Nov. 6, 1962 E. R. BARRON 3,061,951

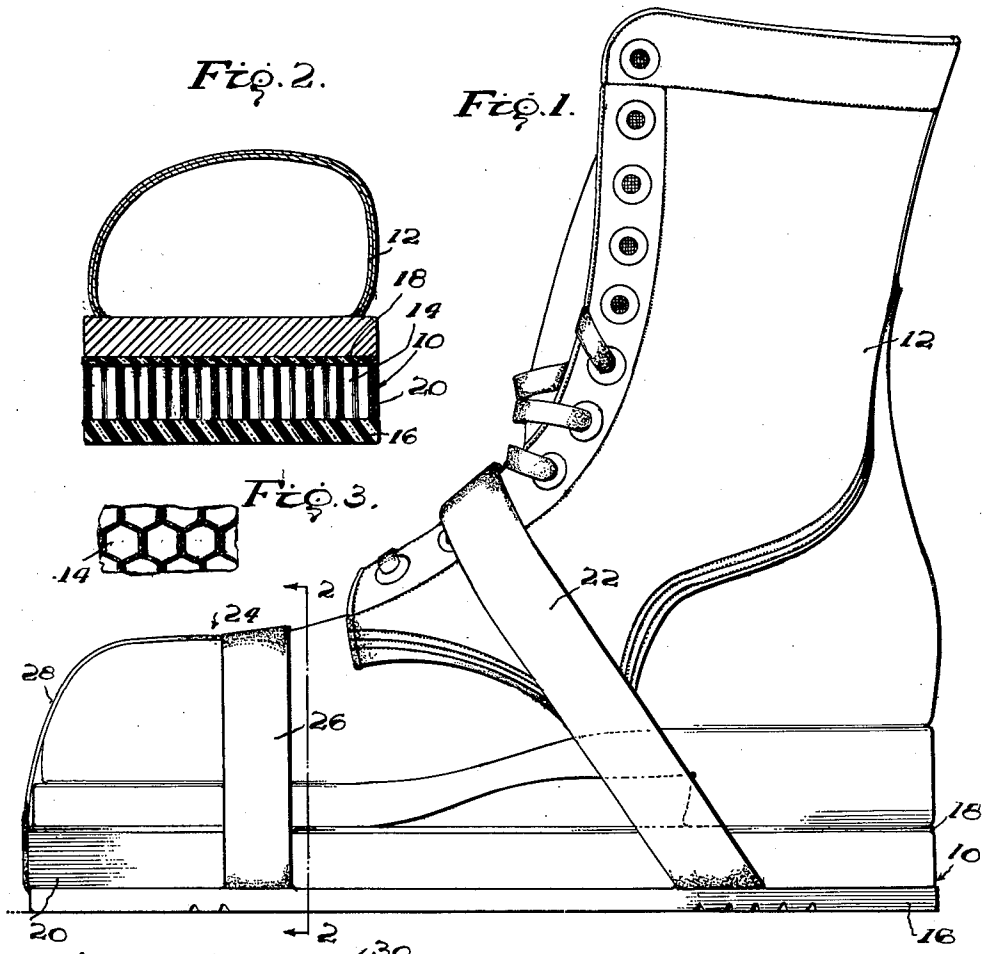
BLAST ATTENUATING FOOTWEAR

Filed May 18, 1961

Fig. 2.

Fig. 3.

Fig. 1.



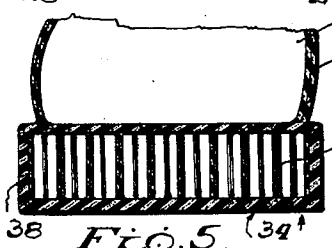
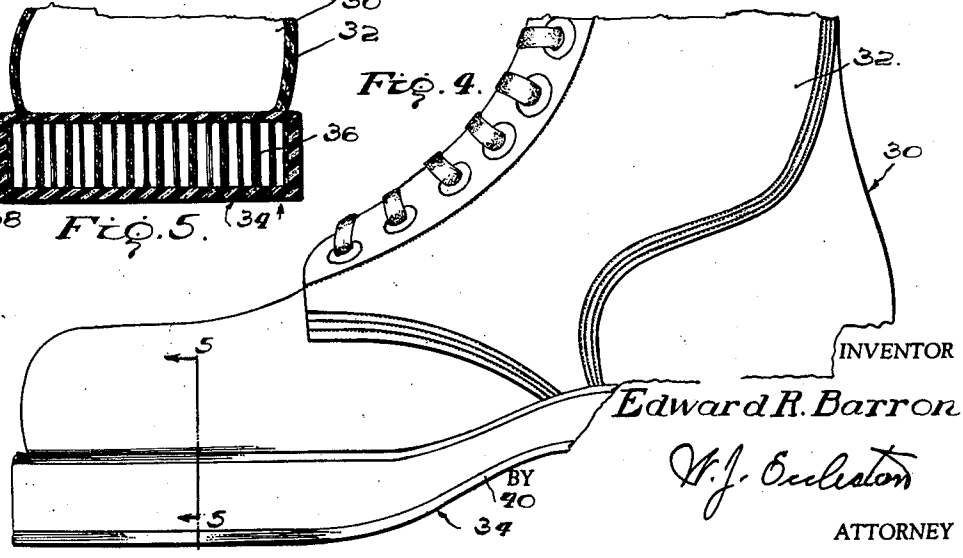


