Sept. 3, 1963 F. B. GRISWOLD ETAL 3,102,347

SAFETY SHOE AND INSTEP GUARD THEREFOR

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FIG. 1

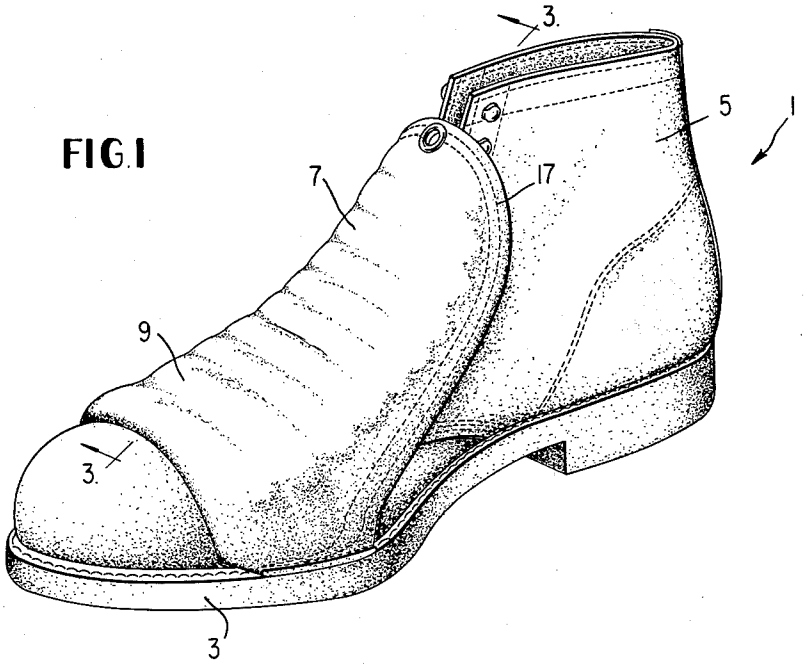
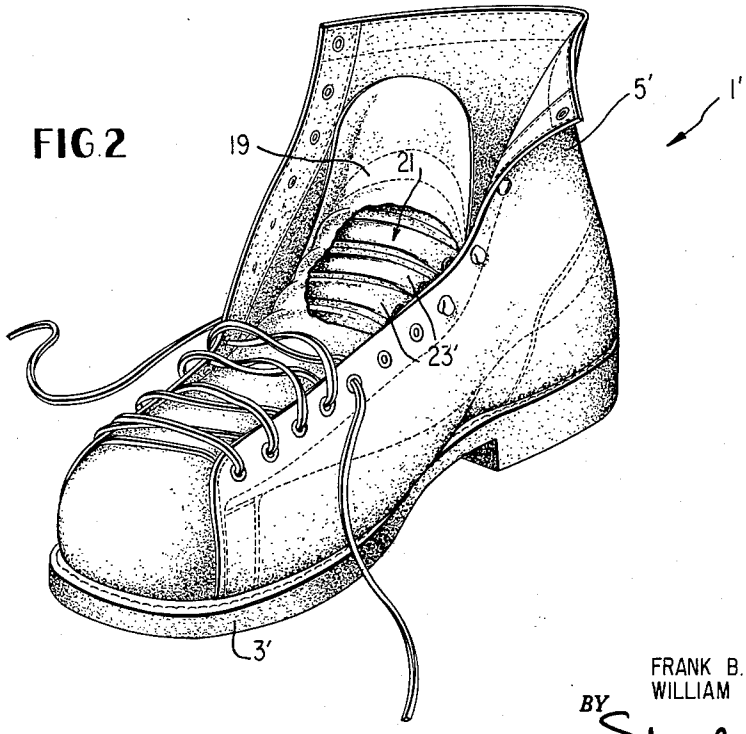


