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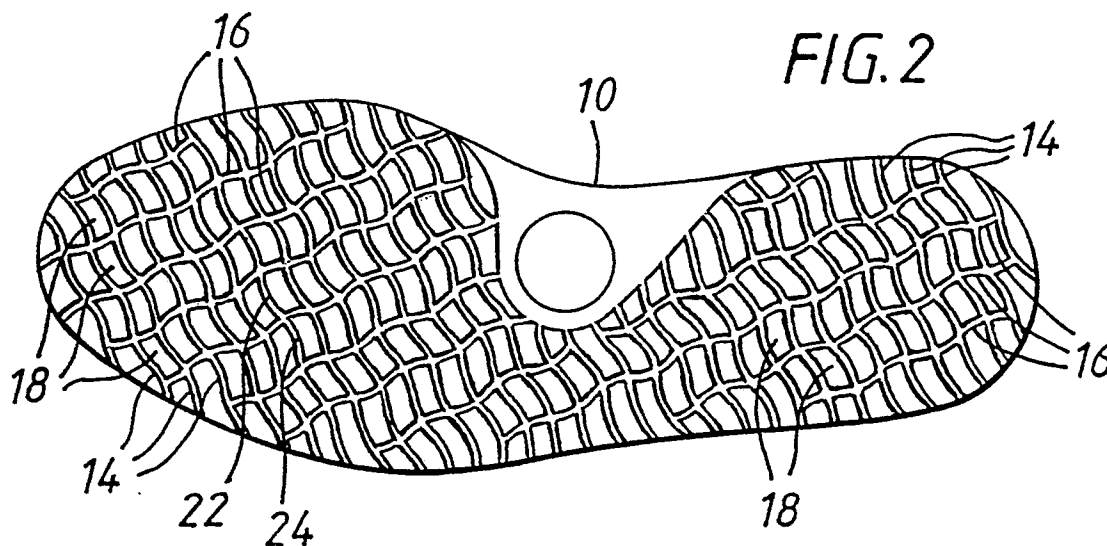
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54 Slip-resistant sole for footwear.

57 An anti-slip sole has intersecting sinuous grooves (14), (16) defining a pattern of cleats (18) having non-linear edges. The sole exhibits good slip resistance on tiled surfaces contaminated with cooking oils or grease.



SLIP-RESISTANT SOLE FOR FOOTWEAR

This invention relates to a slip-resistant sole for footwear.

Aspects of sole design for slip resistant footwear have recently been discussed by Mike Wilson, SATRA Bulletin, February 1989, 150-151.

A problem with which this invention is concerned is the provision of a slip-resistant sole which exhibits good slip-resistance omnidirectionally or in the major directions in which slip is likely to occur both in the dry and in an environment such as a kitchen where spillage of both oil and water can occur. In particular there is a requirement for footwear that exhibits good slip-resistance on smooth tiled surfaces contaminated with cooking oils or fats.

We have found a sole tread pattern presenting leading edges in many directions that uses a pattern of cleats to give slip-resistance, in which the cleats have sinuous or undulating edges. Thus each cleat may have a pair of non-linear edges defined by grooves separating adjacent cleats, said grooves having a general direction transversely of the sole and having a wavy shape.

Generally the sole will be formed with a set of the grooves at equal spacings. Advantageously the grooves have regularity, with a pitch or wavelength related to the dimension of the cleats so that adjacent cleats have convex and concave edges alternately. With this cleat edge profile there is a maximised chance that the cleats will have leading edges facing in a direction of possible slip. The leading edges act as squeegees to remove fluid films and for that purpose are made as sharp as possible bearing in mind the materials and moulding techniques employed e.g. high-pressure moulding. The grooves may run obliquely across the sole with the medial end of each groove in advance of the lateral end. Preferably the grooves are directed at an angle of about 65° to the toe to heel direction.

The cleats are advantageously based on a distorted rectangular or diamond shape, in which case each cleat has a second pair of non-linear edges defined by second grooves separating adjacent cleats and directed so as to intersect the first grooves, said second grooves also having a wavy shape. The angle of intersection is conveniently close to a right angle but need not be precisely 90° . The second set of grooves will normally also be formed in the sole at equal spacings, with the spacing of the grooves of the second set being at least twice the spacing of the grooves of the first set. The aspect ratio of the cleats undisturbed by a shoe edge is thus 2:1 or more. The second grooves may have generally the same pitch or

wavelength as the grooves of the first set, and may run obliquely across the sole in a direction opposite to the grooves of the first set, with the lateral end of each second groove in advance of the medial end. Thus the grooves of the second set may be directed at an angle of about 23° to the toe to heel direction. It will be understood that the first pair of cleat edges have the primary task of preventing slippage in the most likely directions for this to occur, and that the second pair of edges though opposing slip in the orthogonal direction have grooves therebetween which can also act as drainage channels.

