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(71) Applicant: **THE STRIDE RITE CORPORATION**
Five Cambridge Center
Cambridge Massachusetts(US)

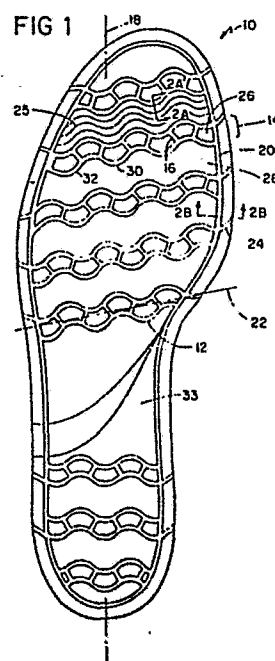
(72) Inventor: Giese, Erik O.
150 Ocean Lane Drive
Key Biscayne Florida(US)

(72) Inventor: Brown, Roger J.
217 Cottonwood Lane
Aspen Colorado(US)

(74) Representative: Deans, Michael John Percy et al,
Lloyd Wise, Tregear & CO. Norman House 105-109
Strand
London WC2R OAE(GB)

(54) Slip-resistant sole.

(57) A slip-resistant shoe sole (10) comprising an outsole layer having a bottom surface defining a region of contact between the sole and the ground, the outsole layer bearing a plurality of channels 12, 16, 30, opening onto the bottom surface to define a pattern of elongated gaps across the contact region, the ratio of the area of the gaps to the surface area of the contact region and the configuration of the gaps being arranged to effectively cause liquid between the contact region and the ground to be conducted away while enhancing the slip resistance produced by the contact region engaging the ground.



SLIP-RESISTANT SOLE
Background of the Invention

The invention relates to slip-resistant shoe soles.

5 Slip resistance can be improved by special tread patterns in the bottom surface of the outsole, and by siping the bottom of the outsole (i.e., incising parallel wavy cuts).

Summary of the Invention

10 In general, the invention features a slip-resistant shoe sole comprising an outsole layer having a bottom surface defining a region of contact between the sole and the ground, the outsole layer bearing a plurality of channels opening onto the bottom
15 surface to define a pattern of elongated gaps across the contact region, the ratio of the area of the gaps to the surface area of the contact region and the configuration of the gaps being arranged to effectively cause liquid
20 conducted away, while enhancing the slip resistance produced by the contact region engaging the ground.

In preferred embodiments, the outsole layer bears a plurality of siping slits (preferably only in the toe area); the ratio of the area of the gaps to the
25 surface area of the contact region is no less than 10% and no more than 40%; each gap is no less than 1/16" wide; each gap is bounded by wiping edges where walls of the channel meet the bottom surface, the wiping edges being contoured to include sections perpendicular to a
30 longitudinal axis of the sole and sections at oblique angles to the longitudinal axis, whereby liquid between the contact region and the ground is effectively forced into the channels and conducted to the perimeter of the

sole, enhancing the slip resistance produced by the contact region engaging the ground at an angle of attack either along or oblique to the longitudinal axis; the portions of the contact region between the elongated

5 gaps include friction pads no shorter than 3/16" (preferably 1/4") in their shortest dimension and no longer than 0.60" in their longest dimension; each channel has walls which meet the contact region at an angle greater than 105° (preferably 110°); the friction

10 pads include friction bars which run transversely across the sole and bear siping slits to improve slip resistance; each friction bar is at least 3/8" (preferably 1/2") and no more than 0.60" in the longitudinal dimension, and bears at least two siping

15 slits; the channels include a plurality of parallel transverse wavy grooves spaced apart along the length of the contact region, the wavy grooves are paired, the grooves of each pair are connected by a plurality of straight grooves to define a sequence of friction pads

20 between the grooves of each pair, and successive pairs of the grooves are separated by friction bars which run substantially uninterrupted transversely across the bottom surface of the outsole layer; at least some of the elongated gaps are arranged in a pattern of

25 concentric arcs centered on a point in the ball area, and adjacent elongated gaps are connected by straight gaps oriented along radii of the pattern; the sole includes shock foam inserts in the ball and heel areas; the sole includes siping (three parallel wavy cuts

30 undulating the same as the wavy grooves) on at least some of the friction bars; and the contact region is flat.

