

[54] PROCESS OF MAKING FOOTWEAR

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[51] Int. Cl. A43d 9/00

[58] Field of Search 12/142 R, 142 RS, 142 E; 36/32 R, 30 R

2,941,316 6/1960 Hack..... 36/32 R
3,109,701 11/1963 Jacquet..... 12/142 RS

FOREIGN PATENTS OR APPLICATIONS

995,325 11/1951 France..... 12/142 RS

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[57] ABSTRACT

The invention disclosed is directed to skid-resistant footwear having an outer sole provided with grooves and wavy ribs spaced apart by the grooves. Also disclosed is an improved process for making the footwear, including injection molding a bottom onto a footwear upper employing a mold with a bottom plate having wavy elongate uprights.

10 Claims, 17 Drawing Figures

[56] References Cited
UNITED STATES PATENTS

3,717,943 2/1973 Orndorff 36/32 R
2,651,118 9/1953 Root 12/142 RS
2,928,192 3/1960 Green 36/32 R

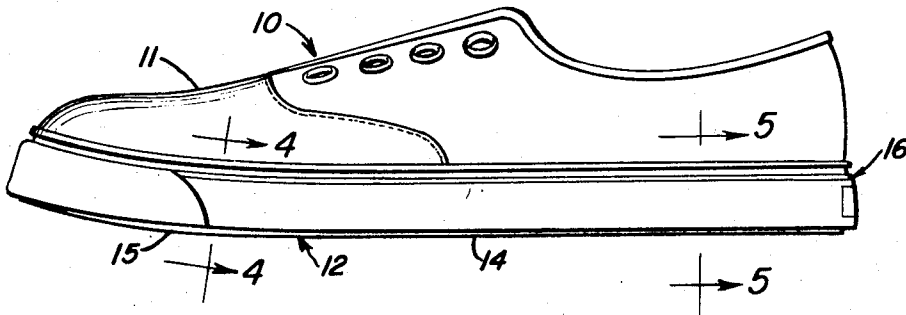


FIG. 1

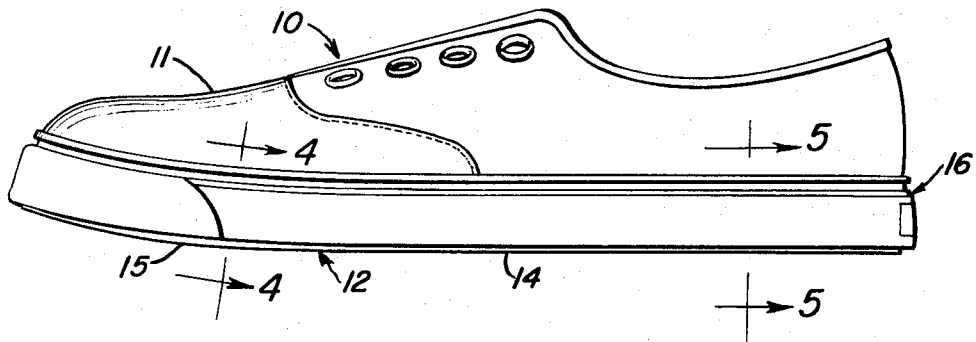


FIG. 2

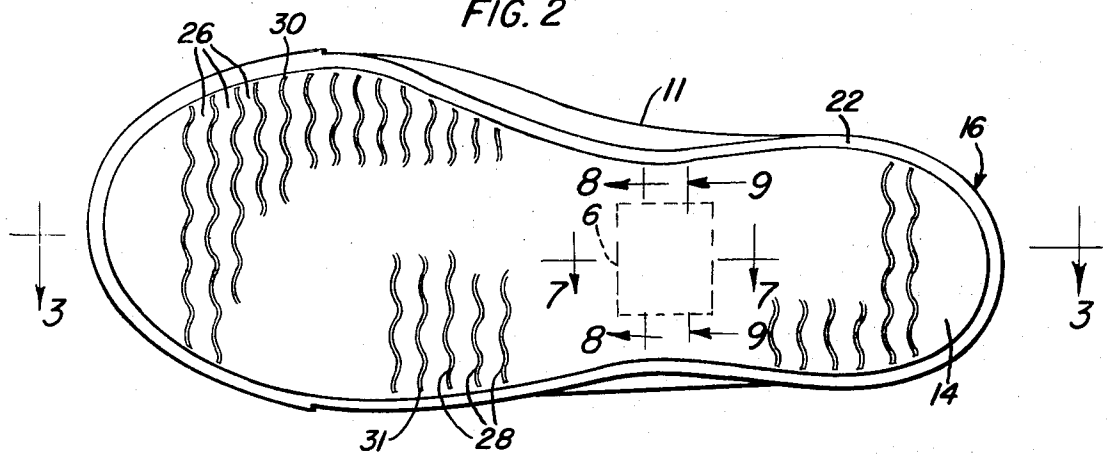


FIG. 3

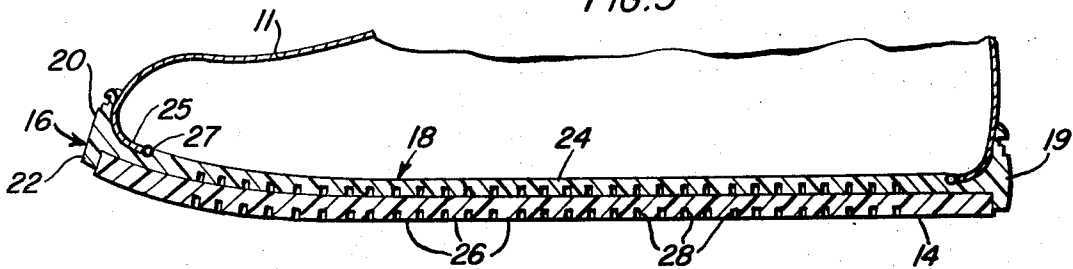


FIG. 4

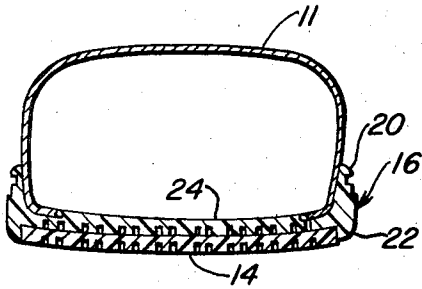


FIG. 5

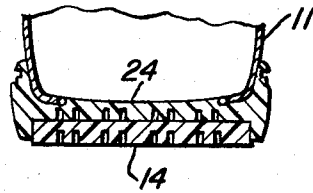


FIG. 6

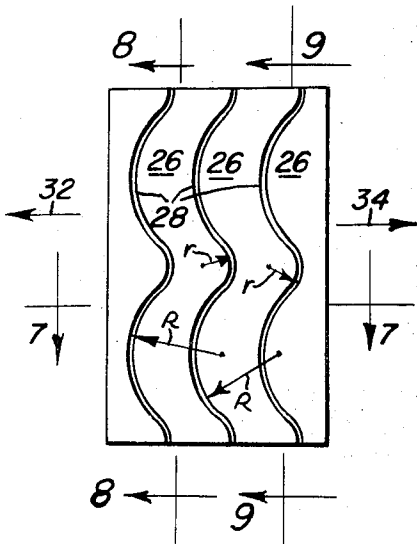


FIG. 8

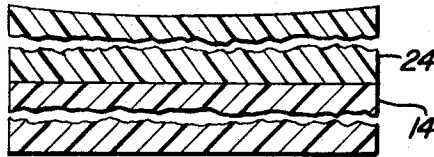


FIG. 9

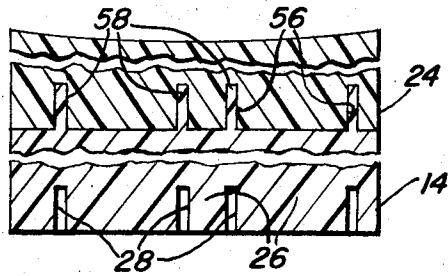
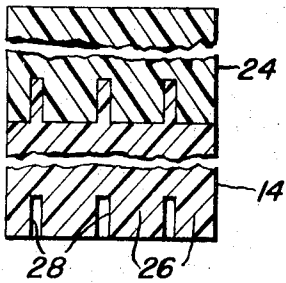


