United States Patent [19]

Inohara

[11] **3,918,181**

[45] **Nov. 11, 1975**

[54] **SPORT SHOE**

[75] Inventor: **Masanobu Inohara**, Akashi, Japan

[73] Assignee: **Onitsuka Co., Ltd.**, Kobe, Japan

[22] Filed: **July 24, 1974**

[21] Appl. No.: **491,263**

Related U.S. Application Data

[62] Division of Ser. No. 383,800, July 30, 1973, Pat. No. 3,849,915.

[30] **Foreign Application Priority Data**

Mar. 1, 1973	Japan	48-24971
Mar. 26, 1973	Japan	48-12519
Mar. 8, 1973	Japan	48-18261

[52] **U.S. Cl.** ..... **36/2.5 A**; 36/59 C

[51] **Int. Cl.**[2] **A43B 5/00**

[58] **Field of Search** . 36/59 R, 59 C, 2.5 A, 2.5 AM

[56] **References Cited**

UNITED STATES PATENTS

495,131	4/1893	Guice	36/59 R
1,137,159	4/1915	Meyer	36/59 C
2,114,421	4/1938	Giuffre	36/59 C X
2,424,463	7/1947	Hogg	36/59 C
3,818,617	6/1974	Dassler et al.	36/2.5 AM X

FOREIGN PATENTS OR APPLICATIONS

867,576	4/1971	Canada	36/59 C
633,885	8/1936	Germany	36/59 C

Primary Examiner—Alfred R. Guest

[57] **ABSTRACT**

A sport shoe comprises a sole and an upper mounted on said sole, wherein a plurality of recesses each with a rounded inner wall surface are provided on the lower surface of said sole for trapping water thereinto and producing anti-slipping effect and a plurality of projections extend downwardly from non-recessed portions of the sole, whereby an athlete is prevented from falling down on an all-weather track in the rain or after the rain, and his running speed and jumping force are increased.