The grooves conduct liquid toward the shoe perimeter (i.e., away from weight-bearing and contact

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surfaces), and the wiping aids by wiping the contact surface, thus improving the friction between the contact region and the ground and reducing slipping and hydroplaning. The wiping edges enhance the wiping of liquid into the grooves. The contour of the wiping edges assures that wiping will occur even when the shoe strikes the ground in directions oblique to the longitudinal axis of the sole. The void-to-contact ratio of gap area to contact area enhances both the conducting of liquid away from the shoe and the frictional slip-resistance of the contact region against the ground. The size of the channels assures adequate space for the conducting of liquid, and the angle of the channel walls minimizes the accumulation of small objects in the channels. The large angle between the channel walls and the contact region (i.e., the high draft of the channels) aids in ejecting foreign objects. The sizes of the friction pads aid in their flexibility, and enable the friction pads to move independently of each other to provide good contact with the ground even during unusual foot movements or uneven weight distribution, e.g., movements on boat decks. The friction pads and bars are large enough to reduce the likelihood of damage to them. In embodiments having grooves in a concentric arc pattern in the ball area, the sole effectively grinds particles, e.g., food, lying on the ground, thus reducing the likelihood of the user slipping. The shock foam inserts reduce shock to the user's foot, and provide more uniformity of pressure distribution to the bottom of the outsole. The flatness of the contact region improves the slip resistance.

Other advantages and features will become apparent from the following description of the preferred embodiments and from the claims.

Description of the Preferred EmbodimentsDrawings

Fig. 1 is a bottom view of a shoe sole according to the preferred embodiment;

5 Figs. 2a, 2b are cross-sectional views taken at 2a-2a and 2b-2b of Fig. 1 and showing respectively the wavy grooves and the Littleway groove in the preferred embodiment;

10 Fig. 3 is a top view of the preferred embodiment;

Fig. 4 is a bottom view of an alternate embodiment.

Fig. 5 is a bottom view showing representative alternative siping patterns.

15 Structure

Referring to Fig. 1, the bottom surface of outsole 10 (men's size 10) has a tread pattern with sixteen transverse wavy grooves 12 on the toe and heel areas. Grooves 12 are arranged in pairs 14, with the
20 grooves of each pair connected by short straight grooves 16 each of which is oriented perpendicular to the two grooves of the pair and oblique to the longitudinal axis 18 of outsole 10. Each groove pair 14 extends from one side to the other side of outsole 10 in a region
25 outlined by Littleway stitching groove 20 which follows along the perimeter of outsole 10. In the toe area, the axis 22 of each groove pair 14 is oriented at an 80° angle to axis 18. In the heel area, each groove pair 14 is oriented perpendicular to axis 18. In each groove
30 pair 14 (except for the rearmost pair), one of the grooves 12 has an extension 24 which passes beyond Littleway groove 20 to the very edge of outsole 10. Within each groove pair 14, a row of friction pads 26 is defined by grooves 12, 16. Each friction pad is no

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shorter than $3/16$ ", and no longer than 0.60 ", preferably $1/4$ ", long (i.e., in the direction of the longitudinal axis 18). Between adjacent groove pairs 14 are friction bars 28, each of which is at least $3/8$ ", and no longer than 0.60 ", preferably $1/2$ ", long (in the direction of longitudinal axis 18). Each friction bar 28 in the toe area bears a siping pattern 29 of three wavy cuts which undulate like grooves 12 (in Fig. 1, the siping is only shown on one of the frictions bars). Each groove 12, by virtue of its wavy contour, has some sections which are perpendicular to axis 18 and other sections which are at various oblique angles to axis 18.

The heel portion of outsole 10 extends forward into the medial region to define an arch support 33.

Referring to Figs. 2a, 2b, grooves 12, 16, 20 are 0.080 " deep v-shaped channels whose side walls 34 meet the bottom surface 36 of outsole 10 at an angle of at least 105° (preferably 110°). The corners where side walls 34 meet bottom surface 36 form wiping edges 35. Each groove 12, 16 thus forms a gap 38 of no less than $1/16$ " (preferably 0.080 ") in bottom surface 36.