The dimensions of the cleats should be sufficiently large to avoid the risk of break-away during service of the sole but there must also be sufficient grooves or channels to provide fluid drainage. Typically cleats not adjacent the edges of the sole each have a major dimension of about 12 mm and a minor dimension of about 6 mm. The grooves are advantageously dimensioned for ease of cleaning and ease of the release of trapped articles on flexion. They are also dimensioned to maximise ground contact, to maximise break-up of fluid films on the ground under the sole, and to ensure that oils and water are likely to be expelled to the edges of the cleats and drained effectively. Thus they may be of width about 2 mm at the exposed face of the sole. The depth will normally be selected on the basis of intended service life of the sole, but is typically about 4 mm.

For maximum ground contact, the sole has a lower face for continuous ground contact from toe to heel, and the pattern of cleats also extends continuously from the toe end to the heel end thereof.

Optimum slip resistance in an environment liable to oil and water contamination is provided by appropriate selection of sole cleat or stud pattern combined with appropriate selection of material and hardness. The sole is preferably moulded in rubber, especially a nitrile or other oil-resistant rubber. It has been found that a sole moulded in rubber retains slip-resistance better than a moulded polyurethane sole using the materials presently available. The material has to combine the properties of adequate oil-resistance, slip-resistance and abrasion resistance and for this purpose it should be of Shore hardness about 60-70, preferably about 65.

For use in slip-resistant footwear, a lower rubber layer may be united at a blind face to an upper layer of blown polyurethane or other expanded plastics material. The upper layer then preferably has a transversely cupped forepart to support the

weight of the metatarsus with a minimum of disturbance of the flatness of the lower face of the sole. The invention is not, however, limited to use in purpose made slip-resistant footwear, and could take the form of rubber replacement for use in the repair of shoes, or it could be used in boots, shoes and slippers for wear by the general public.

The invention also provides a slip-resistant boot or shoe having a sole as aforesaid. In a further aspect the invention resides in the use of a slip-resistant sole as aforesaid in a place having a smooth impermeable floor liable to contamination with oil or grease, for example a ceramic tiled floor of a catering establishment.

An embodiment of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a side view of a composite slip-resistant sole for use in the manufacture of boots or shoes;

Figure 2 is an underneath plan of the sole;

Figure 3 is fragmentary longitudinal section of the forepart of the sole; and

Figure 4 is a section on the line C-C of Figure 2.

In the drawings a moulded composite sole for safety shoes for use in kitchen having a ceramic tiled floor and in which much fried food is cooked such as a "fast food" establishment has a lower layer 10 of nitrile rubber of 65 Shore hardness and an upper layer 12 of blown polyurethane. The polyurethane layer 12 cushions the foot and spreads the load onto the underlying rubber layer 10. The lower face of the rubber layer 10 is formed with a pattern of equi-spaced first sinuous grooves 14 and a pattern of second sinuous grooves 16 intersecting the first grooves to define a pattern of studs or cleats having four non-linear edges. The wavelength of the undulations of grooves 14 (which can resemble sine waves but need not have strict regularity) is related to the pitch or spacing of the grooves 16 so that cleats 18 are defined in which corresponding edges 22, 24 of many adjacent cleats are alternately convex and concave as shown. The regularity of the undulations and the relationship between them may however be only approximate. Both the grooves 14 and the grooves 16 are directed obliquely to the heel-toe direction and they intersect at approximately a right angle. The grooves 14 are more significant for defining slip-resistance leading edges, whereas the grooves 16 which are directed closer to the toe to heel direction are more important from the standpoint of fluid drainage from the contact area. It will be noted that sole is intended to make continuous flat ground contact from the ball of the foot to the heel, and that the pattern of cleats is continuous from toe to heel. For maximum slip-resistance the heel is

chamfered at an angle of about 15° as at 26, the undulating cleat-defining grooves 14, 16 extending into the heel region as shown.

