March 1, 1966 J. R. SANTORE 3,237,322

RESILIENT SOLE HAVING SELF-CLEANING SUCTION CUPS

Filed March 4, 1964 2 Sheets-Sheet 1

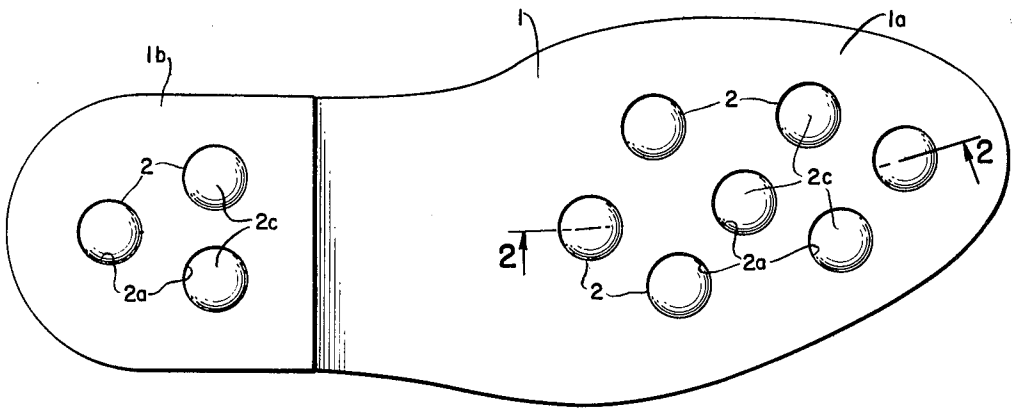


FIG. 1.

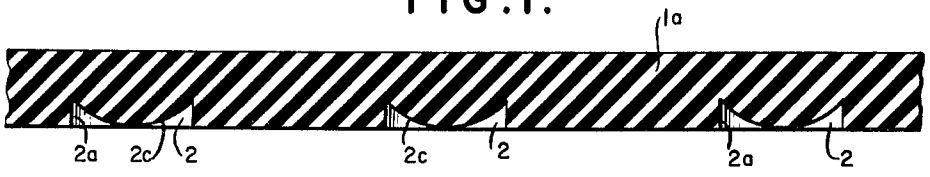


FIG. 2.

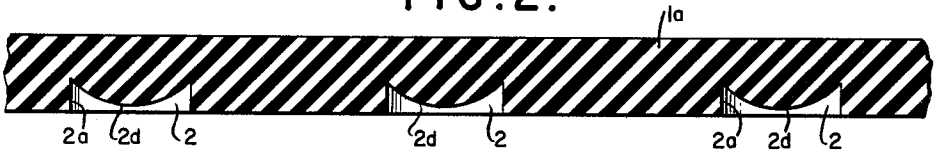


FIG. 3.

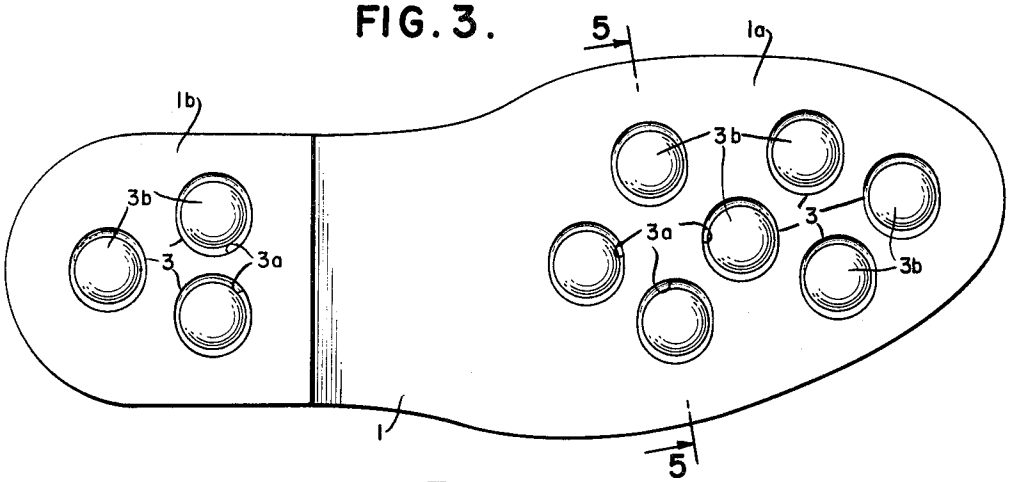


FIG. 4.