The void-to-contact ratio of the contact region of the ball and heel areas (i.e., the ratio of the area represented by gaps 38 to the aggregate area of contact between the ball and heel areas and the ground) is between about 10% and about 40%, preferably about 20%.

Outsole 10 is molded of rubber (available under the name Sperry compound from Goodyear Tire & Rubber Company) having a durometer of 60-65 shore A. Outsole 10 is molded with the bottom surface 36 as flat as possible, minimizing doming or curving, to increase the contact area.

Referring to Fig. 3, outsole 10 is molded with recesses in its upper surface to receive shock foam inserts 42, 44 in the toe and heel areas respectively. The edges of the recesses are 0.520" from the perimeter of outsole 10. Inserts 42, 44 are respectively 0.20" thick and 0.40" thick and are molded of shock attenuating foam (e.g., EVA, Sportcell, or cushion crepe). The perimeter of outsole 10 is marked by wheeling 45.

10 Operation

When outsole 10 strikes a wet ground surface, the wiping edges 35 wipe the liquid into grooves 12, 16, 20, which then conduct the liquid to the perimeter of the outsole. Extensions 24 further conduct the liquid away from the outsole. The pressure between the ground and friction pads and bars 26, 28 also forces the liquid into grooves 12, 16, 20. The wiping aids in the wiping of the ground surface. The ground is left drier allowing the pads and bars 26, 28 to effectively grab the ground surface. These effects occur whether the outsole strikes the ground surface in the direction of longitudinal axis 18 or obliquely to the axis. The ratio of gap area to contact area (void-to-contact ratio) in the range between 10% and 40% maximizes both the conducting of liquid away from the shoe and the frictional slip-resistance of the contact region against the ground. Pebbles or other objects are not caught in the grooves because the grooves are relatively open. The sizes of the friction pads promote their flexibility which enhances friction and enables them to flex independently, while reducing the likelihood of damage to them.

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In one test of the coefficient of friction of an outsole like that of Fig. 1 (but having two siping cuts per friction bar rather than three), a resin surface, simulating a fiberglass boat deck, was flooded with water and the sole (which was pressed against the resin surface by weights) was caused to slide both along the longitudinal axis of the outsole and in directions oblique to the longitudinal axis. The measured peak dynamic coefficient of friction was 1.5, and the average dynamic coefficient of friction was 0.9+.

Referring to Fig. 5, the tested average dynamic friction coefficients of various outsoles (including an outsole in accordance with the invention and other outsoles) having different void-to-contact percentages are shown. Each "*" indicates the average coefficient for a particular sole pattern. The test involved weighting the outsole with a 120 lb. load and sliding it across a wet surface. The results reflect an average of five trials. The range of results among the five trials is represented by the shaded band. The highest dynamic friction coefficients occurred with void-to-contact percentages in the range of 10% to 40%, preferably 20%.

Alternate Embodiments

Referring to Fig. 4, in other embodiments outsole 100 (for use by restaurant employees) has a tread pattern of grooves 102.

In the toe area, there are six concentric arc-shaped grooves 102 (for men's size 10) centered on a point 104 near the inside edge of the toe area. Adjacent arc-shaped grooves are separated by successively greater intervals at greater distances from point 104. Adjacent arc-shaped grooves 102 are connected by short straight grooves 106 which are aligned on radii centered at point 104. Littleway groove 108 follows along the perimeter of outsole 10. Extensions 110 of some of the arc-shaped grooves, and of

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some of the short straight grooves, extend beyond Littleway groove 108 to the edge of outsole 110.

In the heel area are five arc-shaped grooves 112 which are generally perpendicular to the longitudinal axis 114 of outsole 100 and extend from side to side in the region outlined by Littleway groove 108. Two of the grooves 112 extend beyond Littleway groove 108 to the edge of outsole 100.

Grooves 102, 108 and extensions 110 are 0.090" deep v-shaped channels which form gaps of 0.110" in the bottom surface of outsole 100. Each channel has a bottom radius of 0.04" to 0.06". The side walls of each channel meet the bottom surface at an angle of 105°.