FIG. 7



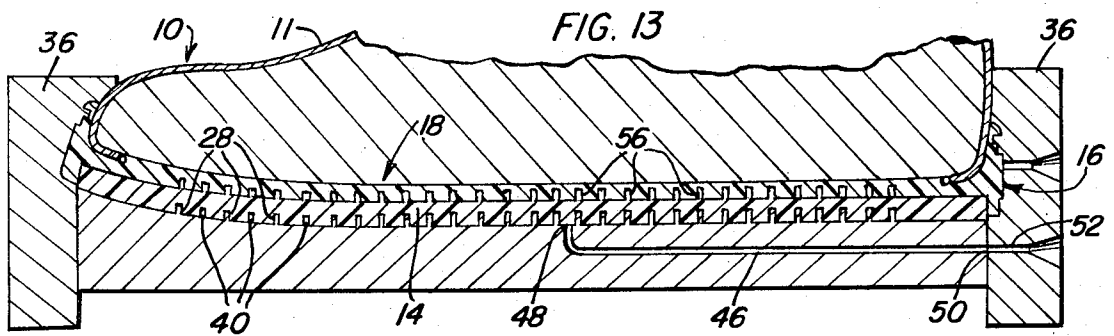
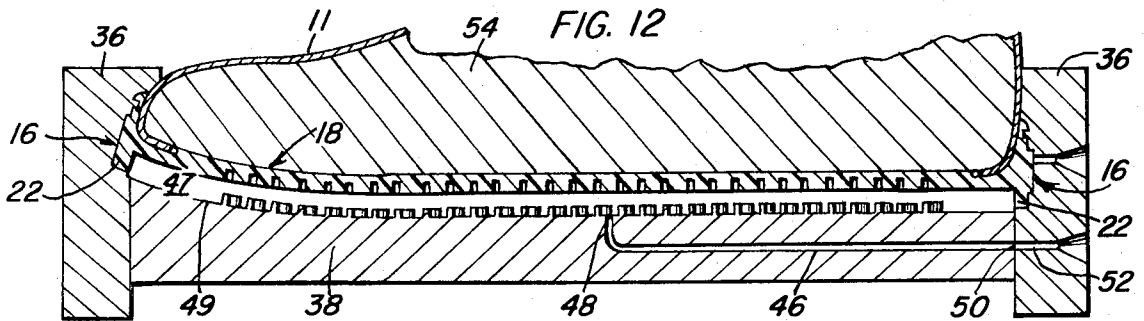
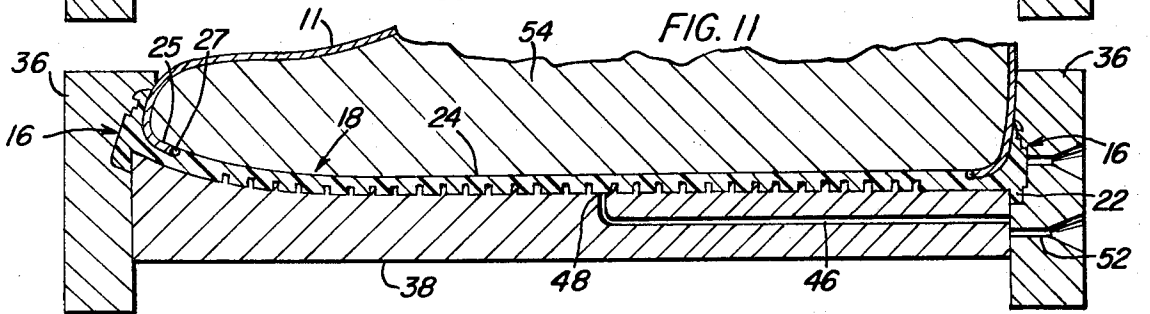
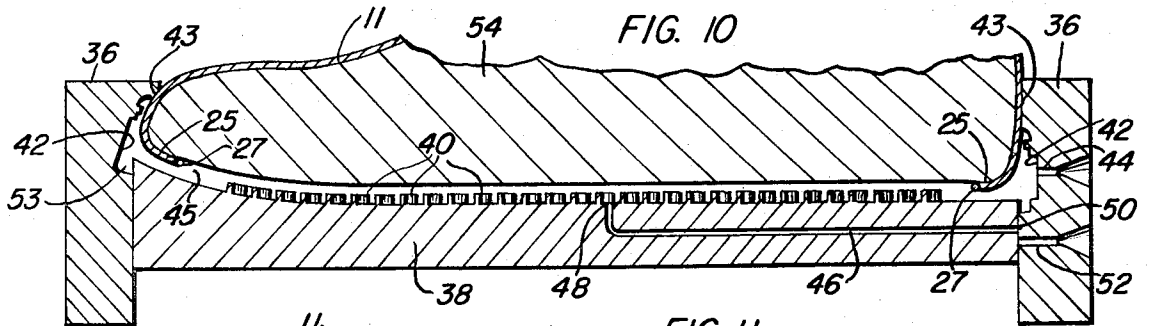


FIG. 14

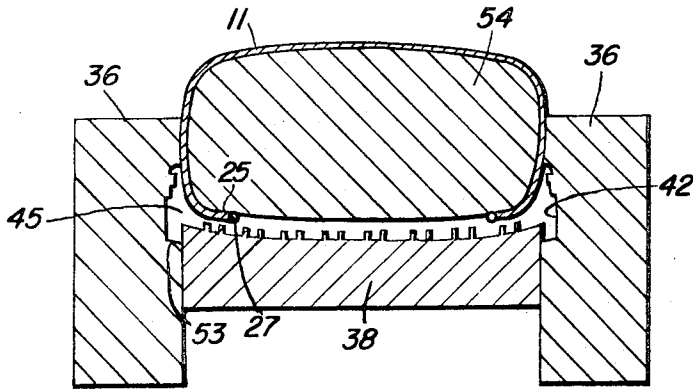


FIG. 16

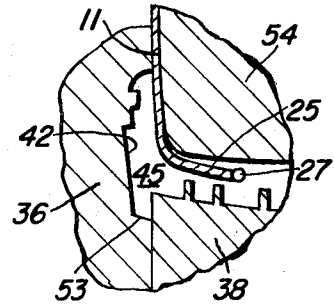


FIG. 15

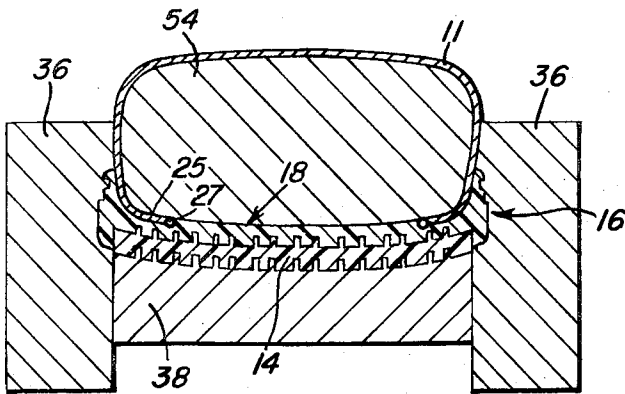
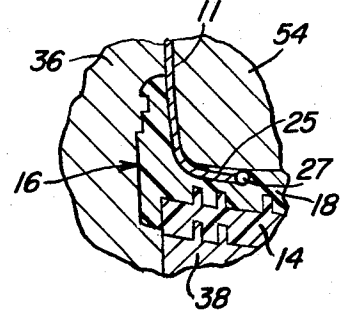


