May 8, 1962 S. J. KENNEDY ETAL 3,032,894

ANTI-PERSONNEL MINE PROTECTIVE SHANK

Filed June 21, 1961

Fig. 1.

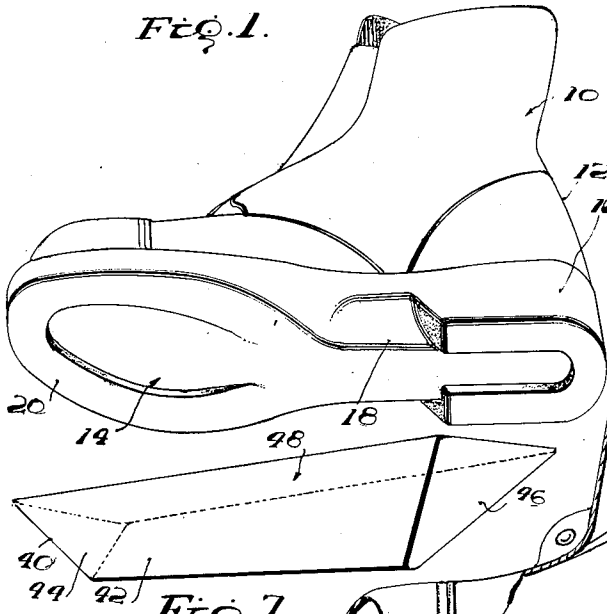


Fig. 2.

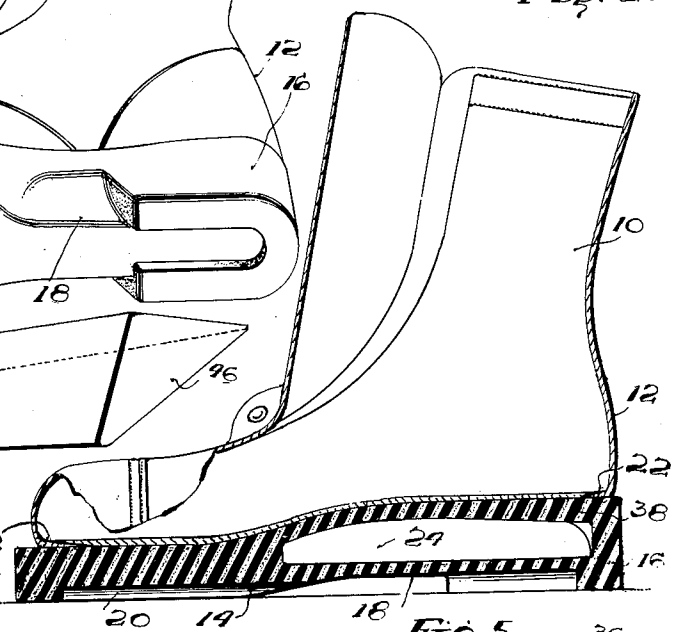


Fig. 7.

Fig. 3.

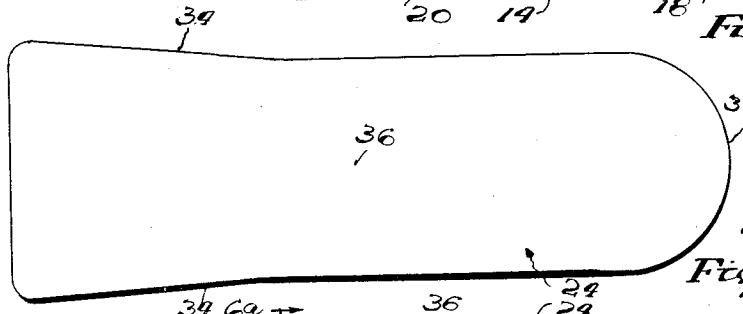


Fig. 5.

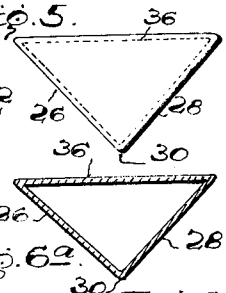


Fig. 6a.

Fig. 6b.

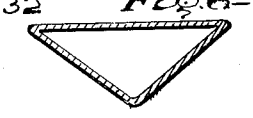


Fig. 4.

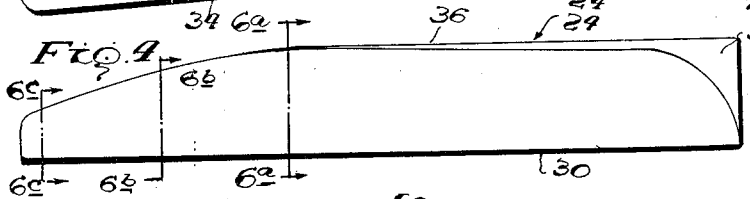


Fig. 6c.