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RESILIENT SOLE HAVING SELF-CLEANING SUCTION CUPS

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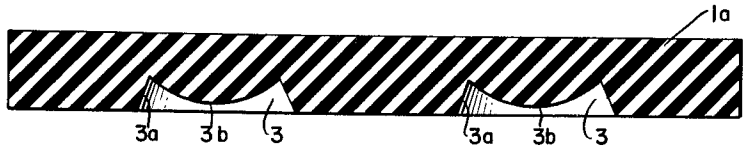


FIG. 5.

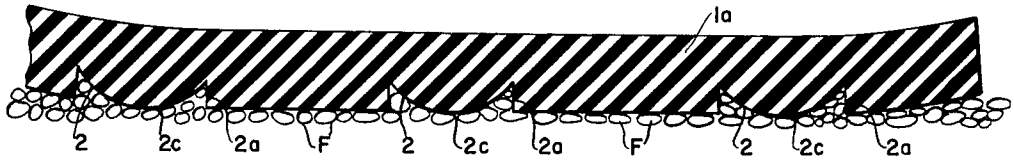


FIG. 6.

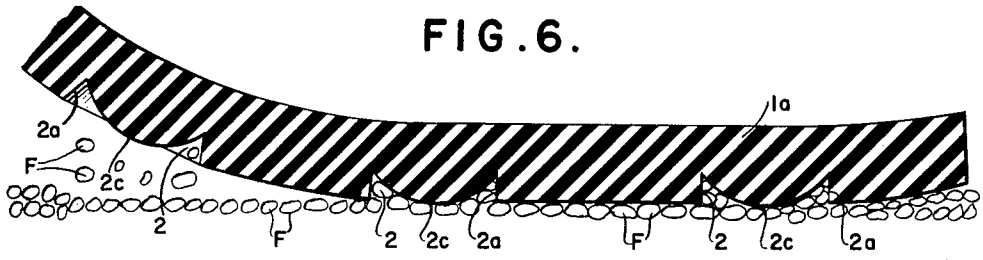


FIG. 7.

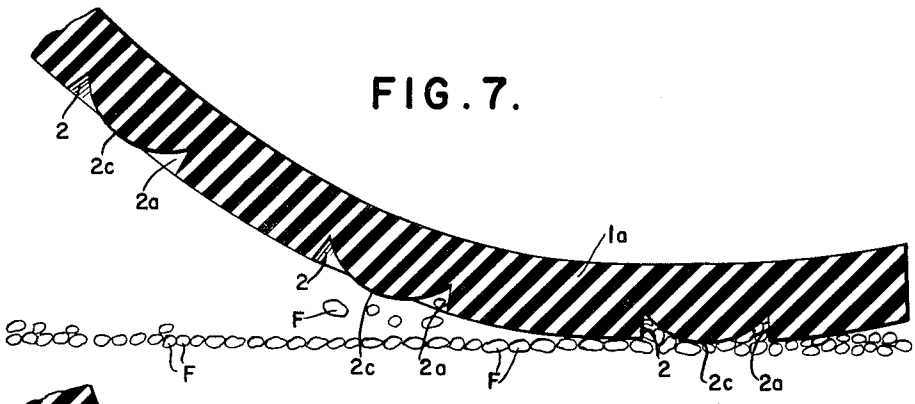


FIG. 8.

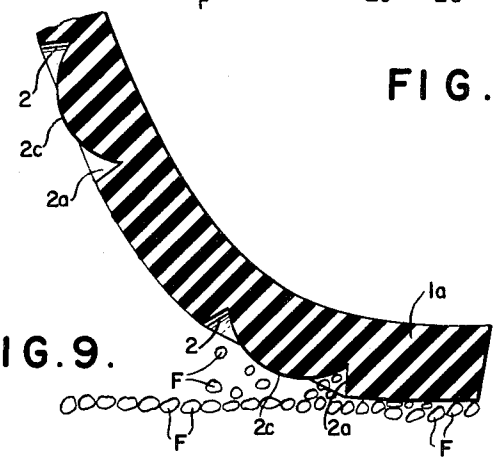


FIG. 9.