5 Claims, 21 Drawing Figures

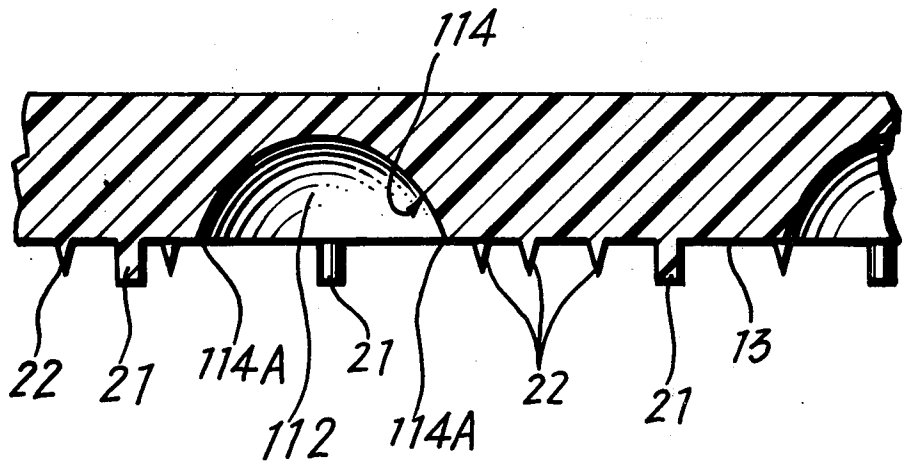


Fig. 1

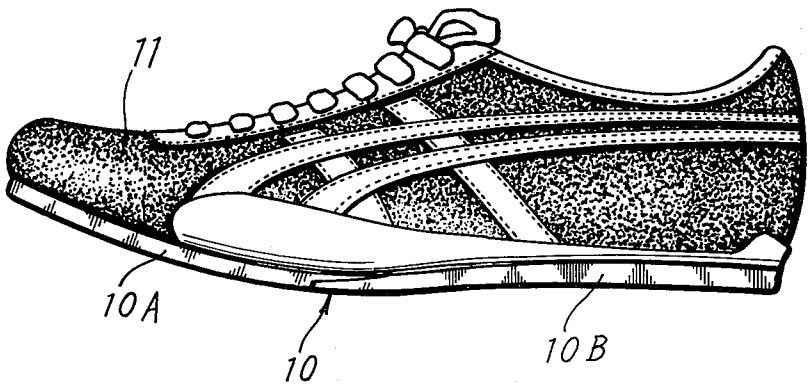


Fig. 2

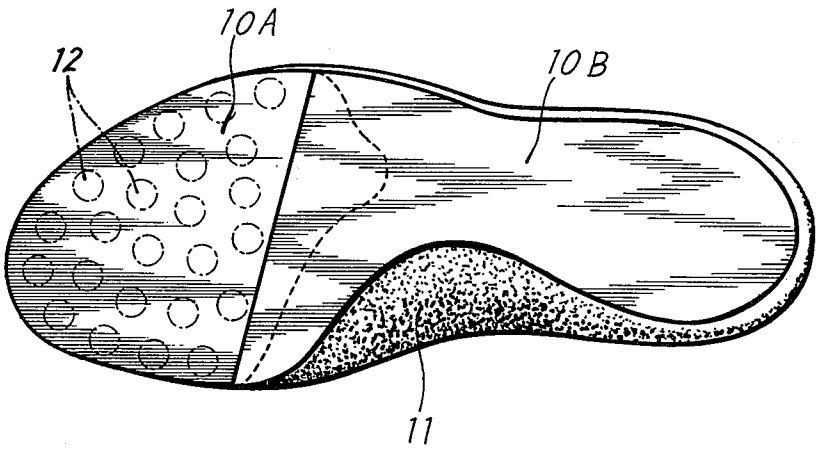


Fig. 3

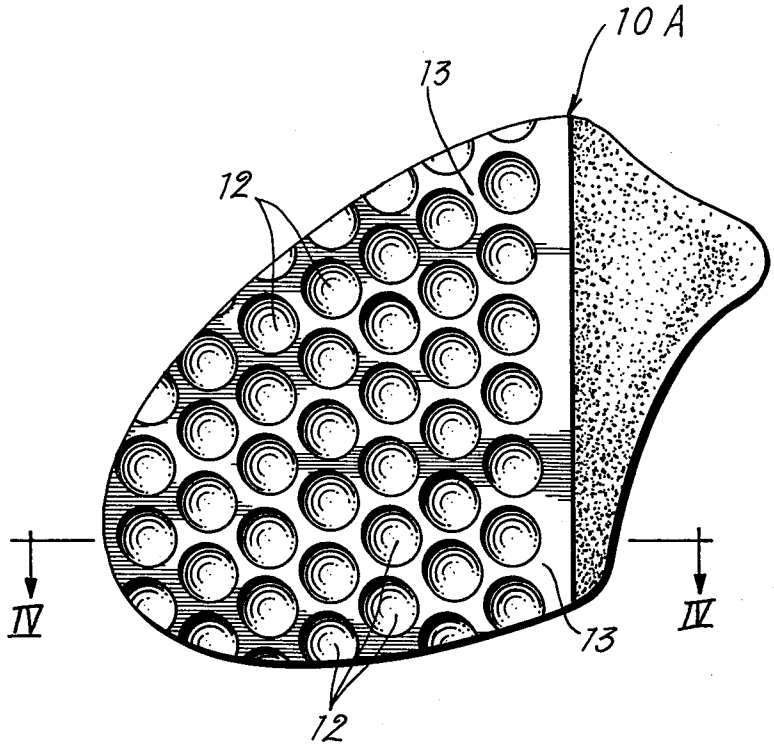


Fig. 4

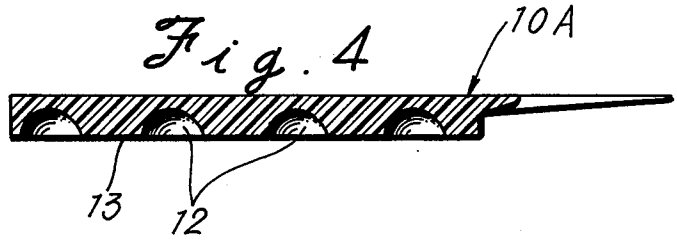


Fig. 5

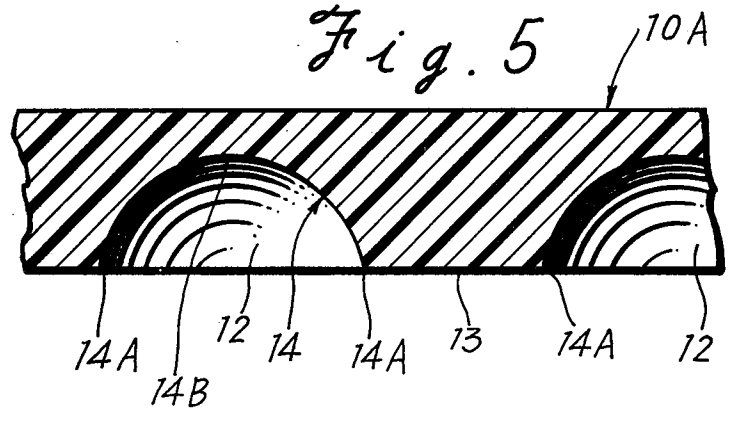


Fig. 6