FIG. 2



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FIG.3

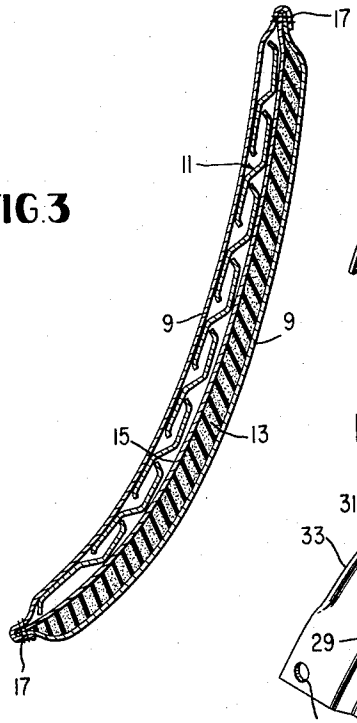


FIG.4

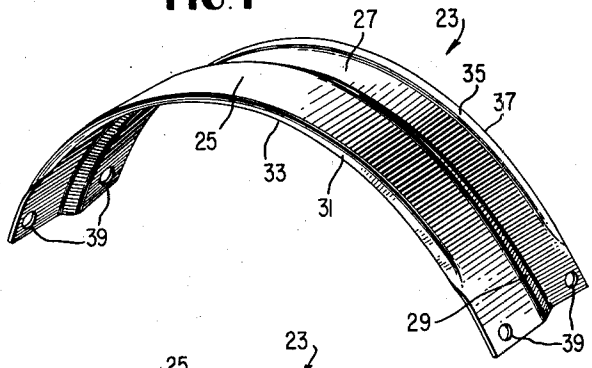


FIG.5

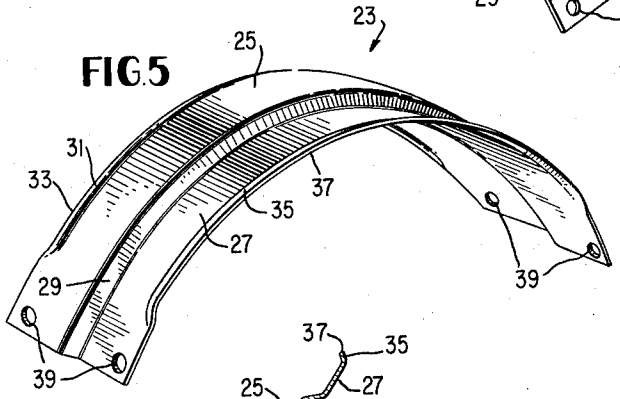


FIG.6

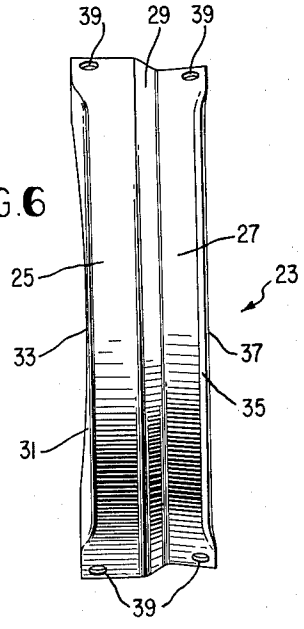


FIG.9

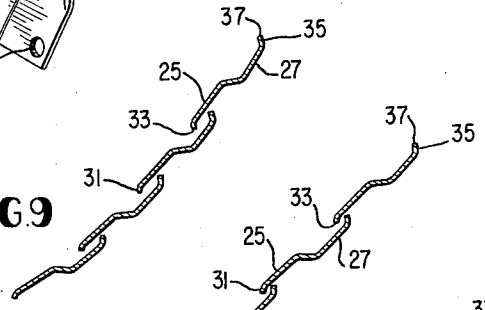
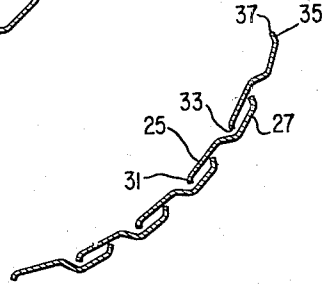