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3,237,322

RESILIENT SOLE HAVING SELF-CLEANING SUCTION CUPS

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Filed Mar. 4, 1964, Ser. No. 349,374
3 Claims. (Cl. 36—59)

This invention relates to shoe soles and heels, the present application being a continuation-in-part of my copending application Serial No. 190,326, filed April 26, 1962 and now abandoned.

The principal object is to provide a shoe sole and heel of cellular rubber or other inherently compressible resilient and flexible material, the tread or ground-engaging surface of which is provided with a plurality of separate independent vacuum cups extending partly through the sole, and so arranged in transversely and longitudinally spaced relation therein as to offer maximum anti-slipping or gripping effect consistent with the qualities of serviceable wear, and at the same time to be self-clearing or self-cleaning, in use, to dislodge snow, ice, dirt or other foreign matter which has become caked, lodged, or attached within said cups, the self-cleaning feature being effected by the resiliency of the cellular material from which the sole is made and by the novel design of the convex bottoms of said suction cups, so that in the act of walking the opposed longitudinal sidewalls of the cups are flexed or bent into longitudinally elongated shape as the lower surface of the sole assumes a downwardly convex form and simultaneously the convex bottoms of the cups are shifted outwardly towards the tread surface, thus pushing out and dislodging any foreign matter which has attached itself to or within the suction cups.

Another object of the invention is to provide a sole and heel of the above type in which the vacuum cups have substantially circular, cylindrical side walls normal to the lower or tread surface of the sole, and have convex bottom protuberances surrounded by said sidewalls, whereby when the tread is flexed in the act of walking to bend the lower surface of the sole from its normal planar form to a downwardly convex form, the cups will be shifted slightly towards the lower tread face of the sole, and the cups will be simultaneously slightly elongated longitudinally of the sole to dislodge any foreign matter contained within the cups, said shifting and elongation being permitted by the compressibility, resiliency and flexibility of the material from which the sole and heel is made.

Due to the resiliency of the sole and the shape of the bottoms of the vacuum cups, any foreign matter which may have become embedded in the cups, will, during the act of walking along the ground surface, thus become dislodged and will be ejected. This is to say, any foreign matter which might tend to attach itself to or fill the vacuum cups will be dislodged since the diameter of the cups longitudinally of the sole will increase when the sole is subjected to lengthwise bending in the act of walking, and as the lower surface of the sole is flexed from its normal flat planar form to a downwardly convex form. This flexing of the material of the sole will cause the cup protuberances to shift toward the lower tread face of the sole, thus pushing out and dislodging any foreign matter which may have attached itself or become confined within the walls of the cup. This pushing out is facilitated by the spreading apart or opening up of the suction cups as explained above.

Other minor objects of the invention will be hereinafter set forth.

I will explain the invention with reference to the accompanying drawings which illustrate several practical embodiments thereof, to enable others familiar with the art to adopt and use the same; and will summarize in the claims the novel features of construction and novel combination of parts, for which protection is desired.

In said drawings:

FIG. 1 is a bottom plan view of one embodiment of a resilient, compressible shoe sole and heel according to my invention.

FIG. 2 is an enlarged longitudinal section on the line 2—2, FIG. 1.

FIG. 3 is an enlarged section similar to FIG. 2, but showing a modification.

FIG. 4 is a bottom plan view similar to FIG. 1 but showing a modified sole and heel.

FIG. 5 is an enlarged transverse section on the line 5—5, FIG. 4.

FIG. 6–9 are views similar to FIG. 2 but showing progressive longitudinal sections through the shoe sole in the act of walking, and illustrating the manner in which the cups are caused to successively dislodge any foreign matter contained therein during the act of walking as the lower surface of the sole is flexed from its normal planar form into a downwardly convex form.