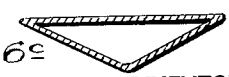
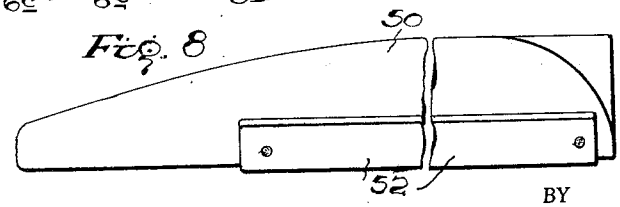


Fig. 8



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ANTI-PERSONNEL MINE PROTECTIVE SHANK

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9 Claims. (Cl. 36—1)

(Granted under Title 35, U.S. Code (1952), sec. 266)

The invention described herein, if patented, may be manufactured and used by or for the Government for governmental purposes, without the payment to us of any royalty thereon.

The present invention relates to protective footwear and more particularly to footwear having a built-in deflector to deflect the blast from anti-personnel land mines or the like exploding underfoot.

In modern warfare anti-personnel land mines which maim rather than kill have been increasingly used since the care of the wounded increases the burden of carrying on warfare, thus tending to diminish the effort available for active combat. This burden falls most heavily on countries, such as the United States, which have particularly high standards of care and rehabilitation of the wounded. The destructive effect of land mines designed to maim, rather than kill, results from the effects of the blast and is exerted primarily on the feet and legs of persons subjected thereto. While any destructive injury of the foot or lower leg is serious, destruction of the heel or arch of the foot or both or serious shattering of the lower leg are likely to require amputation, but even if that is not required, use of the foot and leg will almost certainly be extensively and permanently impaired. It is thought that if at least the heel and arch portions of the foot and the lower regions of the leg could be protected from the blast of anti-personnel land mines, much of the permanent damage that is otherwise done to the feet and legs by land mines exploding underfoot could be obviated.

Although devices for protecting Armed Forces personnel against the effects of land mines have heretofore been proposed and used, these devices were designed particularly for use by personnel clearing mine fields. For various reasons, such as size and weight, they greatly impeded normal walking of the personnel wearing the same. This limited their use strictly to mine field clearing personnel. In contrast to this, no appreciable impediment to normal walking is imposed by the protective footwear of the present invention so that it may be worn at all times in active combat zones. It will thus be possible greatly to reduce injury due to haphazardly placed undiscovered land mines. Moreover, knowledge of this fact by Armed Forces personnel will do much to relieve apprehension with respect to land mines and thus increase efficiency.

Accordingly, an object of the invention is to provide new and improved footwear for protecting the feet and lower extremities of Armed Forces personnel from the effects of the blast of blast type anti-personnel land mines exploding underfoot.

A further object of the invention is to provide new and improved protective footwear as set forth in the preceding object which does not appreciably impair walking so that it may be worn at all times by Armed Forces personnel in active combat zones.

A still further object of the invention is to provide new and improved protective footwear having a deflector built into the lower section thereof to deflect the blast of anti-personnel mines exploding underfoot from at least the heel and arch portions of the foot of the wearer.

Another object of the invention is to provide new and improved protective footwear including a deflector to deflect the blast of anti-personnel land mines exploding underfoot which may be built into any footwear having a lower section made from vulcanizable rubber or rubberlike materials, such as direct molded combat boots and rubber overshoes, without appreciable alteration of the construction thereof.

A more general object of the invention is to provide new and improved protective footwear as set forth in the preceding objects which does not differ appreciably from conventional footwear used by the Armed Forces except for the presence of a deflector therein which may be readily incorporated into the footwear without materially altering the present methods of fabricating footwear so that the cost of such footwear is not greatly increased over the cost of conventional footwear.

Another general object of the invention is to provide new and improved protective footwear as specified in the preceding object in which the deflector may be made of stainless steel in sheet form or in solid form from lighter weight metals such as aluminum or even from plastics so that the deflector does not add appreciably to the weight of the footwear.

These and other objects, advantages and capabilities of the invention will become apparent from the following description wherein reference is had to the accompanying drawing in which:

FIG. 1 is a perspective view of the armored combat boot of the present invention;

FIG. 2 is a vertical longitudinal sectional view of the armored boot of the present invention;

FIG. 3 is a top plan of the deflector used in the armored combat boot of the present invention;

FIG. 4 is a side elevational view thereof;

FIG. 5 is a rear end view of the deflector;

FIGS. 6*a*, 6*b* and 6*c* are vertical transverse sectional views of the deflector taken in the direction of the arrows on the line 6*a*—6*a*, 6*b*—6*b*, and 6*c*—6*c*, respectively, of FIG. 4;

FIG. 7 is a perspective view of a modified form of deflector; and

FIG. 8 is a side elevational view of another modified form of deflector.