FIG. 17



PROCESS OF MAKING FOOTWEAR

The present invention relates to footwear of improved skid resistance having an outer sole provided with grooves and wavy ribs spaced apart by the grooves. The invention also provides improvements in footwear-making processes of the type which include forming and attaching a bottom to an upper by injection molding. The improvements include forming the bottom using a bottom plate having wavy elongate uprights for providing the grooves and ribs in the outer sole.

Numerous methods for forming footwear are available to the art. Generally, however, footwear forming methods known heretofore have not been entirely satisfactory for reasons such as complexity, inefficiency and others. Designs for soles of footwear or shoes are taught in U. S. Pat. D 117,585 to Sperry and in U. S. Pat. D 196,355 to Doherty. Soles provided with the Sperry U.S. Pat. D 117,585 design include zigzag slits in a smooth surface thereof and are characterized when at rest in that sections formed between the slits are in contact. It is a standard procedure in the shoe making industry to cut or punch slits in sole blanks and cut the slit blanks to prepare soles. However, the procedure has a number of drawbacks in that sensitive devices which form the slits are easily damaged and cutting soles from blanks typically results in waste of residual blank materials. Attaching the prepared sole to footwear undesirably requires great skill and care which, when not exercised, often result in formation of low quality footwear referred to in the art as rejects. In general, soles having the U.S. Pat. D 117,585 design have not been entirely satisfactory from not only the standpoint of skid resistance, but also from standpoints of efficiency in forming such soles and in making footwear employing the soles.

Soles of the Doherty U. S. Pat. D 196,355 design include a tread layer of complex tapering construction which provides less than the amount of ordinarily supportable tread surface desired by many wearers. Footwear provided with soles of such designs are of further limited utility in that the soles are difficult to clean and when the soles are pressed by the weight of a wearer against non-rigid supports, such as soft carpets and others, objectionable indentations result in the supports. Moreover, mud and other soils, particularly when wet, tend to cake in the acutely tapering recesses of such soles and after drying, such caking often is undesirably released.

Footwear having a molded bottom attached to an upper is well known in the art. It is conventional to make such footwear using processes of the type which include, in general, steps substantially as follows:

- a. providing a partial mold assembly having side mold means and a sole plate within the side mold means, said side mold means having an inner peripheral recess corresponding substantially in height to the height of the bumper portion of the bottom to be formed, with the side mold means and the sole plate defining an upwardly open hollow space;
- b. inserting a last-and-upper assembly into the hollow space, said last-and-upper assembly including a last and a footwear upper demountably mounted on the last, with the bottom of the upper extending inwardly under at least the bottom edge of the last, to engage the side mold means and to provide a

molding arrangement having a cavity defined by the lower portion of the lasted-upper assembly, the side mold means, and the sole plate, said molding arrangement having channel means connected to said cavity for injection filling the cavity with a solid-forming liquid material;

- c. injecting elastomeric solid-forming liquid material through the channel means to substantially fill the cavity in the molding arrangement; and
- d. permitting the injected liquid material to solidify to form a bottom attached to the upper.

Variations in the process are taught, for example, in U. S. Pat. No. 3,345,664 to Ludwig; U. S. Pat. No. 3,372,415 to King; U. S. Pat. No. 3,345,763 to Rollman; and in U. S. Pat. No. 3,510,968 to Hobbs et al.

It has now been found by practice of the present invention that footwear having a skid-resistant outer sole provided with grooves and wavy ribs spaced apart by the grooves is made in simple, economical manner. Such footwear may be made in accordance with this invention using minimum hand labor, thus overcoming numerous drawbacks of the prior art. Typically, more than half the labor involved in conventional footwear-forming methods may thus be eliminated.

Generally stated, the present invention provides improvements in conventional footwear-making processes of the type which is generally set forth above. The improvements include using in processes of the foregoing type a sole plate having a multiplicity of spaced apart elongate uprights extending transversely of the longitudinal axis of the sole plate in generally parallel wavy relationship one to others, with thickness of the uprights being from about 0.05 to about 1 millimeter longitudinally of the sole plate. When made by the improved process of this invention, the present footwear may be characterized with better resistance to skidding without detracting from wear resistance thereof and without sacrificing foot comfort.

Practice of the present invention will become more apparent from the following detailed description taken in conjunction with the accompanying drawings wherein like numerals refer to similar elements throughout the several views.