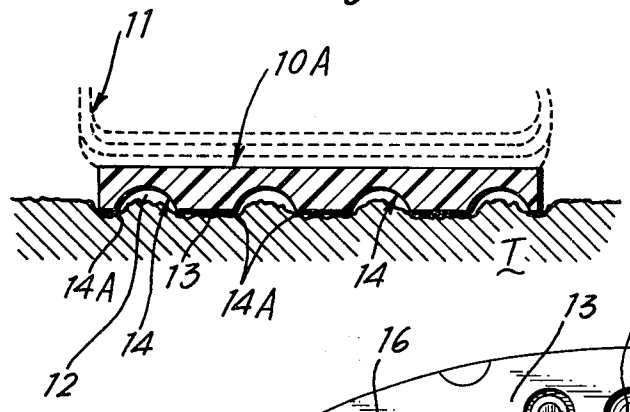


Fig. 7

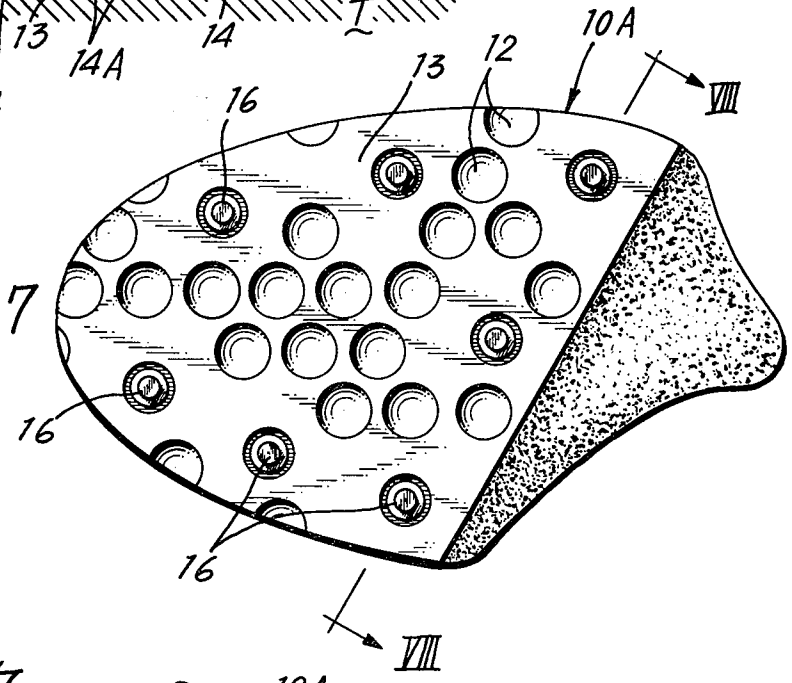


Fig. 8

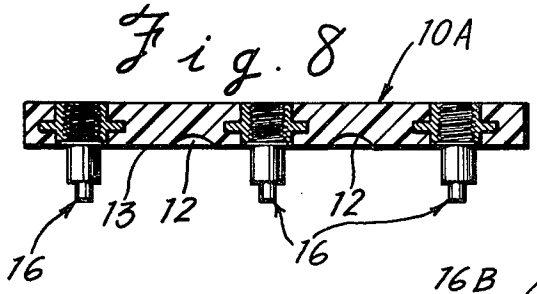


Fig. 9

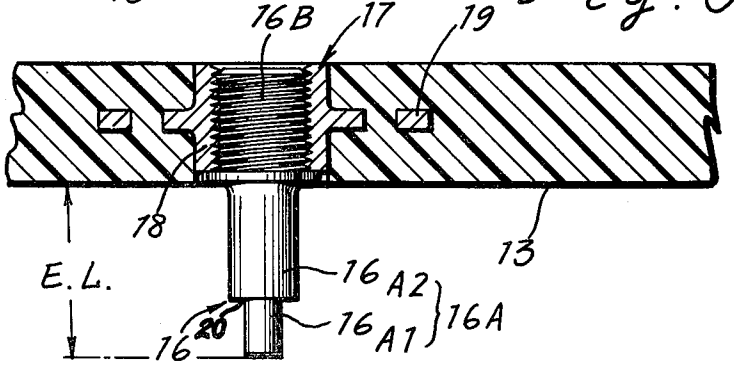


Fig. 10

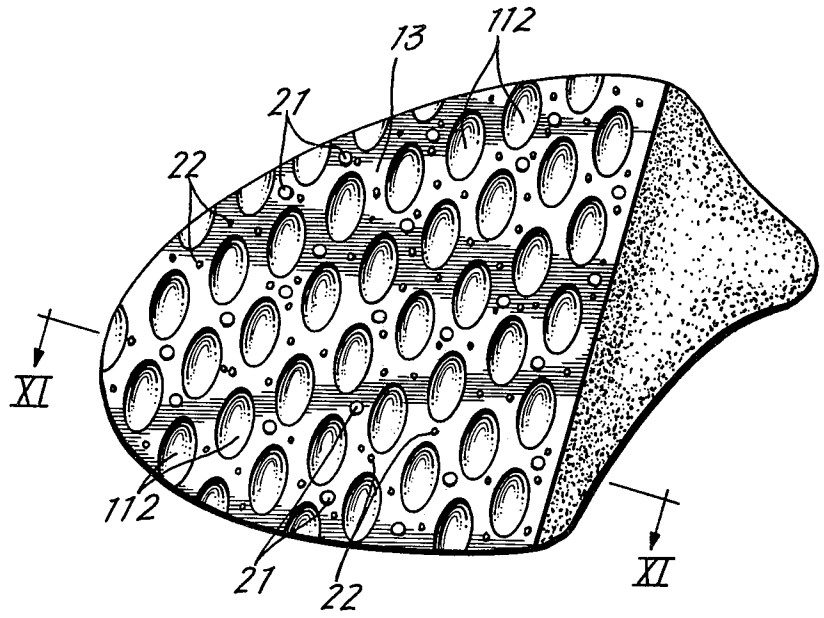


Fig. 11

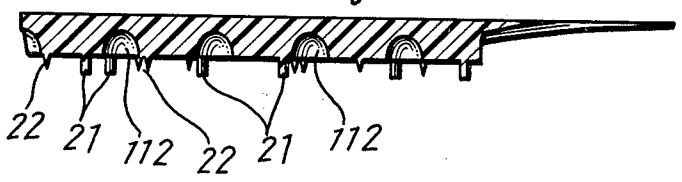


Fig. 12

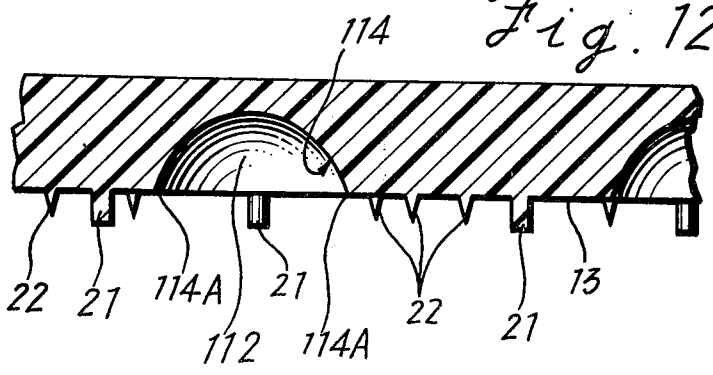