FIG.10

FIG.11



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FIG. 7

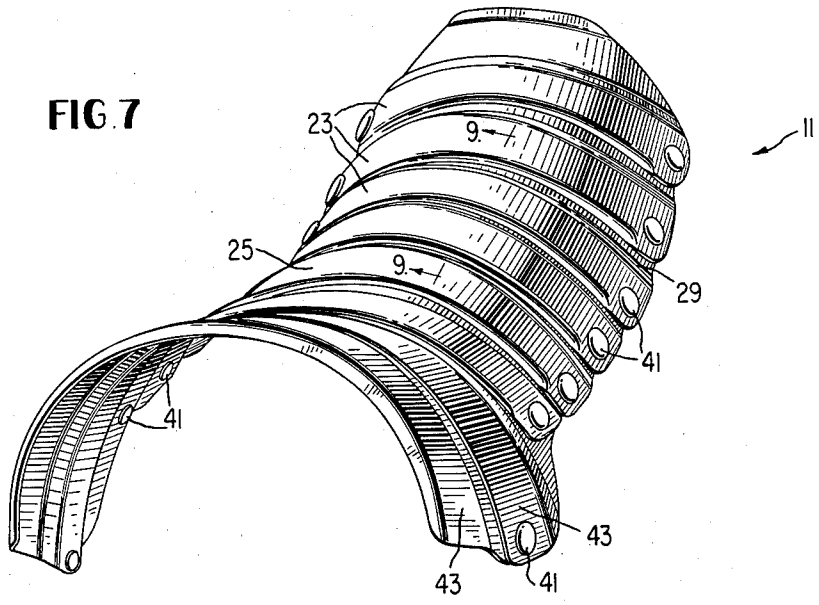
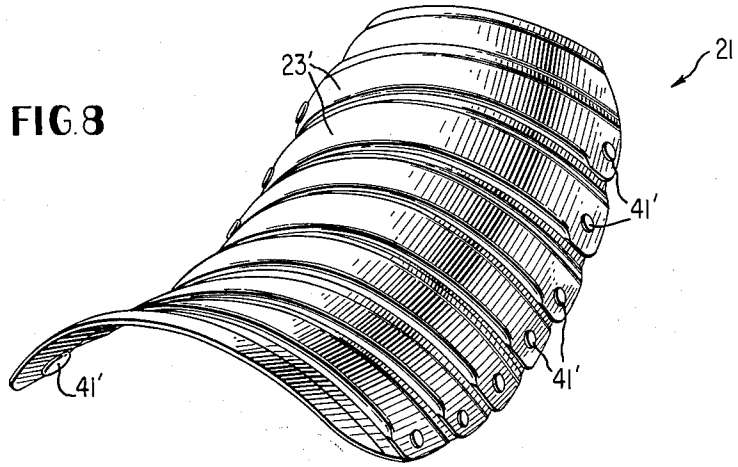


FIG. 8



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SAFETY SHOE AND INSTEP GUARD THEREFOR

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12 Claims. (Cl. 36—72)

The present invention relates to safety shoes and to instep guards for use in safety shoes.

It is a common practice to provide shoes having toe guards in the form of toe caps or built-in steel box-toe construction. Although such toe guards protect the toes, they do not protect the instep of the wearer, and a great many accidents result in injury to the instep despite the presence of a toe guard.

It has been proposed to provide instep guards which embody rigid members conforming generally to the shape of the instep, but these having heretofore been objectionable for a number of reasons. In the first place, they are uncomfortable to wear because they limit the freedom of movement of the wearer. In the second place, they are heavy and add substantially to the weight of the shoe. In the third place, they are difficult to apply to the shoe in a manner to assure their retention on the shoe during use.

To make such earlier instep guards comfortable to wear, it has been proposed to articulate them as by hingedly joining two sections of the guard together, thereby to allow the foot greater freedom of movement. Such articulated instep guards, however, have tended to dig into the foot at the point of articulation, and worse, have greatly lessened the protection afforded by the guard. Such known articulated instep guards have simply transferred blows that would otherwise be applied to the foot at the point of impact, to the foot at the point of articulation.

Although these and many other attempts have been made to provide suitable instep guards and safety shoes embodying the same, none, as far as is known, has been entirely successful when carried into practice industrially on a commercial scale.

Accordingly, it is an object of the present invention to provide safety shoes having instep guards effective to prevent damage to the instep of the wearer.

Another object of the present invention is the provision of instep guards for safety shoes, effective to prevent damage to the instep of the wearer.

Still another object of the present invention is the provision of instep guards and safety shoes embodying the same, which are flexible during normal foot movements but which assume a rigid configuration under a blow to the instep.

Finally, it is an object of the present invention to provide instep guards and safety shoes embodying the same, which will be relatively simple and inexpensive to manufacture, comfortable to wear, and rugged and durable in use.