In the drawings:

FIG. 1 is an elevation view longitudinally of a shoe having a molded bottom generally illustrating footwear of the present invention;

FIG. 2 is a plan view of the shoe of FIG. 1 illustrating the groove-containing outer sole thereof;

FIG. 3 is a longitudinal section of the shoe taken on line 3—3 of FIG. 2, with part of the upper removed;

FIG. 4 is a transverse section of the shoe illustrated in FIG. 1 taken on line 4—4 thereof;

FIG. 5 is a transverse section of the shoe of FIG. 1 taken on line 5—5 thereof;

FIG. 6 is an enlarged plan view of the part of the bottom within broken rectangular line 6 of FIG. 2 showing part of the outer sole in greater detail;

FIG. 7 is an enlarged longitudinal section taken on line 7—7 of FIG. 2 and FIG. 6;

FIG. 8 is an enlarged transverse section taken on line 8—8 of FIG. 2 and FIG. 6;

FIG. 9 is an enlarged transverse section taken on line 9—9 of FIG. 2 and FIG. 6;

FIG. 10 is an elevation section longitudinally of a molding arrangement for making footwear having a multiple groove-containing outer sole according to the

improved process of this invention, illustrating the sole plate employed, with the sole plate in a position for forming an upper sole;

FIG. 11 illustrates, in sectional view resembling FIG. 10, an upper sole formed according to the process;

FIG. 12 is a view showing the molding arrangement after lowering the sole plate to a position for injecting outer sole material;

FIG. 13 is a sectional view similar to FIG. 12, illustrating an outer sole formed according to the process;

FIG. 14 is an elevation section transversely of the molding arrangement prior to injecting material to form the upper sole;

FIG. 15 is a sectional view similar to FIG. 14, illustrating a shoe bottom made using the process;

FIG. 16 is an enlarged fragmentary section of the mold illustrating the shoulder portion of an embodiment lasted upper; and

FIG. 17 illustrates, in a view resembling FIG. 16, embodiment footwear with the upper more deeply embedded in the upper sole.

Footwear made according to the improved process of this invention is illustrated by shoe 10 shown in an elevation view in FIG. 1, in a bottom plan view in FIG. 2 and in longitudinal elevational section in FIG. 3. The shoe includes upper 11 of suitable flexible material to which is attached bottom part 12 which includes outer sole 14 connected to the upper by bumper portion 16 which is peripheral of the bottom and integral with inner portion 24 of upper sole 18 (FIG. 3). As shown in FIG. 2 generally, and more fully described herein below, the bottom includes a number of wavy ribs 26 which are spaced apart by a multiplicity of elongate grooves 28 extending transversely of the longitudinal axis of the shoe in generally parallel wavy relationship one to others. The grooves must be from about 0.05 to 1 millimeter in thickness, measured longitudinally of the bottom part. The outer sole may include margins 30 and 31 between opposite ends of the grooves and the bumper portion.

Details in the construction of the shoe are more clearly illustrated by the sectional views shown in FIGS. 3, 4 and 5, which are taken along lines 3-3, 4-4 and 5-5 respectively (FIGS. 1 and 2). The bumper or edge portion includes midpart 19 with ridge 20 projecting upwardly from the midpart and fitting tightly about upper 11 in outwardly facing portions of the lower shoulder thereof. The bumper includes lower portion 22 which projects downwardly from the midpart and contains the outer or tread sole 14. The lower shoulder of the upper includes shelf 25 extending inwardly of the bumper with lasting string 27 attached to the edge of the shelf by stitching not shown. The topside of inner portion 24 of the upper sole may be concavely arcuate transversely of the shoe, as generally shown in the transverse sectional elevation views of FIG. 4 and FIG. 5. Generally, concave upper soles provide greater comfort to the feet of wearers.

The ribs and grooves provided in the outer sole of footwear made according to this invention are illustrated in greater detail in FIGS. 6-9. Generally, the grooves must be from about 0.05 to about 1 millimeter in thickness, measured longitudinally of the outer sole. It is found that grooves which are larger than about 1 millimeter in thickness trap objects causing discomfort or annoyance to the wearer, while grooves which are smaller in thickness generally fail to provide adequate

skid resistance to the shoe. The grooves preferably are in the range from about 0.2 to about 0.3 millimeter in thickness. The inner portion of the upper sole may be of a foam material. The bumper portion and the tread surface of the outer or lower sole are preferably of dense wear-resistant elastomeric material. The grooves in the outer sole permit flexing of the ribs and reflexing to non-biased position, and are generally found to aid in minimizing wear of the sole tread surface.

As a general preference, the grooves are of generally rectangular U-shape in vertical section longitudinally of the shoe. It is found that grooves of such shape normally resist clogging with mud or other soils and at least do not uncontrollably release such soils in the event that clogging does obtain, thereby increasing the versatility of the shoe with respect to where it may be suitably worn. It is also generally found that grooves of thin rectangular shape provide good balance between anti-caking and receptivity to water such that good traction is provided on slippery surfaces, for example, on boats where water often collects in slip producing manner. The present shoe is thus eminently suitable for use by wearers even on surfaces of boats and other slippery surfaces.