As shown in FIGS. 1–3, the blank **1** embodying the present invention is formed of cellular rubber or other inherently compressible resilient and flexible material, and may include a sole portion **1***a* and a heel portion **1***b*, but obviously the heel and sole portions may, if desired, be formed as separate units.

According to my invention, the sole portion **1***a* and heel portion **1***b* contain in their lower surfaces a plurality of separate independent vacuum cups **2** extending partly therethrough and arranged in transversely and longitudinally spaced relation therein.

As shown in FIG. 2, each cup **2** is substantially circular and has cylindrical sidewalls **2***a* disposed substantially normal to the lower tread surface of the sole blank **1**, whereby the sole will have a vacuum grip on the surface on which it contacts, thereby preventing slipping on said surface during the act of walking or climbing, thus making my sole particularly adapted for all kinds of footwear, boots, shoes, galoshes, articles, rubbers, or the like. The vacuum cups **2** as shown in FIG. 1 are of substantial diameter and the arrangement of the cups **2** is sufficient in number, arrangement and size to form an effective vacuum grip to prevent slipping on the surface to which the sole is applied.

As shown in FIG. 2, the bottoms of the cups **2** are convex and in the nature of rounded buttons **2***c*, each disposed on a surface which is substantially a section of a sphere. In FIG. 2 the centers of the buttons **2***c* normally terminate in the plane of the lower tread surface of the sole, while in FIG. 3 the buttons **2***d* are similar in all respects to the buttons **2***c* of FIG. 2 with the exception that the centers of buttons **2***d* terminate somewhat above the plane of the lower tread surface of this sole. The cylindrical walls **2***a* of the cups **2** and the button-shaped or convex buttons **2***c*–**2***d* together form in effect a concavo-convex shape for the recesses or cups **2**. The recesses or cups **2** may be formed by molding, drilling or punching the material of the sole **1**, and the depth of the cups **2** will be governed by the thickness of the sole material.

FIGS. 4 and 5 show a modification of the cups which are formed in the sole blank **1**, the material of the sole in FIGS. 4 and 5 being the same as previously described with respect to FIGS. 1–3. In FIGS. 4 and 5 the cups **3** instead of having cylindrical sidewalls such as described with reference to FIGS. 1–3, are slightly

oval transversely of the sole, the arrangement of the cups 3 being, however, similar to the arrangement of cups 2 shown in FIG. 1. In FIGS. 4 and 5 the sidewalls 3*a* flare slightly downwardly as shown in FIG. 5 and the cups 3*a* as shown in FIG. 5 are provided at their bottoms with button-like protuberances 3*b* which are similar in all respects to the buttons 2*c* and 2*d* of FIGS. 2 and 3, except that the buttons 3*b*, like the cups 3 themselves, are correspondingly oval-shaped transversely of the sole.

In FIG. 5 the centers of the buttons 3*b* are shown as terminating slightly above the lower tread surface of the sole 1*a* or heel 1*b* in a manner similar to the buttons 2*d* of FIG. 3. However, it is understood that the centers of the buttons 3*b* may, if desired, be normally flush with the lower tread surface of the sole or heel when the latter is in normal planar form or condition, since the actions of the cups in dislodging foreign matter which may have become caked, lodged, or attached within the cups 3 during the act of walking is the same irrespective of whether the centers of the buttons 3*b* normally contact or are spaced above the lower tread surface of the sole or heel.

FIGS. 6–9 illustrate, progressively, longitudinal sections through the sole in the act of walking, and illustrate the manner in which the cups are caused to successively dislodge any foreign matter contained therein during the act of walking and as the lower surface of the sole is flexed from its normal planar form into a downwardly convex form.

In FIG. 6 the sole 1*a* is shown seated upon a layer of foreign matter F which fills the cups 2, the lefthand end of the sole portion 1*a* being shown slightly flexed upwardly in the form it would assume when the lower surface of the sole in the act of walking was initially being flexed from its normal planar form into a downwardly convex form. In this figure the sidewalls 2*a* of the cups 2 are shown as substantially normal to the outer surface of the sole 1*a*, and each of the cups 2 are shown filled with foreign matter F.