Fig. 13

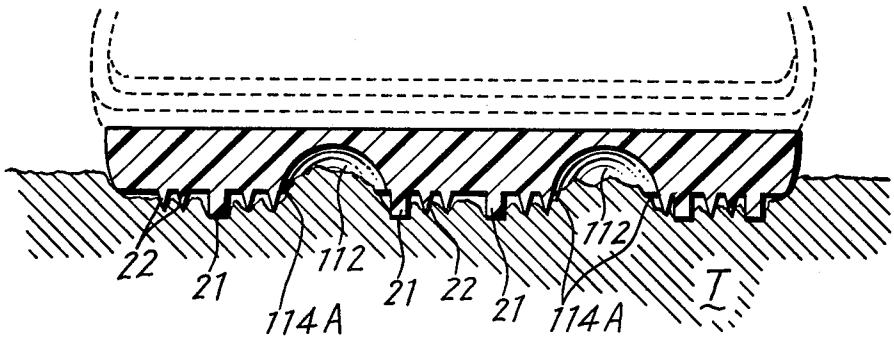


Fig. 14

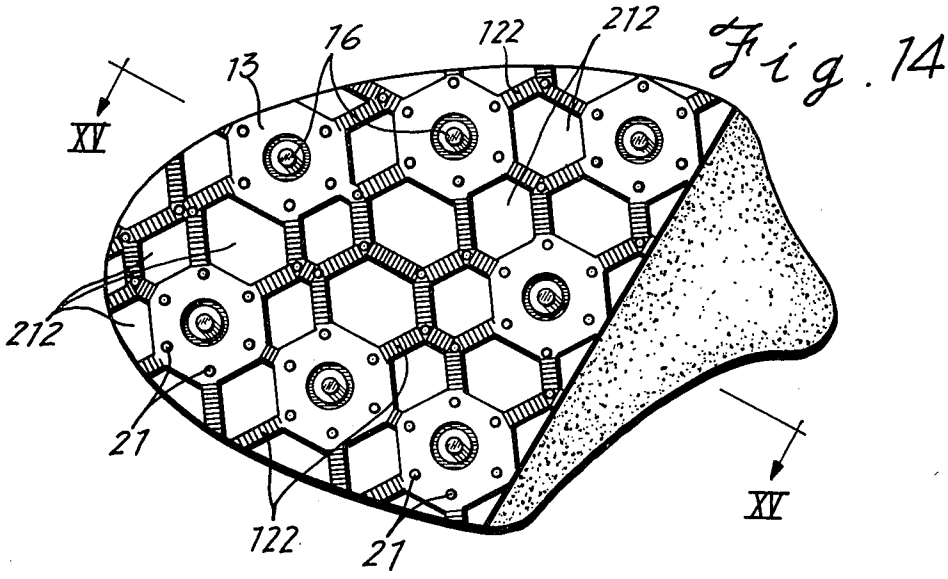


Fig. 15

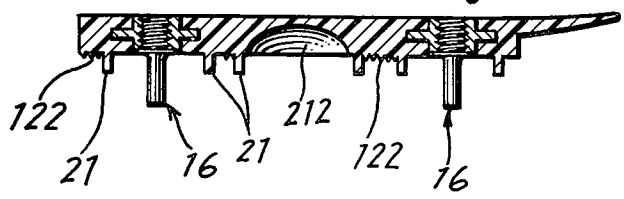


Fig. 16

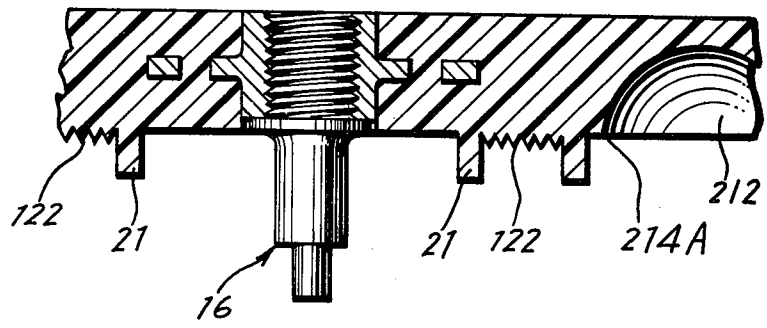


Fig. 17

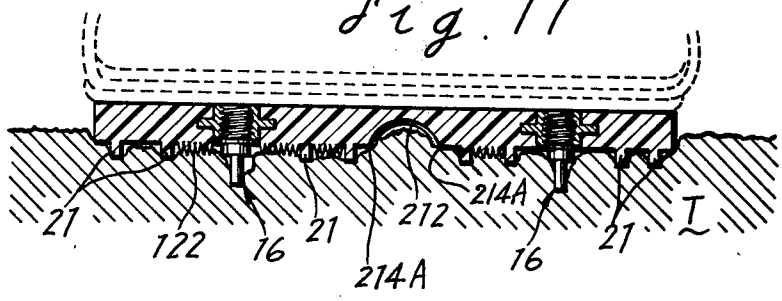


Fig. 18

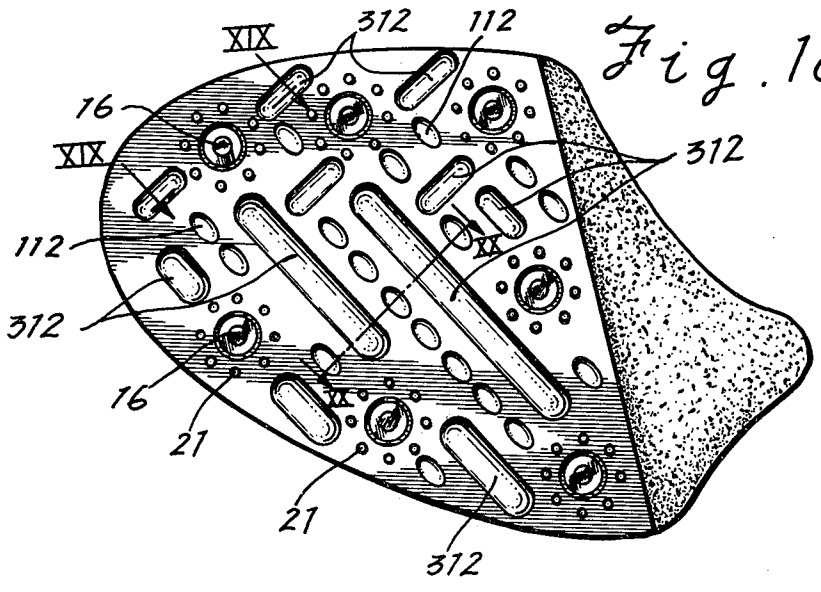