In a preferred embodiment, the curvature of the grooves bears a relationship to the thickness thereof such that the ribs provided in the sole are solid in transverse vertical section taken, as at line 8-8 (and shown in FIG. 8) forwardly of the foremost parts of the rear face of a rib and rearwardly of the rearmost parts of the forward face of the same rib. As used herein, the words "forward," "forwardly" and "foremost" refer to the forward or toe end of the sole (or the direction thereof), the location of which is indicated in FIG. 6 by directional arrow 32; and the terms "rearward," "rearwardly" and "rearmost" refer to the opposite or heel end of the sole (or the direction thereof), the location of which is indicated by directional arrow 34.

The sides of the various grooves which appear as wavy lines transversely of the sole in the plan view of FIG. 6 include a plurality of spaced apart arcuate toewards convex portions and a plurality of spaced apart arcuate toewards concave portions, generally as illustrated, with the convex portions connected one to others in repeated manner by the concave portions and with the concave portions connected one to others in repeated manner by the convex portions. It is unexpectedly found that skid resistance is further improved by providing grooves having sides characterized in that the average radius r of the arcuate side portions which face in a first direction is relatively small with respect to the average radius R of the arcuate portions facing in the opposite direction as shown in FIG. 6.

While the grooves may be of almost any depth, groove depth of about 2 to about 5 millimeters is found suitable. Flexibility of the ribs is dependent on the material of which the lower sole is formed. In general, however, suitable flexibility is provided by ribs having longitudinal thickness corresponding to from about 0.8 to about 2 times the depth of the grooves. A sole which is generally preferred includes, in combination, ribs having longitudinal thickness from about 2 to about 3 millimeters and grooves having longitudinal thickness of about 0.1 to about 0.3 millimeter and depth of about 2 to about 3 millimeters. In general, ribs corresponding in thickness to more than about 5 times the depth of

the grooves are insufficiently flexible to provide adequate skid resistance.

As used herein, the term "elastomer" means any and all plastics or plastic-like materials embodying characteristics of resiliency and capability of being rendered plastic for a sufficient length of time to be injected into a mold to form the bottom part of a shoe and to be then caused to set, cure, harden, solidify or otherwise become relatively dimensionally stable. Suitable solid-forming liquid materials which may be used to form the bottom of the shoe are exemplified by, but not limited to, polyvinyl chloride mixtures, rubber, polyurethane mixtures and the like.

Referring to FIGS. 10-15, the present process for making footwear, illustrated by shoe 10, includes providing a mold assembly having side mold means, illustrated by split ring side molds 36, and sole plate 38. In accordance with this invention, the sole plate has a multiplicity of wavy elongate uprights 40 extending transversely of the longitudinal axis of the plate in generally parallel relationship one to others for providing grooves 28 in shoe 10. The thickness of the uprights generally must be from about 0.05 to about 1 millimeter longitudinally of the sole plate. It is found that uprights which are more than on one millimeter in thickness form unsuitably thick grooves in outer soles, while uprights which are less than 0.05 millimeter in thickness are of inadequate damage resistance for economical use thereof. For greater protection against these and other undesirable results, the uprights preferably are of thickness in the range of from about 0.2 to about 0.3 millimeter. Split ring side mold 36 includes inner peripheral recess 42 corresponding substantially in height to the height of the bumper portion of the bottom to be formed, with the side mold and the sole plate defining an upwardly open hollow space. The side mold includes lip 43 above recess 42 for engagement with a lasted upper inserted into the hollow space. A lasted upper assembly including upper 11 lasted about last 54 is inserted into the mold space to form a molding arrangement wherein the lasted upper is in engagement with mold lip 43 and having cavity 45 (FIG. 10) defined by the lower portion of the lasted upper assembly, the side mold, and the sole plate. The molding arrangement is provided with means for injection filling cavity 45 as illustrated by passage 44 which connects recess 42 to the outer edge of the side mold and may have a tapered end for receiving an outlet nozzle of an injection extruder. Sole plate 38 may be provided with means for injecting elastomeric material as illustrated by passage 46 having a first port 48 in plate surface 49 and a second port 50 for flow communication with passage 52 provided in the side mold (FIGS. 12 and 13).

The lasted upper assembly may be any suitable arrangement of an upper on a last, examples of which include Mackay lasted uppers, vertical welt and string lasted uppers, and lasted uppers with sewn-in upper soles for contacting the foot of a wearer.

Elastomeric solid-forming liquid material is injected as through passage 44 to substantially fill the cavity 45 (FIGS. 10 and 14) while the sole plate is in a first position characterized in that bottom edge 53 of the recess in the side mold is below the shoulder of the sole plate as shown in FIGS. 10, 11 and 14. The sole plate is maintained in the first position until the injected material solidifies or hardens substantially throughout to form upper sole 18 attached to the upper and having bumper

portion 16 peripherally of inner portion 24 of the upper sole as shown in FIG. 11. It is found that sole plates formed of aluminum or alloys thereof or almost any material of thermal conductivity on the order of that of aluminum reduce the time for solidification to take place. Uprights 40 are found to aid in minimizing solidification time. The plate may be provided with additional means for cooling such as holes (not shown) with cooling water circulated therethrough.