Other objects and advantages of the present invention will become apparent from a consideration of the following description, taken in connection with the accompanying drawings, in which:

FIGURE 1 is a perspective view of a work shoe embodying an instep guard according to one embodiment of the present invention;

FIGURE 2 is a view similar to FIGURE 1, but showing a modified form of the present invention;

FIGURE 3 is a section on the line 3—3 of FIGURE 1 and showing the instep guard embodiment of that figure;

FIGURE 4 is a perspective view from one angle of an

individual strip of the protective articulated assembly of an instep guard according to the present invention;

FIGURE 5 is a view similar to FIGURE 4 but showing the strip from a different angle;

FIGURE 6 is a plan view of the strip of FIGURES 4 and 5;

FIGURE 7 is a perspective view of the articulated protective assembly of the embodiment of FIGURE 1;

FIGURE 8 is a view similar to FIGURE 7 but showing the articulated protective assembly of the embodiment of FIGURE 2;

FIGURE 9 is a diagrammatic cross-sectional view taken on the line 9—9 of FIGURE 8 and showing the strips comprising the articulated protective assembly in their normal or rest position;

FIGURE 10 is a view similar to FIGURE 9 but showing the articulated assembly spread out flat with the strips in an abnormal position relative to each other; and

FIGURE 11 is a view similar to FIGURES 9 and 10 but showing the articulated assembly in its most arcuate position, as when a blow is delivered to the instep guard in use, and showing the strips in the position they assume when they lock into a rigid asembly that prevents transmission of the blow directly to the instep of the wearer.

Referring now to the drawings in greater detail, there is shown a first species of the present invention in FIGURE 1, embodied in a safety shoe of the work shoe type indicated generally at 1 and including the usual sole 3 and upper 5. An instep guard according to the present invention, indicated at 7, is applied to the shoe over the instep thereof, leaving the toe free, guard 7 having downwardly depending side portions that are secured to the sole of the shoe about midway between the shank and the toe as by sewing or the like, thereby leaving the upper portion of the guard free to be pushed forward to enable lacing and unlacing of the shoe.

The construction of guard 7 is best seen in cross section in FIGURE 3 to include an outer leather casing 9 extending on both sides thereof and containing an articulated assembly 11 which is the protective armor of the guard. A resilient pad 13 of foam rubber or the like is disposed on the inner side of the guard within casing 9 and is separated from articulated assembly 11 by a sheet 15 of durable cloth or the like so that articulated assembly 11 does not chew up pad 13. The assembly is sewed up at its edges by stitching 17.

The embodiment of FIGURE 2 differs from that of FIGURE 1 in that the instep guard is not applied separately to the shoe but is integral with the shoe. Specifically, the safety shoe of FIGURE 2 embodies a tongue 19 within which is stitched an articulated assmbly 21 that is the armored instep guard of the embodiment of FIGURE 2. A resilient pad and a protective sheet (not shown) similar to pad 13 and sheet 15 of FIGURE 3 are disposed below articulated assembly 21, and the leather of tongue 19 provides on both sides of the articulated assembly a casing within which the instep guard is contained. As assembly 21 is articulated and flexible, tongue 19 is sufficiently flexible to allow the shoe to be easily put on and taken off. In FIGURE 2 parts corresponding to parts in FIGURE 1 are designated by primed reference characters.

Regardless of the embodiment the instep guard takes, whether as in FIGURE 1 or as in FIGURE 2 or otherwise, the essential portion of the guard is the articulated assembly 11 or 21, and the essential portion of the articulated assembly, in turn, is a multiplicity of elongated arcuate rigid strips 23 which are essentially the same in all embodiments of the invention. Accordingly, the strips 23 and their relationship to each other and their functions will now be discussed in detail, it being under-

stood that the discussion of these strips and their function in the articulated assemblies applies equally well to all embodiments of the invention unless otherwise specifically noted.

Each strip 23 is of a rigid material such as metal or plastic, steel being preferred, and is comprised of an upwardly offset portion 25 and a downwardly offset portion 27 separated from portion 25 by a smoothly rounded shoulder 29. Portions 25 and 27 and shoulder 29 extend substantially full length of the strip. On the side opposite shoulder 29, upwardly offset portion 25 carries a downturned edge portion 31 terminating in a free edge 33, while on its side opposite shoulder 29, downwardly offset portion 27 carries an upturned edge portion 35 terminating in a free edge 37. Downturned edge portion 31 and upturned edge portion 35 extend most of the length of strips 23 but are discontinuous adjacent the ends of the strips, so that the four end corners of the strips lie on the contour of portions 25 or 27.