Fig. 19

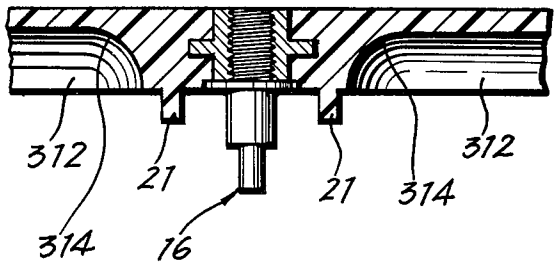


Fig. 20

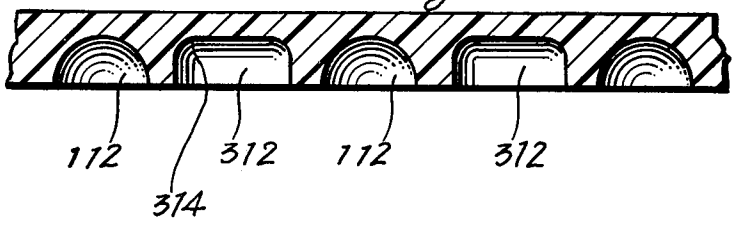
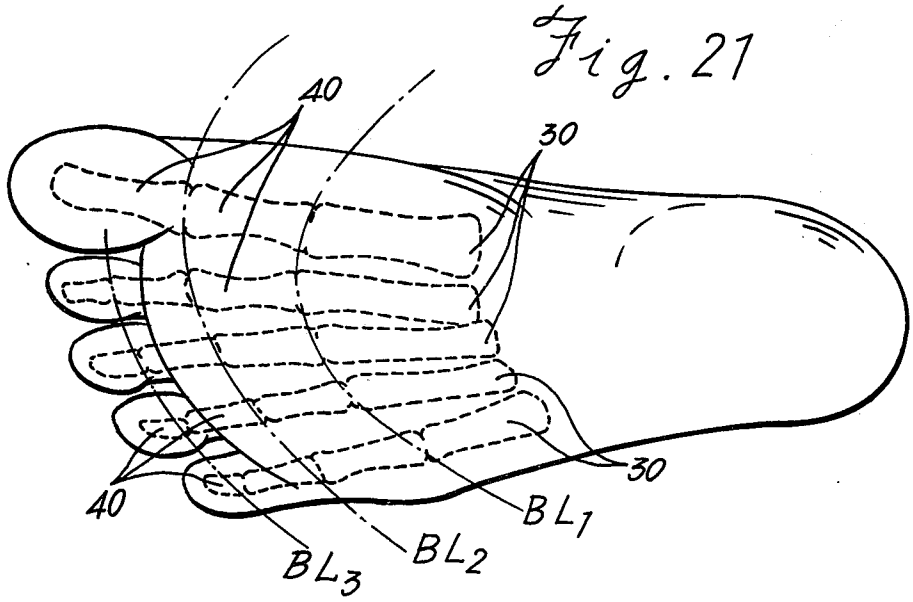


Fig. 21



SPORT SHOE

RELATED APPLICATION

This application is a division of my prior application, Ser. No. 383,800, filed July 30, 1973, now U.S. Pat. No. 3,849,915, issued Nov. 26, 1974.