As the heel of the wearer rises further upwardly in the act of walking, the sole 1*a* then assumes the curvature shown in FIG. 7. In this figure it will be noted that the righthand cup 2 and the central cup 2 retain the same position shown in FIG. 6 and that these cups are still filled with foreign matter F, while the lefthand cup 2 (FIG. 7) has been freed of foreign matter F owing to the fact that the sidewalls 2*a* of this cup 2 have been elongated or bent from their normal cylindrical relation into downwardly flaring relation since this portion of the lower surface of the sole has been changed from its normal flat planar form into a downwardly convex form, and the normally cylindrical sidewalls 2*a* have assumed a downwardly flaring relation, thus freeing the foreign matter F which had been contained within this cup 2 adjacent the sidewalls 2*a*. Simultaneously with the elongation of the cup 2 and the downward flaring of its sidewalls 2*a*, the center of the related button 2*c*, which normally in the planar form of the sole lies in the plane of the lower surface of the sole 1, has been pushed downwardly so that its center is disposed below the lower tread surface of the flexed portion of the sole as clearly shown in FIG. 7.

In FIG. 8 the sole 1*a* is shown as further flexed in the act of walking, and it will be noted that the cup 2 at the righthand side of said figure is still shown filled with foreign matter F while the center cup 2 and the cup 2 at the lefthand side of FIG. 8 are shown free from foreign matter F owing to the longitudinal elongation of these said cups 2, and to the projection of the centers 2*c* of said buttons below the lower tread surface

of the sole 1*a*, i.e., in the positions assumed when dislodging the foreign matter F from the center and lefthand cups 2.

In FIG. 9 the sole 1*a* has been shown further flexed in the act of walking to such extent that the righthand cup 2 and the center cup 2 are both freed of foreign matter F due to elongation and flaring of the side walls 2*a* of the cups and to the projection of the centers 2*c* of the said buttons below the plane of the lower tread surface of the sole 1*a*.

Thus it will be seen that due to the shape of the vacuum cups any foreign matter which may have become embedded in the cups will during the act of walking along the ground surface become dislodged and will be ejected, that is to say, any foreign matter F which may tend to attach itself to and fill the vacuum cups 2 or 3 will be dislodged since the diameters of the cups longitudinally of the sole will increase when the sole is subjected to lengthwise bending in the act of walking and as the lower surface of the sole is changed from the flat planar form shown in FIGS. 2, 3 and 5 to a downwardly convex form shown progressively in FIGS. 6–9 inclusive. This flexing of the material of the sole will cause the protuberances 2*c*, 2*d*, 3*b* to shift towards the lower tread face of the sole, thus pushing out and dislodging any foreign matter which may have attached itself or become confined within the walls of the cups. This pushing-out is facilitated by the spreading apart or opening-up of the suction cups as explained above.

I do not limit my invention to the exact forms shown in the drawings, for obviously changes may be made therein within the scope of the claims.

I claim:

1. A self-clearing shoe sole comprising a compressible flexible base having a substantially flat planar lower ground-engaging face having formed therein a plurality of separate independent cups extending partly therethrough and arranged in transversely and longitudinally spaced relation therein, each of said cups having a circumferentially continuous substantially cylindrical sidewall and having substantially the entire area of its bottom disposed on a continuous, convex, spherical surface extending to said sidewall and forming a protuberance which joins in acute angular relation the associated sidewall by a substantially circular continuous line of junction, said side wall of each cup being disposed on straight lines in all vertical sections intersecting said lower face in substantially normal angular relation, whereby when the base is flexed to bend the lower surface of said planar form to a downwardly convex form the cups will be slightly elongated, the sidewalls will open up, and the bottom protuberances of the cups will be shifted slightly toward said lower surface to dislodge any foreign matter contained in said cups.

2. In a shoe sole as set forth in claim 1, the centers of the protuberances of the cups being disposed above the plane of the lower face of the base when the latter is in planar form.

3. In a shoe sole as set forth in claim 1, the sidewalls of the cups flaring slightly outwardly and downwardly towards the lower surface of the base when the latter is in planar form.

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