Shoulder 29 is generally parallel to the length of strip 23, as is also free edge 37 except as the latter edge is displaced from parallel relationship by its position on upturned edge portion 35. However, the free edge 37 is not parallel to the length of strip 23 or to shoulder 29, but rather is recessed, that is, is concave as seen in plan in FIGURE 6 and opens away from shoulder 29 in that sense. Moreover, upwardly offset portion 25 and downwardly offset portion 27, although offset from each other by shoulder 29, are not parallel and their planes are not concentric or coaxial. Instead, considering offset portions 25 and 27 to be fragments of cylindrical surfaces, which they are not necessarily, then the axes of those cylinders would not only be noncoincident but would also be nonparallel to each other. Specifically, lines lying on offset portions 25 and 27 perpendicular to the length of strips 23 are disposed at oblique angles to each other as measured on the upper sides of strips 23, instead of in parallelism to each other as would be the situation if portions 25 and 27 of an individual strip 23 were parallel to each other.

The purposes of the particular configurations of strips 23 will become apparent from a consideration of the positions and functions of those strips in the articulated assemblies shown in FIGURES 7 and 8 and diagrammatically in FIGURES 9, 10 and 11, in which the longitudinal edges of each arched strip are disposed transverse to the length of the articulated assembly.

Each strip 23 is provided with four holes 39 therethrough, one located in each end corner of the strip, and rivets 41 pass through holes 39 of edgewise overlapping strips 23 to connect the strips by means of a multiplicity of points of articulation into the articulated assemblies shown in FIGURES 7 and 8. In FIGURE 8 parts corresponding to parts in FIGURE 7 are designated by primed reference characters. Specifically, an upwardly offset portion 25 overlies a downwardly offset portion 27 of an immediately adjacent strip in shingle fashion from top to bottom of the articulated assemblies 11 and 21. In this connection, it should be noted that in the illustrated embodiments, the "upwardly" offset portions 25 are actually at the lower side of each strip 23, they being "upwardly" offset from the contour of "downwardly" offset portions 27. Similarly, "downwardly" offset portions are thus offset in the sense that they are downwardly offset from the contour of "upwardly" offset portions 25, despite the fact that "downwardly" offset portions 27 are actually at the upper sides of the strips when the articulated assemblies are in their operative positions.

The relationship of the parts in their normal or unflexed position is shown in perspective in FIGURES 7 and 8 and in section in FIGURE 9. In that normal position of the parts, the overlying portions 25 and 27 of immediately adjacent strips 23 are parallel to each other. Also in that position of the parts, the free edge 33 and shoulder 29 of those same two overlying immediately adjacent parts are parallel to each other. The portions

25 and 27 of any single strip 23, however, are not parallel to each other, as described above; and the shoulder 29 and free edge 33 of any given strip 23 are not parallel to each other, as also described above. Accordingly, the reason for these non-parallel relationships of various portions of a given strip relative to each other will now be clear: it is so that the said portions of immediately adjacent strips will be parallel to each other in the rest or unflexed position of the articulated assembly, and so that in the rest or unflexed position marked by those parallel positions of corresponding portions of immediately adjacent strips, the articulated assembly will have the configuration shown in FIGURES 7, 8 and 9, that is, upwardly concave on its upper surface as well as downwardly concave on its under surface, or more specifically, downwardly concave transverse to the length of the articulated assembly but upwardly concave parallel to the length of the articulated assembly. This compound curvature is provided so that the articulated assemblies will conform generally to the curvature of a human instep.

The portions of immediately adjacent strips 23 also coact with each other in unique ways when the articulated assemblies are flexed undesirably far in either direction. FIGURE 10 shows diagrammatically what happens to an articulated assembly when it is attempted to straighten it beyond any intended useful position of the assembly. As is there shown, the upturned edge portions 35 of each strip engage with the underside of upwardly offset portions 25 or downturned edge portions 31 of the immediately adjacent strip, and downturned edge portions 31 engage with the upper sides of downwardly offset portions 27 or upturned edge portions 35 of the immediately adjacent strips, thereby preventing further articulation of the assembly in a direction to straighten it, and more important, preventing disengagement of the strips from overlying relationship with each other.