In Figure 3 it will be noted that for good flexibility the grooves 14 extend through a major portion of the thickness of the rubber layer 10, the layer 10 locally being 6 mm thick and the grooves 14 being 4 mm deep. The profile of grooves 14 is inwardly tapering at an angle of 3° for ease of release during moulding and also for ease of cleaning. The polyurethane layer 12 at the toe and metatarsal region of the sole is of thickness about 3mm, but thickness increases to about 20 mm in the heel region to cushion the force of heel contact during walking. In Figure 4, the forepart of the sole appears in transverse section, and the lower face of rubber layer 10 is substantially flat for maximum ground contact, whereas the upper face of the polyurethane layer 12 is dished or cupped as at 30 to receive the metatarsal region of the foot and distribute the applied load with a minimum of disturbance to the flatness of the layer 10.

Claims

1. A sole for footwear having a pattern of cleats to give slip-resistance, wherein each cleat has a pair of non-linear edges defined by grooves separating adjacent cleats, said grooves having a general direction transversely of the sole and having a wavy shape.

2. A sole according to Claim 1, wherein a set of the grooves is formed in the sole at equal spacings.

3. A sole according to Claim 1 or 2, wherein the grooves have a pitch or wavelength related to the dimension of the cleats so that adjacent cleats have convex and concave edges alternately.

4. A sole according to Claim 2 or 3, wherein the grooves run obliquely across the sole with the medial end of each groove in advance of the lateral end.

5. A sole according to Claim 4, wherein the grooves are generally directed at an angle of about 65° to the toe to heel direction.

6. A sole according to any preceding claim, wherein each cleat has a second pair of non-linear edges defined by second grooves separating adjacent cleats and directed so as to intersect the first grooves, said second grooves also having a wavy shape.

7. A sole according to Claim 6, wherein a set of the second grooves is formed in the sole at equal spacings.

8. A sole according to Claim 7, wherein the spacing of the grooves of the second set is at least twice the spacing of the grooves of the first set.

10. A sole according to any of Claims 6 to 9, wherein the grooves of the second set run obliquely across the sole in a direction opposite to the grooves of the first set, with the lateral end of each second groove in advance of the medial end. 5

11. A sole according to Claim 10, wherein the grooves are generally directed at an angle of about 23° to the toe to heel direction.

12. A sole according to any preceding claim, wherein cleats not adjacent the edges of the sole each have as major dimension of about 12 mm and a minor dimension of about 6 mm. 10

13. A sole according to any preceding claim, wherein the grooves are of width about 2mm at the exposed face of the sole. 15

14. A sole according to any preceding claim, wherein the grooves are of depth about 4mm.

15. A sole according to any preceding claim which extends from heel to toe and has a pattern of cleats extending continuously from the toe end to the heel end thereof. 20

16. A sole according to any preceding claim, having at least a lower part moulded in rubber.

17. A sole according to Claim 16, wherein the rubber is a nitrile rubber or other oil-resistant material having anti-slip properties. 25

18. A sole according to Claim 16 or 17, wherein the rubber is of about 65 Shore hardness.

19. A sole according to any of Claims 16 to 18 having a lower rubber layer united at a blind face to an upper layer of blown polyurethane or other expanded plastics material. 30

20. A sole according to Claim 19, wherein the upper layer has a transversely cupped forepart to support the weight of the metatarsus with a minimum of disturbance of the flatness of the lower face of the sole. 35

21. A slip-resistant boot or shoe having a sole as claimed in any of Claims 1 to 20.

22. A boot or shoe having a sole as claimed in any of Claims 1 to 20 when used as slip-resistant footwear in a place whose floor is subject to oil or grease contamination. 40