The present invention relates to a sport shoe, especially to a sport shoe provided with a shoe sole of a new construction suitable for running and jumping.

Lately, as a running or racing track in a sport ground, a track formed of resilient rubbery sheet of high polymer compound has come into frequent use in place of the conventional track formed of multi-layered soil such as en-tout-cas layer or cinder layer, gravel layer, sand layer and the like. The track formed of high polymer compound has the properties of good resiliency, waterproofness and non-permeability, thus being applied to a track in a ground of all-weather type.

Such all-weather track, unlike above-mentioned conventional track of en-tout-cas layer and the like, cannot absorb water and therefore when it rains the surface thereof is submerged. Thus, due to water layer formed between a shoe sole and the track surface, the wearer is apt to slip in running by so-called hydroplaning phenomenon, and is always in an unstable condition and cannot play to his full.

Further, the conventional spiked sport shoe is provided with a plurality of tapered and circular conical metal spikes. Above-mentioned resilient rubbery sheet of high polymer compound has the property of being buoyant and resilient when rather lightly pressed, and rigid when pressed hard. For example, in a sprint race, a weight three times as heavy as a running sprinter's weight is put on the track, and further in the take-off of hop' step' and jump a weight seven to nine times as heavy as a racer's weight is put thereon. So, it is necessary to choose spiked shoes suitable for such a track after due consideration of such properties thereof.

In particular, if on such a resilient rubbery track used are the conventional spiked shoes with circular conical spikes which are adapted to penetrate or be stuck into a track in order to obtain kicking force, said penetration and sticking is restrained owing to above-mentioned properties of the track, thus the wearer's or athlete's balance being disturbed. And if spikes are forced to penetrate or be stuck into said track, resistance force will increase in pulling them out and extra energy is required in lifting feet, resulting in the athlete's fatigue in a shorter time and reduction of his progressing speed or jumping force. In addition, marks left on the resilient rubbery sheet by said spikes cannot heal of themselves.

Consequently, spiked shoes for such a track requested by an athlete as well as a ground owner are such as can catch the track surface well, and obtain strong resistance to side slipping without damaging the track by leaving spike marks thereon.

The main object of the present invention is to provide sport shoes wherein on the lower surface of the shoe sole are provided a plurality of recesses each having a rounded inner wall surface for trapping water thereinto and in addition preventing slip of the shoe sole, whereby during running in the rain or after the rain on such all-weather track an athlete does not fall down by so-called hydroplaning phenomenon and can increase his running speed and jumping force.

Another important object of the present invention is to eliminate above-mentioned disadvantages of the conventional sport shoes and to provide sport shoes suitable especially for an all-weather track.

Features and advantages of the present invention will become apparent from the following description of embodiments with reference to the accompanying drawings.

FIG. **1** is a side elevational view of a sport shoe according to the present invention;

FIG. **2** is a bottom plan view of a sport shoe of FIG. **1**;

FIG. **3** is a bottom plane view illustrating an example of a front sole of a sport shoe according to the present invention;

FIG. **4** is a sectional view of the front sole taken along line IV—IV of FIG. **3**;

FIG. **5** is an enlarged sectional view illustrating a part of the front sole of FIG. **3**;

FIG. **6** is a cross-sectional view illustrating the action of the front sole of FIG. **3** to the surface of an all-weather track;

FIG. **7** is a bottom plan view of another example of a front sole;

FIG. **8** is a sectional view of the front sole taken along line VIII—VIII of FIG. **7**;

FIG. **9** is an enlarged sectional view illustrating a part of the front sole of FIG. **7**;

FIG. **10** is a bottom plane view of another example of a front sole;

FIG. **11** is a sectional view of the front sole taken along line XI—XI of FIG. **10**;

FIG. **12** is an enlarged sectional view illustrating a part of the front sole of FIG. **10**;

FIG. **13** is a cross-sectional view illustrating the action of the surface of an all-weather track;

FIG. **14** is a bottom plan view of another example of a front sole;

FIG. **15** is a sectional view of the front sole taken along line XV—XV of FIG. **14**;

FIG. **16** is an enlarged sectional view illustrating a part of the front sole of FIG. **14**;

FIG. **17** is a cross-sectional view illustrating the action of the front sole of FIG. **14** to the surface of an all-weather track;

FIG. **18** is a bottom plane view illustrating another example of a front sole;

FIG. **19** is a cross-sectional view of the front sole taken along line XIX—XIX of FIG. **18**;

FIG. **20** is a cross-sectional view of the front sole taken along line XX—XX of FIG. **18**; and

FIG. **21** is an explanatory view of the sole of a man's foot, wherein shown are a part of the bony framework with broken lines, and a plural number of flexion lines with imaginary lines.