Outsole 100 is molded of rubber having a durometer of 52-56 Shore A scale.

The pattern of outsole 100 is particularly suitable in uses which require frequent rotational or swiveling motion around the ball area.

In one test of the coefficient of friction of an outsole like that of Fig. 4, a quarry tile surface, typical of restaurant floors, was flooded with water or with soapy water. With regular water, the average dynamic friction coefficient was over 1.0, and with soapy water about 0.95.

Other embodiments are within the following claims. For example, referring to Fig. 6, a variety of other siping patterns can be used. The undulations of each cut can be more frequent (200) than in Fig. 1. The number of cuts on each friction bar can be more or less than three (200). The undulations can be relatively frequent waves superimposed on less frequent waves (202, 204, 206) and the orientations of the superimposed more frequent waves can either be coordinated with the

longitudinal axis (206) or with the less frequent waves on which they are superimposed (202, 204).

Other compounds (having different friction and other characteristics) and other hardness values can be
5 used for the sole composition.

Claims

1. A slip-resistant shoe sole comprising
an outsole layer having a bottom surface
defining a region of contact between the sole and the
5 ground,

said outsole layer bearing a plurality of
channels opening onto the bottom surface to define a
pattern of elongated gaps across the contact region,

the ratio of the area of the gaps to the
10 surface area of the contact region and the configuration
of the gaps being arranged to effectively cause liquid
between the contact region and the ground to be
conducted away while enhancing the slip resistance
produced by the contact region engaging the ground.

15 2. The sole of claim 1 wherein the outsole
layer bears a plurality of siping slits.

3. The sole of claim 2 wherein the siping
slits appear across less than the entire contact region.

4. The sole of claim 3 wherein the siping
20 slits appear in the toe area.

5. The sole of claim 1 wherein the ratio of
the area of the gaps to the surface area of the contact
region is no less than 10% and no more than 40%.

6. The sole of claim 1 wherein each gap is no
25 less than 1/16" wide.

7. The sole of claim 1 wherein
each gap is bounded by wiping edges where walls
of the channel meet the bottom surface,

the wiping edges being contoured to include
5 sections perpendicular to a longitudinal axis of the
sole and sections at oblique angles to the longitudinal
axis,

whereby liquid between the contact region and
the ground is effectively forced into the channels and
10 conducted to the perimeter of the sole, enhancing the
slip resistance produced by the contact region engaging
the ground at an angle of attack either along or oblique
to the longitudinal axis.

8. The sole of claim 1 wherein the portions of
15 the contact region between the elongated gaps comprise
friction pads,

at least some of the friction pads being no
shorter than 3/16" (preferably 1/4") in their shortest
dimension.

20 9. The sole of claim 8 wherein at least some
of the friction pads are no longer than 0.60" in their
longest dimension.

10. The sole of claim 1 wherein each channel
comprises walls which meet the contact region and the
25 angle between each of the walls and the contact region
is greater than 105° (preferably 110°).

11. The sole of claim 8 wherein the friction
pads include friction bars which run transversely across
the sole, and the friction bars bear wiping slits to
30 improve slip resistance.

12. The sole of claim 11 wherein each friction bar is at least 3/8" (preferably 1/2") in the longitudinal dimension, and bears at least two siping slits.

5 13. The sole of claim 12 wherein each friction bar is no more than 0.60" in the longitudinal dimension.

10 14. The sole of claim 1 wherein the channels comprise a plurality of parallel transverse wavy grooves spaced apart along the length of the contact region, the wavy grooves are paired, the grooves of each pair being connected by a plurality of straight grooves to define a sequence of friction pads between the grooves of each pair, and successive pairs of the grooves are separated by friction bars which run substantially uninterrupted
15 transversely across the bottom surface of the outsole layer.

15 15. The sole of claim 1 wherein at least some of the elongated gaps are arranged in a pattern of concentric arcs centered on a point in the ball area, and adjacent elongated gaps are connected by straight
20 gaps oriented along radii of the pattern.

