting the sock on a last that is substantially smaller than the initial size of the body of the sock upper and bottom, confining the upper portion of said upper along a line around the upper portion of the last in a manner to leave the portion of the sock upper below said line and the sock bottom in slack condition, applying heat to the sock to cause the slack portions of the same to shrink tightly onto the last below said line of confinement to change the sock from its initial soft and pliable larger condition to a smaller but stiffer pliable and

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form-retaining condition, and then removing that portion of the sock upper that is above the line of confinement.

2. The method according to claim 1, in which the sock upper, along its line of confinement, is folded on itself during its application to the last.

3. The method according to claim 1, in which the line along which the sock upper is confined around the last is coincident with a circumscribing shoulder provided in the last.

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