After upper sole 18 sets or solidifies to form a dimensionally stable structure, the sole plate is lowered to a second position characterized in that the bottom edge of the recess is slightly above the shoulder of the plate, thus providing cavity 47 within downwardly projecting portion 22 of the bumper 16 as shown in FIG. 12. Cavity 47 may then be filled by injecting solid-forming liquid material through passage 52, port 50, passage 46 and port 48 in sufficient amount to at least substantially fill the cavity. The plate is maintained in the second position for a suitable time to permit setting or solidification of the injected material, resulting in formation and bonding of groove-containing outer sole 14 to upper sole 18 as shown in FIGS. 13 and 15. The mold is thereafter opened as by retracting a half-ring of the side mold to permit removal of the molded bottom shoe which may be demounted from the last in any suitable manner. Residual injection molding material may be withdrawn from the various passages in any suitable manner as by means of sprue extractor apparatus disclosed in U. S. Pat. No. 3,588,958 to Metzger.

The sole plate may have upright-free margins between the opposite ends of the uprights and the peripheral edge of the sole plate, the sole plate margins corresponding to margins 30 and 31 of the outer sole as shown in FIG. 2. It is found that sole plates having margins provide longer and more efficient service with less accidental damage to the uprights.

In footwear made by the above-described two-step injection embodiment of the present improved process and illustrated by shoe 10, wavy elongate projections 56 of the outer sole 14 are tightly received in corresponding grooves 58 in the upper sole, thereby providing added strength to the bond. The two-step injection process has the added advantage that different plastic compositions may be used for the upper sole and for the outer sole. The different compositions may also differ in color, thereby providing greater versatility.

Optionally, outer sole 14 and upper sole 18 may be formed of one piece construction in a one-step injection operation in which the sole plate is initially placed in the second position, i.e., omitting the first plate position and injecting solid-forming liquid material into the resulting cavity.

While the bottom of the outer sole may have any suitable shape, it is found that generally better skid resistance and increased bottom durability are provided by a preferred embodiment of the present process using a sole plate with the sole plate surface 49 arcuately tapering longitudinally upwardly from generally about the middle of the sole plate or slightly forward thereof to within a one inch region near the toe end in a manner corresponding generally to longitudinally arcuate forward portion 15 of the outer sole as illustrated in FIG. 1. The forward portion of the outer sole may be formed of transversely arcuate upwardly concave shape as shown in FIG. 4 by molding with a sole plate the for-

ward portion of which is transversely arcuate as shown in FIG. 15.

Sole plates for use herein may be formed using any suitable forming method. For example, the sole plate may be made from an appropriate piece of metal stock, preferably aluminum or aluminum alloy stock, using conventional milling techniques.

The shape of the uprights provided on the sole plate should be substantially the same as the shape of the grooves to be provided in the outer sole being formed. Thus, as a general preference, the uprights are generally of rectangular U-shape in vertical section longitudinally of the sole plate. The tops of the uprights may suitably be above the sole plate surface across which the uprights extend by from about 2 to about 5 millimeters. Spacing between the uprights may be from about 0.8 to about 2 times the height of the uprights. A generally preferred shoe is made using a sole plate with uprights spaced apart at a distance from about 2 to about 3 millimeters, the uprights being from about 0.1 to about 0.3 millimeter in thickness longitudinally of the sole plate and from about 2 to about 3 millimeters in height as measured between the tops of the uprights and the sole plate surface across which the uprights extend. The uprights may have sides characterized in that the average radius of arcuate side portions facing in a first direction is small relative to the average radius of oppositely facing side portions, corresponding to the grooves illustrated in FIG. 6. Where sole plate margins corresponding to outer sole margins 30 and 31 are included, they preferably are at least about one millimeter in width transversely of the sole plate.

The enlarged fragmentary view of FIG. 16 (corresponding to a portion of FIG. 14) and the enlarged fragmentary view shown in FIG. 17 (corresponding to a portion of FIG. 15) show an arrangement of the upper on the last in another embodiment of this process. It is seen that the lower margin or shelf 25 of the upper may be drawn by string 27 to a position tapering inwardly and slightly downwardly away from last 54. Upon injection molding in the foregoing manner, this embodiment results in further embedding the shelf and string in the molded bottom and thus provides a smoother foot contacting surface to the added comfort of the wearer.

It is to be understood that the foregoing detailed description is given merely by way of illustration and that various modifications may be made therein, including in the improvements provided by the present invention and in the basic heretofore known process, without departing from the spirit or scope of the present invention.