With reference to the drawings, shown in FIGS. **1** and **2** is a sport shoe of the present invention, which comprises a shoe sole **10** of proper thickness formed of rigid natural or synthetic resin and an upper **11** formed of soft leather mounted thereon.

The shoe sole **10** consists of a front sole **10A** formed of Nylon layer which is relatively thick, tough and therefore difficult to be broken in use, and a rear sole **10B** formed of rubber layer which is rather thin, strong and soft, said two soles being formed separately.

The front sole **10A** is, as shown in FIGS. **3** and **4**, provided with a plurality of recesses **12** on the lower surface or the tread surface thereof. As apparently seen in the drawings, each recess **12** has a rounded inner wall surface extending with proper depth inwardly from the

lower surface **13** of the sole, said recess having circular-shaped outline on said lower surface of the sole (see FIG. **3**), while cross-section thereof is semi-circular-shaped.

The recesses **12** of the front sole **10A** are adapted to trap water thereinto so that water is not interposed between the lower surface **13** of the sole and the track surface in a game on a track submerged like an all-weather track in the rain or after the rain, whereby so-called hydroplaning phenomenon is not caused during the wearer's running at full speed; thus preventing his falling down.

In addition, said recesses **12** can produce an effect of preventing slipping of the shoe on an all-weather track T due to the presence of the peripheral edge **14A** thereof. Each recess has, as above-mentioned and shown in FIG. **5**, the rounded inner wall surface **14** and hence semi-circular section, so that distribution of stress against external force changes smoothly from the peripheral edge **14A** to the innermost portion **14B**. Therefore not caused are cracks on the inner wall surface **14** of each recess **12** by an abrupt change of stress.

The front sole **10A** can, by providing as many recesses as possible thereon, be made lightweight in spite of thickness thereof, properly flexible and resilient. So, kicking force and anti-slipping force is further effected in accordance with the action of the wearer's foot, and his running speed and jumping force are strikingly increased.

FIGS. **7** and **8** show a modified example of a front sole, which is provided with a plurality of the same recesses as shown in FIGS. **3** and **4**, and a plurality of spikes **16** mounted where there are no recesses. Each spike **16** is, as shown in FIG. **9**, vertically fixed through a supporting member **17** to the front sole **10A**. The supporting member **17** comprises a tubular part **18** with threaded inside and an annular anchoring flange **19**, and is embedded in the front sole **10A**. Each spike **16**, at least in the effective part thereof (part extending from the lower surface of the sole to the lower end of the spike, and the length of said effective part is shown by the designation E.L. in the drawings), comprises a parallel portion 16_{A1} having uniform cross-section both in form and area throughout the length thereof and constituting the lower part of said effective part, the bottom face of said parallel portion 16_{A1} being shaped as cut by a plane crossing the axis of the spike, and an enlarged portion 16_{A2} extending upwardly from said parallel portion and having larger diameter or section than said parallel portion, the lower end of said enlarged portion 16_{A2} being provided with a resistance face **20** for checking unnecessarily deep penetration of the spike into a track. Said parallel portion 16_{A1} and said enlarged portion 16_{A2} are preferably circular cylindrical, but may be of any other proper shape. The upper end **16B** of the spike **16** is threaded and screwed into the supporting member **16** provided with the anchoring flange. The spike and the sole may be connected to each other by other various kinds of means.

In a spiked shoe of the present invention, resistance force to side slipping, which is required in running and will exist on the tread end of each spike, can be compared with that in a conventional spiked shoe having tapered spikes. Further, when spiked shoes of the present invention are used on an all-weather track formed of resilient rubbery sheet of high polymer compound, pressure (namely, reaction force exerting upwardly from the tread face of each spike against the depressing pressure of the athlete's foot) is put uniformly on the whole bottom face or tread face of each spike, so that each spike depresses and touches the track with temporarily denting the surface thereof without leaving any spike marks thereon. In addition, when the material of a track is hard, the spikes do not penetrate unnecessarily deep thereinto, thus preventing reduction of effective kicking action of the athlete's foot and at the same time dispensing with extra energy for pulling out spikes stuck thereinto.

Accordingly, sport shoes provided with such spikes and above-mentioned recesses enable the sole thereof to fully catch the surface of a track, especially an all-weather track owing to anti-slipping force effected by the perhipheral edge of said recesses, and in addition have full kicking force or anti-slipping force, whereby the wearer's movement and his running or jumping force are strengthened.

FIGS. **10** and **11** illustrate a further modification of the front sole. As enlargedly shown in FIG. **12**, this front sole has on the lower surface a plurality of recesses **112** each with elliptical outline and a number of the first and the second projections **21**, **22** in the area where there are no recesses, each of said projections being integrally extending downwardly from said lower sole surface. The first projection may be shaped in a parallel pillar vertically extending from said lower sole surface with cross-section uniform in form and area throughout the length thereof, or a frustum (not shown) with diameter of cross-section gradually reducing downwardly. The end face or tread face of said first projection being flat, while the second projection **22** is shorter in length than the first projection and formed in a tapered shape such as a circular cone.