Referring to FIGS. 1 and 2 of the drawings, there is shown an exemplification of the improved armored mine protective footwear of the present invention in the form of a direct molded combat boot **10**. This boot includes the usual leather upper section designated as an entirety by the number **12** which is generally similar to the uppers of conventional combat boots and a lower section or lower designated as an entirety by the number **14**. This lower comprises a heel portion **16**, a shank portion **18** and a sole portion **20**. The lower **14** is made from vulcanizable rubber or rubberlike material of the type commonly used in making direct molded footwear so that the upper section **12** may be directly molded to the lower section **14** by fusing the two sections together along the welt line which is indicated more or less diagrammatically at **22** in FIG. 2.

The improved footwear of the present invention differs from conventional direct molded footwear in one important respect. Whereas conventional footwear may have a shank stiffener of one sort or another in the shank portion thereof, the footwear of the present invention has a generally wedge-shaped deflector **24** (FIG. 2) built into or embedded in the heel and shank portions **16** and **18**, respectively, of the lower **14**.

The form of deflector shown in FIGS. 2 to 6*c*, preferably, is made from sheet metal, such as .050″ stainless steel or other tough metals, alloys or reinforced plastics. It comprises a body of triangular shape in transverse section (FIG. 5) having opposite side walls **26** and **28**, respectively, joined along an apex **30**. The body has a

rounded rear end 32 (FIGS. 3 and 4). The portion of the deflector so far described preferably is formed by post forming or any other process that will eliminate the need for welding along the apex 30, and the apical angle between the sides 26 and 28 increases appreciably along the instep and forward end portions of the deflector 24, as seen in FIGS. 6a to 6c, thus producing an outward flaring of the upper edges of the body of the deflector 24 along this portion thereof as indicated at 34 in FIG. 3. The apical angle may, for example, increase from approximately 90° along the rear end portion of the deflector, as seen in FIG. 5, to approximately 140°, as seen in FIG. 6c. The deflector 24 also has a top wall 36 generally conforming in peripheral outline to the peripheral contour of the heel and arch portions of a human foot, as seen in FIG. 3, and thus conforming generally in contour to the contour of the rear or posterior portion of an insole. This top wall may be of the same material as the side walls 26 and 28, and it may be welded or otherwise suitably secured to the upper peripheral edges of the aforesaid side walls and the rounded rear end wall 32.

In the form of the invention disclosed in FIGS. 1 to 6c, the anterior or forward portion of the side and top walls of the deflector 24 arch downwardly as seen in FIGS. 2 and 4 so as to conform more or less closely to the arching found in the shank portion of conventional footwear. In a preferred construction, the height of the rear end of the deflector 24 was approximately 1¼", while the height of the forward end of the deflector was less than half that amount. As best seen in FIG. 2, the deflector extends from the rear of the heel portion of the boot 10 over the heel and shank portions thereof to a line in the region of the ball of the foot portion of the boot and therefore underlies these portions of the foot of a wearer of the thus armored boot 10 thus tending to protect those portions of the foot against the direct effects of an underfoot blast.

After a deflector 24 as above described has been fabricated, the surface thereof should be cleaned to receive a coat of rubber cement of a type compatible with the vulcanizable rubber compound used in the heel 16, shank 18 and outsole 20 of the particular footwear which is being fabricated so that the deflector will bond to these parts, and to a rubber overlayer similar to an insole as indicated at 38 in FIG. 2 when the footwear is molded in accordance with known direct molding processes. The deflector 24 thus is embedded or built into the completed footwear as indicated in FIG. 2.

In FIGS. 7 and 8 deflectors of slightly different construction from that already described are shown. The deflector shown in FIG. 7 has flat sides 40 and 42, flat ends 44 and 46 and a flat top 48. A deflector of this shape could readily be molded in which case it should be made from a light-weight aluminum or other light-weight alloy. While it is wedge shaped in transverse section, as is the deflector first described, the apical angle thereof progressively increases in size from the rear end to the forward end thereof instead of along the front end only, and the top side 48, likewise, instead of arching only along the forward end portion thereof, is flat and inclines uniformly from the rear to the forward end.

The deflector 50 shown in FIG. 8 may be the same as the deflector 24 first described in all respects, except for the fact that it is provided with a reinforcing strip 52 along a portion of the apex thereof as shown in FIG. 8. Obviously, this reinforcement may extend a greater or a less portion of the total length of the apex than shown in this view.

From an examination of FIGS. 1 and 2, it will be observed that the presence of the deflector 24 in the combat boot 10 causes the instep of the boot to be lower than the shank of a conventional boot. This arises from the fact that the deflector 24 is approximately 1¼" high at its rear end as previously explained and preferably is so disposed with respect to the lower 14 of the boot 10

that the apex 30 thereof lies in a substantially horizontal plane in the finished boot. This would likewise be true when deflectors of the type shown in FIGS. 7 and 8 are used instead of the deflector 24. In other respects, the armored combat boot 10 is quite similar to the unarmored combat boots made by the direct molding process.