In the other direction of flexure of the articulated assembly, FIGURE 11 shows what happens when it is attempted to decrease excessively the radius of the upwardly opening concave curve lengthwise of the articulated assembly. The downturned edge portions 31 then move into contact with shoulders 29 to prevent further flexing. This last flexure of the articulated assembly is that which is induced by a blow to the instep of the wearer. Hence, it will be recognized that a very important feature of the present invention is the above-described relationship of parts such that when a blow is delivered to the instep of the wearer of an instep guard according to the present invention, the guard will flex until the upper strips 23 abut edgewise against shoulders 29 of the immediately lower strips 23, whereupon the articulated assembly becomes a rigid assembly that cannot flex further and that accordingly resists the blow and does not transmit the blow at any particular point to the foot of the wearer.

The upturned and downturned edge portions 35 and 31 also perform the function of presenting smoothly rounded edges to the outer sides of the articulated assemblies thereby to avoid sharp edges that might cut the coverings of the assemblies.

In normal usage, the articulated assembly is perfectly free to flex in either direction from the normal position shown in FIGURE 9, between the limits shown in FIGURES 10 and 11. The instep guards of the present invention are thus quite comfortable to wear and do not impede movements of the wearer, but lock into a rigid assembly under the impact of a blow. There is thus provided a safety shoe and instep guard therefor which combines all the comfort features of a freely flexible guard with the safety features of a completely rigid guard.

As indicated above, the heart of the invention is the articulated assembly of individual strips 23, which can be largely identical to each other apart from immaterial variations in shape, length, or curvature dictated by their position in the articulated assembly, and this relationship holds true regardless of which embodiment of the inven-

tion is practiced. Thus, for example, the strips **23** at the upper ends of the articulated assemblies will of course have curved upper edges to provide a smoothly curved upper end for the articulated assembly. Similarly, the strips **23** adjacent the lower ends of the articulated assemblies may be a little longer than those adjacent the upper end, and at the lower end may be smoothly curved to provide a smoothly curved lower end of the assembly. In the case of the embodiment of FIGURE 1, in which it is desired to transmit some of the impact directly to the sole of the shoe, the lower strips can be in the form of substantially longer strips **43** that bridge across the lower portion of the instep between upper surfaces of the sole of the shoe on opposite sides of the foot. In the case of at least the upper of these longer strips **43**, the rivet holes **39** and rivets **41** are not spaced apart equal distances transversely of the length of the articulated assembly. Instead, the upper holes **39** and rivets **41** have about the same spacing as on the upper strips **23**, while the lower holes **39** and rivets **41** are spaced apart from each other a substantially greater distance transversely of the length of the articulated assembly.

Apart from such minor variations, it is generally true that the holes **39** and rivets **41**, marking the points of articulation of the articulated assembly, are disposed generally in a line extending lengthwise of the articulated assembly along each side thereof. It is important to note, therefore, that in the rest or normal position of the parts indicated in FIGURES 7, 8 and 9, this line along which the points of articulation lie on each side of the articulated assembly is upwardly concave lengthwise of the assembly, in general conformity with the longitudinally upward concavity of articulated assembly as contrasted with the transversely downward concavity thereof occasioned by the arched configuration of strips **23**.

From a consideration of the foregoing disclosure, it will be obvious that all of the initially recited objects of the present invention have been achieved.

Although the present invention has been described and illustrated in connection with preferred embodiments, it is to be understood that modifications and variations may be resorted to without departing from the spirit of the invention, as those skilled in this art will readily understand. Such modifications and variations are considered to be within the purview and scope of the present invention as defined by the appended claims.

What is claimed is:

1. A safety shoe having an instep guard of a compound curvature conforming generally to the shape of a human instep, the guard being secured to the shoe adjacent at least the lower end of the guard and being comprised of a plurality of elongated arched rigid strips extending transversely of the length of the guard, and means articulately interconnecting a plurality of the strips with the edges of adjacent strips overlapping each other, there being four said means passing through each of a plurality of the strips one adjacent each junction of an end and a transverse edge of the strip.