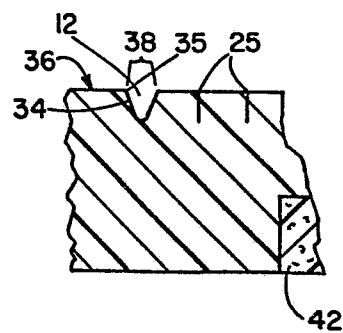
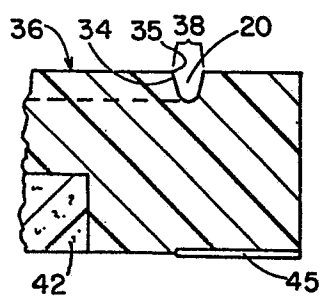
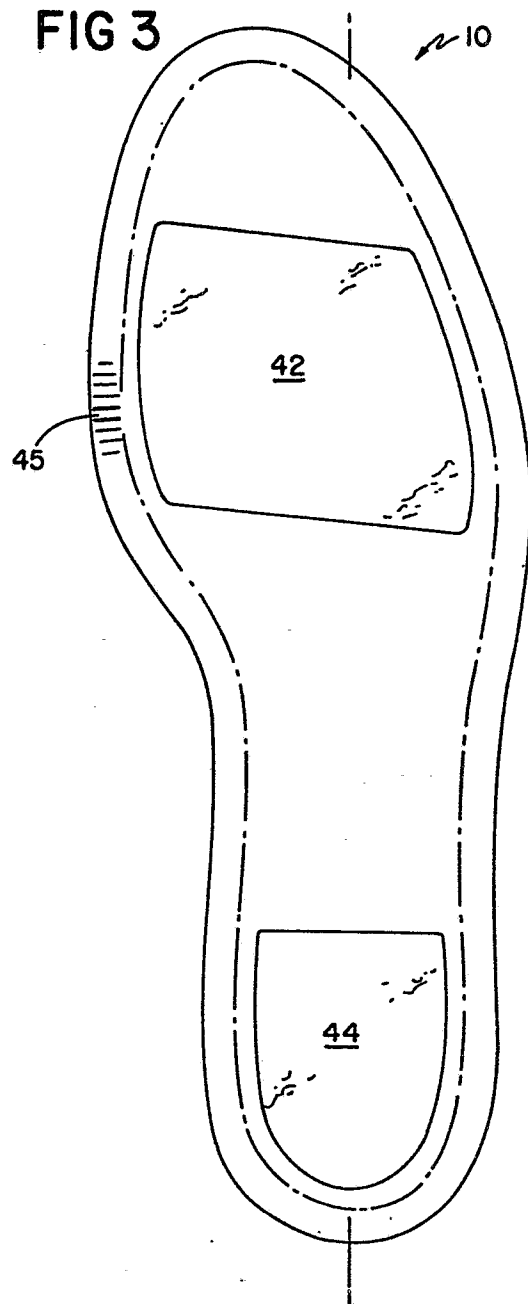
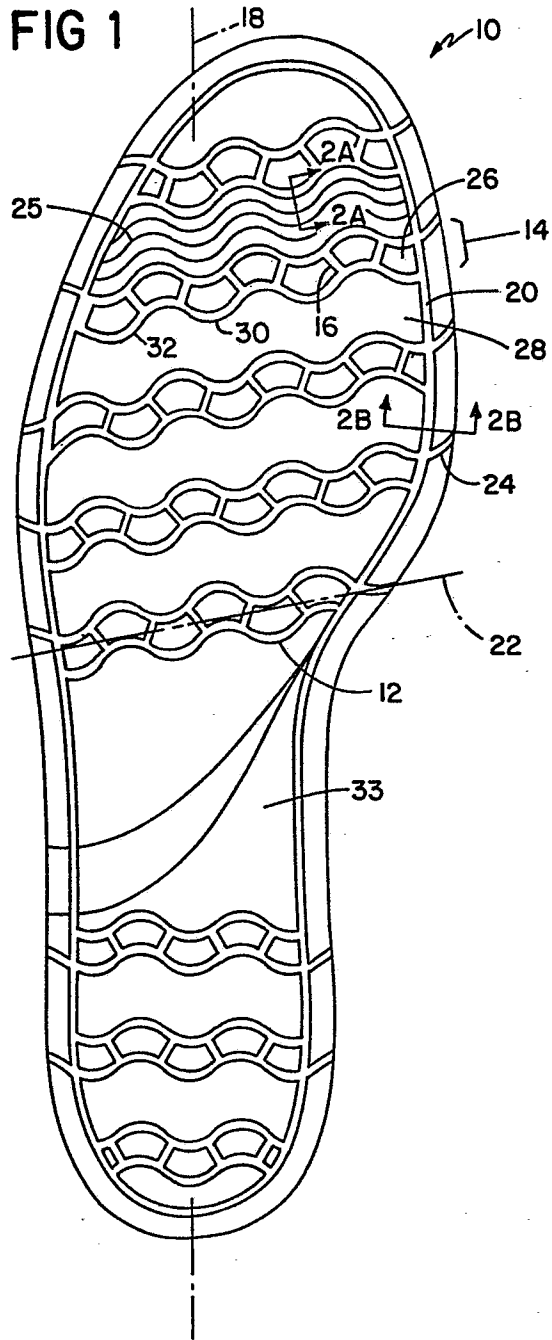
16. The sole of claim 1 further comprising shock foam inserts in the ball and heel areas.