23. A boot or shoe according to Claim 22 when used in a place having a ceramic tiled floor. 45

24. A boot or shoe according to Claim 22 or 23 when used in a kitchen.

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FIG. 1

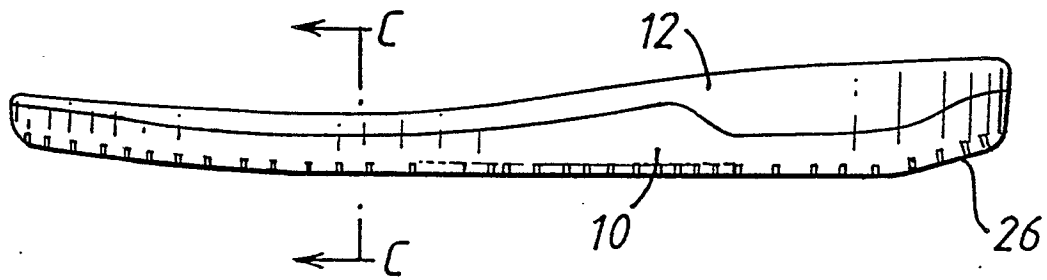


FIG. 2

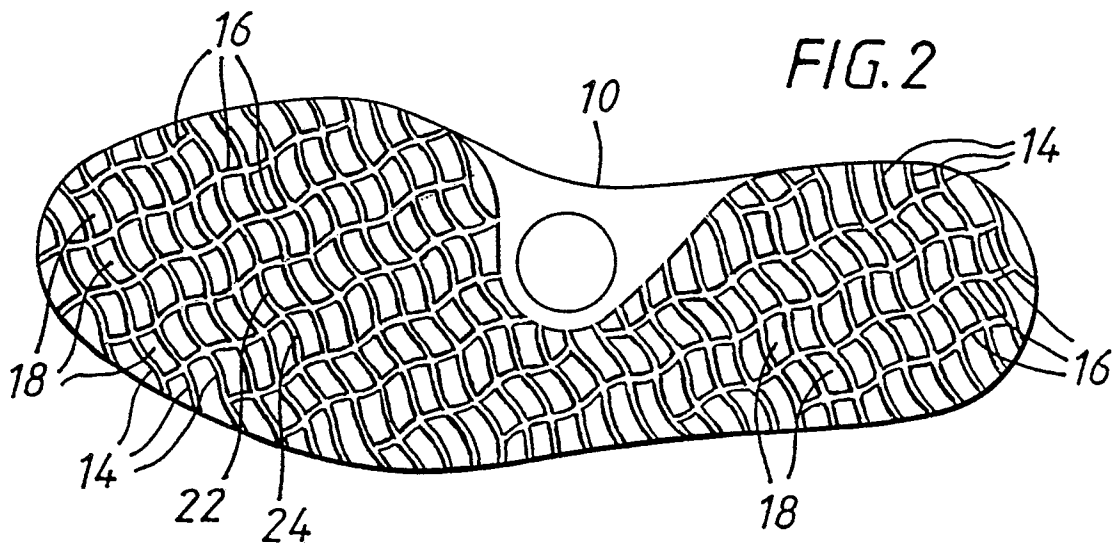


FIG. 3

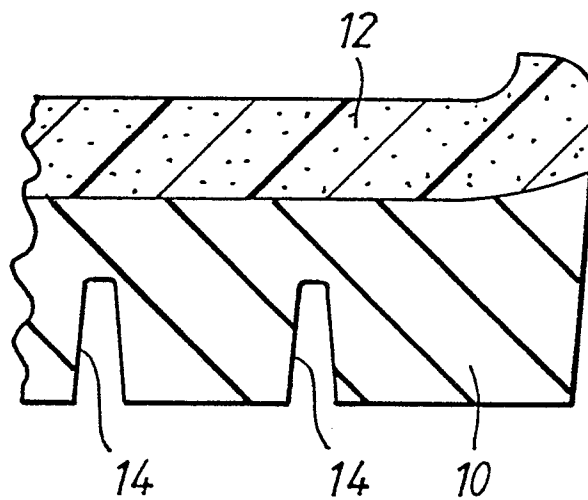
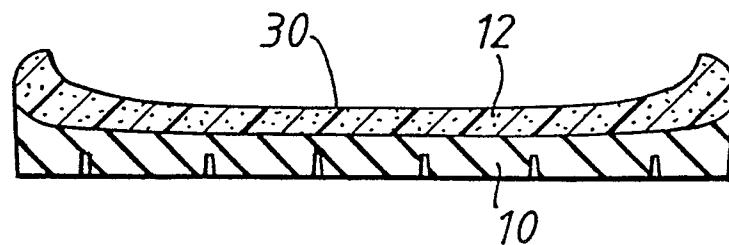


FIG. 4





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. 5)
X	GB-A- 545 994 (N. AUSTIN) ---	1,2,15, 16,21- 24	A 43 B 13/22 A 43 B 13/12
X	GB-A- 770 588 (US RUBBER) ---	1,2,15	
X	US-A-4 570 362 (C. VERMONET) ---	1,2,15, 16	
X	GB-A-1 542 328 (UNIROYAL) ---	1,2	
A	FR-A- 825 941 (J. BRUNSWICK) ---	6,7,16	
A	GB-A- 919 658 (LA BATELLERIE) ---	6,7,15, 16	
A	GB-A- 513 375 (DUNLOP) ---	6,7,16	
A	GB-A-2 076 725 (C.L. LIU) ---	19	
A	US-A-4 547 979 (M. HARADA) ---	19	TECHNICAL FIELDS SEARCHED (Int. Cl.5)
A	US-A-4 571 852 (R. LAMARCHE) -----	1	A 43 B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 20-03-1990	Examiner DECLERCK J.T.
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			