However, this difference in construction does not interfere with normal walking to any appreciable extent because nearly all of the flexibiilty of footwear is in the region of the ball of the foot. That being the case, the armored boot 10 retains sufficient flexibility not appreciably to interfere with walking by the wearer. Interference with normal walking due to the presence of the deflector 24 in the armored boot 10 is also minimized because the upper side of the deflector is arched in a manner similar to the arching in this portion of a conventional combat boot, and the forward end of the deflector extends only to the region of the ball of the foot.

Since the top side 36 of the deflector 24 conforms in shape or contour generally to the peripheral contour of the heel and arch portions of the foot and the sides 26 and 28 thereof taper or incline outwardly from the apex 30, these sides tend to deflect the force of a blast from an underfoot explosion thus protecting the heel, arch and lower extremities of the legs from the direct effects of a blast of this type. The damage an explosion of this type might do to these areas would thus be greatly reduced and the likelihood of amputation being required correspondingly reduced. While the footwear of the present invention does not protect the forward portion of the foot of a wearer, loss of this portion of the foot or extensive damage thereto is not as likely to require amputation of the entire foot or lower leg or to interfere as seriously subsequently with walking as do extensive damage to the arch, heel or lower portions of the leg.

It will thus be seen that the armored footwear of the present invention provides effective protection against the more serious consequences of blast on the feet and legs of those subjected to underfoot explosions. It will also be seen that the improved armored footwear of the present invention is relatively simple in construction, and, for that reason, and because its use is compatible with present footwear fabricating methods and designs and it does not require right and left hand units, it is inexpensive. Moreover, it can be used in any footwear in which the lower is made of a vulcanizable moldable rubber or rubber-like material. Combined with all these advantages is the fact that the deflector 24 adds little to the weight of armored footwear and does not interfere appreciably with the flexibility needed in footwear for ease in walking so that it does not noticeably impede normal walking.

It is to be understood that the form of the invention herewith shown and described is to be taken as a preferred embodiment of same, and that various changes in the shape, size and arrangement of parts may be resorted to without departing from the spirit of our invention or the scope of the subjoined claims.

We claim:

1. Protective footwear to attenuate the force of the blast from an underfoot explosion of an anti-personnel land mine or the like on the heel and instep portions of the foot of a wearer of the footwear comprising an upper section, a lower section to form the heel, shank and sole portions of said footwear and an elongated wedge-shaped blast resistant deflector built into said lower section with the apex thereof directed downwardly, said deflector extending over at least all of the heel and shank portions of said footwear.

2. Protective footwear as defined in claim 1 wherein said blast deflector is hollow and has relatively thin walls of a high tensile strength non-shatterable sheet material.

3. Protective footwear as defined in claim 1 wherein the top side of said deflector slopes toward the apical edge thereof at least along the forward end thereof and

the apical angle increases from an intermediate portion of the deflector to the said forward end thereof.

4. Protective footwear as defined in claim 1 wherein the top side of said deflector inclines uniformly downwardly toward the apical edge thereof from the rear end to the forward edge thereof and the apical angle increases from the rear to the forward end of the deflector.

5. Protective footwear to attenuate the force of the blast from an underfoot explosion of an anti-personnel land mine or the like on the heel and arch portion of the foot of a wearer of the footwear comprising an upper section, a lower section to form the heel, shank and sole portions of said footwear, at least said lower section being formed from a vulcanizable rubber or rubber-like material and an elongated wedge shaped blast resistant deflector susceptible to being bonded to the material of said lower and directly molded by a vulcanizing process into said lower section with the apex thereof directed downwardly, said deflector extending over at least all of the heel and shank portion of said lower section.

6. Protective footwear as defined in claim 5 wherein said blast deflector is hollow and has relatively thin walls of a high tensile strength non-shatterable sheet metal.

7. A deflector of the class described comprising a body of elongated generally wedge shape in transverse section from end to end thereof, the peripheral outline of the side of said body opposite the apex thereof corresponding in shape to the shape of the heel and shank portion of an insole for conventional footwear and the apical angle of said body increasing at least along the end thereof corresponding to the shank of an insole.

8. A deflector as defined in claim 7 wherein the walls are made from a high tensile strength non-shatterable relatively thin sheet material formed to define a hollow body.

9. A deflector as defined in claim 7 wherein the side opposite the apical edge thereof slopes toward the latter edge at least along one end thereof and the apical angle increases from an intermediate position of the deflector to the said latter edge.

References Cited in the file of this patent

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