FIG. **13** illustrates the action of the front sole shown in FIGS. **10–12** on the track T. The second projections **22** can exert anti-slipping force on the track surface in the direction different from that of the anti-slipping force produced by the peripheral edge **114A** of the recesses **112**. And the projections **21** can, similarly to spikes, exert anti-slipping force by penetrating relatively deep into a track, especially a resilient all-weather track formed of high polymer compound, and in addition can receive full repelling force of said track surface in releasing depressing force of said projections **21**, hence affording to speed up the wearer's forwarding movement accompanied by the exertion of his kicking force.

FIGS. **14**, **15** and **16** illustrate further modifications of the front sole, said front sole having a structure formed by combining various kinds of recesses, spikes and projections mentioned in the preceding examples.

Apparently seen in FIG. **14**, recesses **212** may have substantially hexagonal or rhombic outline, and on the parts of the lower surface between adjacent recesses are provided saw-toothed projections **122** which have anti-slipping effect similarly to above-mentioned second and circular conical projections **22**. Further on the lower surface where there are no recesses, a plurality of spikes **16** and the first projections **21** are provided, each of which has the same structure as is shown in FIGS. **9** and **12**.

FIG. **17** illustrates the action of the front sole of FIGS. **14–16** exerting on an all-weather track T, wherein each spike **16** can exert larger anti-sideslipping force than the first or the second projection by only temporarily denting the surface of the track T without leaving marks thereon unlike the conventional spikes,

and each recess **212** exerts anti-slipping force on the surface of the track T, while the first and the second projections **21, 122** exert anti-slipping force in the direction different from that by the peripheral edge of said recess.

Therefore, the spiked shoes provided with such a front sole can fully catch the track surface by combined anti-slipping effects by the recesses, the spikes and the first and the second projections, whereby the wearer's movement is enforced and his running speed and jumping force are increased.

In the above-mentioned various embodiments of the present invention, the shoe sole comprises a front sole and a rear sole each separately formed, but they may be integrally formed as in the conventional shoe sole. Consequently, the recesses, the first and the second projections and the spikes are, if needed, provided throughout the surface of the shoe sole. The shoe sole can be molded out of thermo-plastic and easily moldable synthetic resin with rigidness, such as polyamid (nylon), polyurethane or ionomer.

FIG. **18** illustrates another example of a front sole according to the present invention. This front sole has substantially the same structure as of the preceding examples with the exception that the present front sole has, besides circular recesses **12** as shown in FIG. **3** or **7**, recesses **312** each with an elongated outline with semicircular ends or channel-shaped outline, which are the modifications of above-mentioned circular recesses. Each of said channel-shaped recesses **312** is extending on the sole surface with a certain angle with respect to the longitude of the wearer's foot. Each recess **312** has, as apparently seen in FIGS. **19** and **20**, a rounded inner wall surface **314** similar to that of above-mentioned recess **12, 112** or **212**, and thereby water-trapping and anti-slipping (resisting against side slip-give proper flexibility to the front sole.

The bony framework of a man's foot consists, as shown in FIG. **21**, of seven tarsals or ankle bones (not shown), five metatarsals or foot bones **30** and fourteen phalanges or toe bones **40**. It is felt that the bony framework is flexed at the longitudinal positions of the foot, but in fact, examining from the anatomical point of view, it is flexed at the joint connecting phalanges to each other and the joint connecting each phalanges **40** to each metatarsel **30**. In FIG. **21** illustrated are flexion lines BL_1, BL_2 and BL_3 each laterally connecting corresponding joints.

In conclusion, the conventional shoe sole, in which no such anatomical attentions have been paid, cannot flex in accordance with the movement of the wearer's foot, hence not only giving uncomfortable feeling but doing hurt to the wearer's foot in the game. On the contrary, according to the present invention, elongated-circle-shaped or channel-shaped recesses are formed on the sole in the direction substantially along the flexion lines BL_1, BL_2 . . . so that the sole can be bent in accordance with the flexion of the bony framework of wearer's foot, thus smoothing the motion of his foot, keeping the same in safety and further strengthening his movement.

The elongated-circle-shaped recesses **312** may be provided not only on the front sole as shown in above-mentioned example but throughout the shoe sole including the rear sole in particular.

What I claim is:

1. A sport shoe comprising a sole and an upper mounted on the sole, the sole having a lower surface provided with a plurality of recesses each having a rounded inner wall surface, and a plurality of first and second projections extending downwardly from non-recessed portions of the lower surface of the sole, each of the first projections having a flat lower surface and each of the second projections being tapered downwardly and being shorter than the first projections.

2. The sport shoe of claim **1** wherein each of the recesses has a circular periphery.

3. The sport shoe of claim **1** wherein each of the recesses has an elliptical periphery.

4. The sport shoe of claim **1** wherein each of the recesses has a polygonal periphery.

5. The sport shoe of claim **1** wherein at least some of the recesses has peripheries in the form of elongated circles extending in a direction substantially along the flexion lines of the bone framework of the wearer's foot.

* * * * *