What is claimed is:

1. In a process for making footwear having a molded bottom attached to an upper, said process including:

a. providing a partial mold assembly having side mold means and a sole plate within the side mold means, said side mold means having an inner peripheral recess corresponding substantially in height to the height of the bumper portion of the bottom to be formed, with the side mold means and the sole plate defining an upwardly open hollow space;

b. inserting a last-and-upper assembly into the hollow space, said last-and-upper assembly including a last and a footwear upper demountably mounted on the last, with the bottom of the upper extending inwardly under at least the bottom edge of the last,

to engage the side mold means and to provide a molding arrangement having a cavity defined by the lower portion of the lasted-upper assembly, the side mold means, and the sole plate, said molding arrangement having channel means connected to said cavity for injection filling the cavity with a solid forming liquid material;

c. injecting elastomeric solid forming liquid material through the channel means to substantially fill the cavity in the molding arrangement; and

d. permitting the injected liquid material to solidify to form a bottom attached to the upper;

the improvement which comprises using a sole plate having a multiplicity of spaced apart elongage uprights extending transversely of the longitudinal axis of the sole plate in generally parallel wavy relationship one to the others, with thickness of the uprights being from about 0.05 to about 1 millimeter longitudinally of the sole plate and the spacing between the uprights to the height of the uprights being from about 0.8 to about 5.

2. The process of claim 1 wherein the thickness of the uprights is from about 0.2 to about 0.3 millimeter longitudinally of the sole plate.

3. The process of claim 1 wherein the tops of the uprights are above the sole plate surface across which the uprights extend by from about 2 to about 5 millimeters.

4. The improved process of claim 1 wherein the uprights are of generally rectangular U-shape in vertical section longitudinally of the sole plate.

5. The process of claim 1 wherein said uprights are from about 0.1 to about 0.3 millimeter in thickness longitudinally of the sole plate and from about 2 to about 3 millimeters in height, the distance between the uprights being from about 2 to about 3 millimeters.

6. The process of claim 1 wherein the sole plate surface is arcuately tapered longitudinally upwardly from about the middle of the surface to within one inch of the toe end and is of transversely arcuate upwardly concave shape in said longitudinally arcuate portion.

7. The process of claim 1 wherein the improvement further includes lasting the upper such that the bottom of the upper tapers inwardly and slightly downwardly away from the last.

8. In a process for making footwear having a molded multipart bottom attached to an upper, said process including:

a. providing a partial mold assembly having side mold means and a movable sole plate within the side mold means, said mold means having an inner peripheral recess corresponding substantially in height to the height of the bumper portion of the bottom to be formed, with the side mold means and the sole plate defining an upwardly open hollow space;

b. inserting a last-and-upper assembly into the hollow space to engage the side mold means, said last-and-upper assembly including a last and a footwear upper demountably mounted on the last, with the bottom of the upper extending inwardly under at least the outer portion of the bottom of the last;

c. moving the sole plate to a first position characterized in that the bottom edge of said recess is below the shoulder of said plate to provide a mold having a first cavity defined by the lower portion of the last-and-upper assembly, the side mold means, and the sole plate;

- d. injecting elastomeric solid-forming liquid material to substantially fill the first cavity in the mold;
- e. maintaining the plate in said first position until the injected material solidifies substantially throughout to form a first sole attached to the upper and having a bumper portion peripherally of its inner portion;
- f. providing a second cavity by lowering the sole plate to a second position characterized in that the bottom edge of said recess is slightly above the shoulder of the plate;
- g. injecting solid-forming liquid material to substantially fill the second cavity; and
- h. maintaining said plate in the second position until the liquid material injected in part (g) solidifies substantially throughout to form a lower sole attached to said first sole;

the improvement which comprises using a sole plate having a multiplicity of spaced apart elongate uprights extending transversely of the longitudinal axis of the sole plate in generally parallel wavy relationship one to others, with thickness of the uprights being from about 0.05 to about 1 millimeter longitudinally of the sole plate.

9. The process of claim 8 wherein the sole plate includes margins between the opposite ends of said uprights and the sole plate periphery.

10. In a process for making footwear having a molded bottom attached to an upper, said process including:

- a. providing a partial mold assembly having side mold means and a sole plate within the side mold means, said side mold means having an inner peripheral recess corresponding substantially in height to the

- height of the bumper portion of the bottom to be formed, with the side mold means and the sole plate defining an upwardly open hollow space;
- b. inserting a last-and-upper assembly into the hollow space, said last-and-upper assembly including a last and a footwear upper demountably mounted on the last, with the bottom of the upper extending inwardly under at least the bottom edge of the last, to engage the side mold means and to provide a molding arrangement having a cavity defined by the lower portion of the lasted-upper assembly, the side mold means, and the sole plate, said molding arrangement having channel means connected to said cavity for injection filling the cavity with a solid forming liquid material;
- c. injecting elastomeric solid-forming liquid material through the channel means to substantially fill the cavity in the molding arrangement; and
- d. permitting the injected liquid material to solidify to form a bottom attached to the upper;

the improvement which comprises using a sole plate having a multiplicity of spaced apart elongate uprights extending transversely of the longitudinal axis of the sole plate in generally parallel wavy relationship one to the others, with thickness of the uprights being from about 0.05 to about 1 millimeter longitudinally of the sole plate, said uprights having first arcuate side portions facing in a first direction and connected by oppositely facing arcuate side portions, the average radius of the first arcuate portions being relatively smaller than the average radius of the oppositely facing arcuate portions.

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