25 17. The sole of claim 10 further comprising siping on at least some of the wavy friction bars.

18. The sole of claim 17 wherein the siping comprises a set of three parallel wavy cuts on each friction bar.

5 19. The sole of claim 18 wherein the undulations of each wavy cut are the same as the undulations of the wavy grooves.

20. The sole of claim 1 wherein the contact region is flat.



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FIG 4

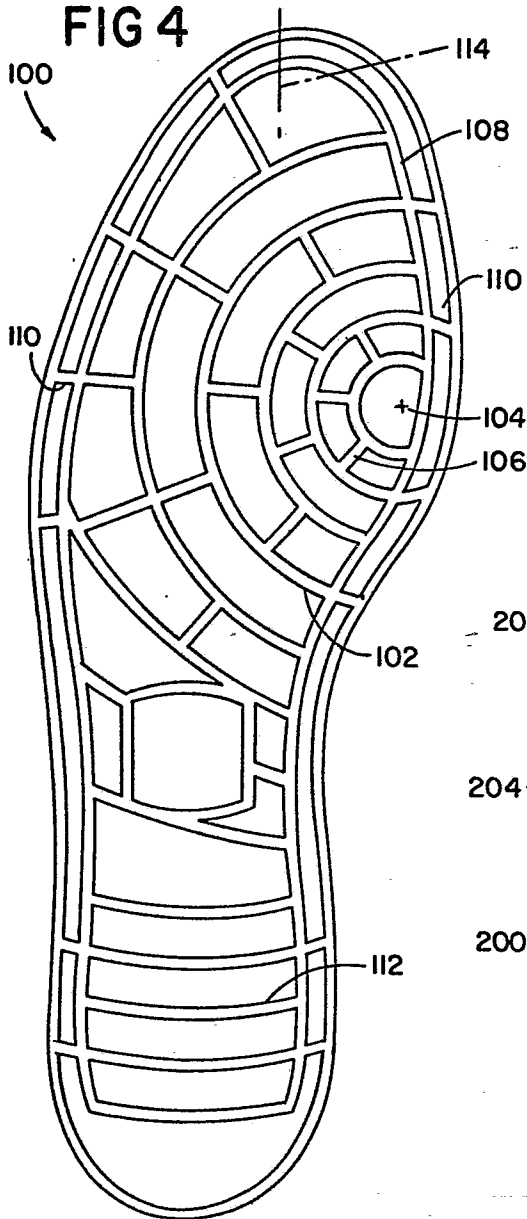


FIG 6

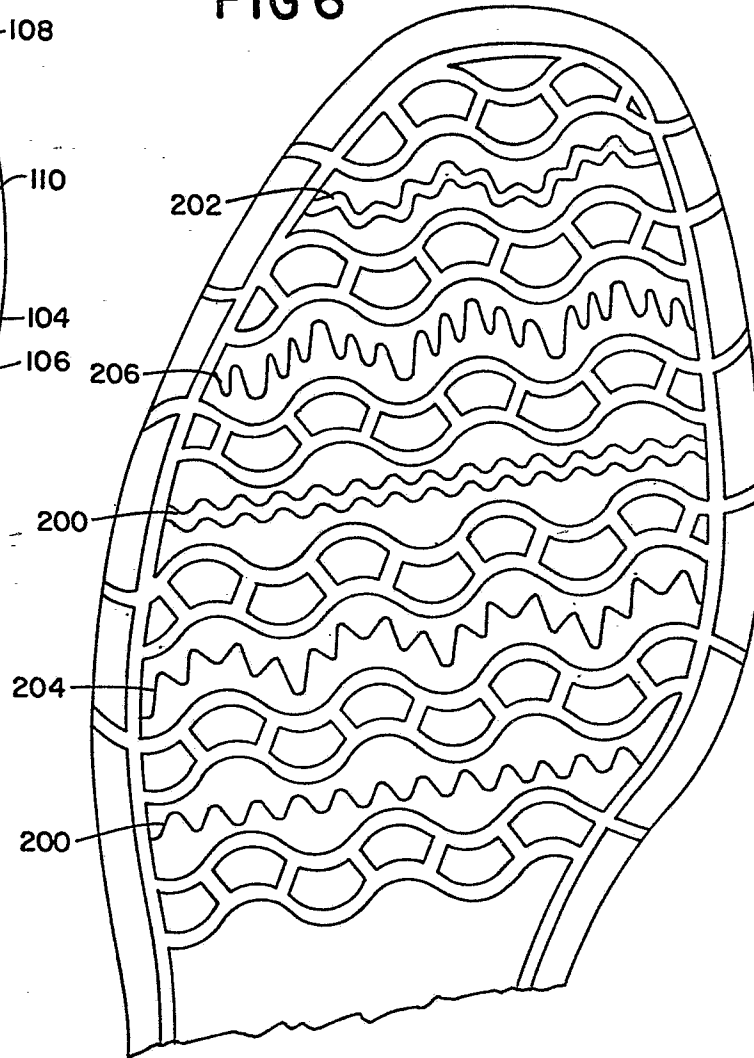
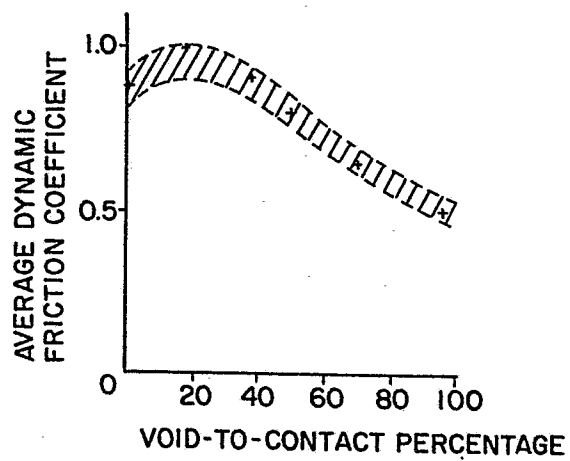


FIG 5





DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X,Y	FR-A-2 284 289 (INDUSTRIEWERK LEMM) * Page 1, lines 11-16; figure *	1-20	A 43 B 13/22 A 43 B 5/08
X	US-A-4 378 641 (A.S. TARLOW) * "Background of invention"; figure 1-7 *	1,7	
X	US-A-2 206 860 (P.A. SPERRY) * Page 1, left-hand column, line 46 - right-hand column, line 25; figure 1-5 *	1-13, 16-20	
Y	FR-A-2 148 347 (NOEL FRERES) * Page 2, lines 9-16; figures 1,2 *	14	
Y	FR-A-2 434 587 (ADIDAS) * Claims 1,7; figures 1-4 *	15	
Y	FR-A-1 158 294 (ROMIKA K.G. LEMM) * Figures 1-3 *	14	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 27-08-1985	Examiner MALIC K.
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	