2. A safety shoe having an instep guard of a compound curvature conforming generally to the shape of a human instep, the guard being secured to the shoe adjacent at least the lower end of the guard and being comprised of a plurality of elongated arched rigid strips extending transversely of the length of the guard, and means articulately interconnecting a plurality of the strips with an edge of each of the plurality of strips transverse to the length of the guard overlying a transverse edge of one of the immediately adjacent strips and the other edge of each of the plurality of strips transverse to the length of the guard underlying a transverse edge of the other of the immediately adjacent strips, each of a plurality of the strips having portions parallel to adjacent portions of each immediately adjacent strip, said portions of each strip being disposed at an angle to each other such that when all said portions are parallel to their immediately adjacent said portions of immediately adjacent strips, the guard is concave longitudinally upward as well as transversely downward.

3. A safety shoe as claimed in claim 2, the strips being articulately interconnected at points adjacent the ends of the strips, said points lying on a pair of lines one lying along each longitudinal side edge of the guard, said lines being upwardly concave when said immediately adjacent portions are parallel as aforesaid.

4. A safety shoe having an instep guard of a compound curvature conforming generally to the shape of a human instep, the guard being secured to the shoe adjacent at least the lower end of the guard and being comprised of a plurality of elongated arched rigid strips extending transversely of the length of the guard, and means articulately interconnecting a plurality of the strips with an edge of each of the plurality of strips transverse to the length of the guard overlying a transverse edge of one of the immediately adjacent strips and the other edge of each of the plurality of strips transverse to the length of the guard underlying a transverse edge of the other of the immediately adjacent strips, each of a plurality of the strips having a portion upwardly offset from the profile of the remainder of the strip and a portion downwardly offset from the profile of the remainder of the strip, the upwardly offset portion of each of a plurality of the strips overlying the downwardly offset portion of an immediately adjacent strip.

5. A safety shoe as claimed in claim 4, a free edge of the upwardly offset portion of each of a plurality of strips transverse to the length of the guard being downturned and a free edge of the downwardly offset portion of each of a plurality of strips transverse to the length of the guard being upturned.

6. A safety shoe as claimed in claim 4, said upwardly and downwardly offset portions extending substantially full length of the strips.

7. An instep guard for a safety shoe, the guard having a compound curvature of a shape conforming generally to the shape of a human instep, the guard being comprised of a plurality of elongated arched rigid strips extending transversely of the length of the guard, and means articulately interconnecting a plurality of the strips with an edge of each of the plurality of strips transverse to the length of the guard overlying a transverse edge of one of the immediately adjacent strips and the other edge of each of the plurality of strips transverse to the length of the guard underlying a transverse edge of the other of the immediately adjacent strips, there being four said means passing through each of a plurality of the strips one adjacent each junction of an end and a transverse edge of the strip.

8. An instep guard as claimed in claim 7, each of a plurality of the strips having portions parallel to adjacent portions of each immediately adjacent strip, said portions of each strip being disposed at an angle to each other such that when all said portions are parallel to their immediately adjacent said portions of immediately adjacent strips, the guard is concave longitudinally upward as well as transversely downward.

9. An instep guard as claimed in claim 8, the strips being articulately interconnected at points adjacent the ends of the strips, said points lying on a pair of lines one lying along each longitudinal side edge of the guard, said lines being upwardly concave when said immediatly adjacent portions are parallel as aforesaid.

10. An instep guard for a safety shoe, the guard having a compound curvature of a shape conforming generally to the shape of a human instep, the guard being comprised of a plurality of elongated arched rigid strips extending transversely of the length of the guard, and means articulately interconnecting a plurality of the strips with an edge of each of the plurality of strips transverse to the length of the guard overlying a transverse edge of one of the immediately adjacent strips and the

other edge of each of the plurality of strips transverse to the length of the guard underlying a transverse edge of the other of the immediately adjacent strips, each of a plurality of the strips having a portion upwardly offset from the profile of the remainder of the strip and a portion downwardly offset from the profile of the remainder of the strip, the upwardly offset portion of each of a plurality of the strips overlying the downwardly offset portion of an immediately adjacent strip.

11. An instep guard as claimed in claim 10, a free edge of the upwardly offset portion of each of a plurality of strips transverse to the length of the guard being downturned and a free edge of the downwardly offset portion of each of a plurality of strips transverse to the length of the guard being upturned.

12. An instep guard as claimed in claim 10, said upwardly and downwardly offset portions extending substantially full length of the strips.

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