Fig. 5.

Fig. 4.



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BLAST ATTENUATING FOOTWEAR

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

The present invention relates to protective devices and more particularly to a device for attenuating the destructive effect of the blast of anti-personnel land mines or the like exploding underfoot of Armed Forces personnel.

In modern warfare, anti-personnel land mines which maim rather than kill have found increasing use since care of those wounded by such mines or in other ways increases the burden of carrying on warfare and thus tends 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 effect of the blast and is exerted primarily on the feet and legs of persons subjected thereto. Since the force of a blast diminishes rapidly as the distance from the center of the blast increases, anything which increases the vertical spacing or distance between the mines in a mine-field and personnel walking over the field will tend to reduce the extent of the injuries to those personnel from underfoot explosions. The protective device of the present invention is designed to insure the existence of a blast attenuating space between buried anti-personnel land mines and the underside of the feet of personnel walking over the field in which they are buried.

Accordingly, an object of the invention is to provide a new and improved device for reducing the destructive effect of the blast of blast-type anti-personnel mines on the feet and lower extremities of Armed Forces personnel when they encounter such mines.

A further object of the invention is to provide a new and improved device as set forth in the preceding object which insures that a blast attenuating space will be present between the anti-personnel land mines in a mine field and personnel encountering the mines.

A still further object of the invention is to provide a new and improved device for protecting personnel of the Armed Forces from the blast of anti-personnel land mines which may be used as an accessory for wear over conventional footwear or may be built into footwear without extensive alteration in the construction or the process of fabrication.

Still another object of the invention is to provide a new and improved device for protecting personnel of the Armed Forces from the blast of anti-personnel land mines which is designed to be worn not only by personnel engaged in clearing mine fields, but at any time that personnel of the Armed Forces are in a combat zone regardless of the activities in which they may be engaged.

A more specific object of the invention is to provide a new and improved anti-personnel mine blast attenuating device to protect the feet and lower extremities of Armed Forces personnel which includes an elevating core or layer of honeycomb or the like disposed between the bottom of a wearer's foot and the ground, the core being sufficiently rigid normally to sustain the weight of a wearer but being crushable under the effects of the blast of anti-personnel mines.

A more general object of the invention is to provide a new and improved device for protecting personnel of the Armed Forces from the blast of anti-personnel land mines which is simple and inexpensive to construct, readily constructed in various sizes and shapes and which may be readily donned and doffed when it is furnished as an accessory.

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

FIG. 1 is a side-elevational view of a conventional combat boot with the improved protective device of the present invention secured thereon;

FIG. 2 is a vertical transverse sectional view taken in the direction of the arrows on the line 2—2 on FIG. 1;

FIG. 3 is a top plan view of a fragment of the core of the protective device of the present invention;

FIG. 4 is a fragmentary side elevational view of a modification of the invention; and

FIG. 5 is a vertical transverse sectional view taken in the direction of the arrows on the line 5—5 on FIG. 4.

For convenience in nomenclature, the improved blast attenuator of the present invention has been designated a sandal, footpad or protective footpad in the following specification and claims. This term is used to designate both forms of the invention disclosed herein.

Referring to the drawings, a protective sandal or footpad 10 constructed in accordance with the present invention is shown in FIGS. 1 to 3 which is detachably connectable to conventional footwear, such as the combat boot shown at 12 in FIG. 1. This footpad comprises a layer or core 14 of non-elastic honeycomb material shaped in peripheral outline to correspond to the peripheral outline of the underside of the heel, shank and outsole portions of the boot 12. The honeycomb core 14, which may be of conventional construction, preferably is made from paper, but it may also be made from textile materials, paper and textile laminates, aluminum, plastics or rubber-like materials. It may vary from ⅛" to 5" in thickness or height.

To protect the core 14 against the effects of wear under ordinary conditions of use, the underside thereof is provided with an outsole or tread portion 16, and the upwardly facing side thereof is provided with a covering layer 18 while the peripheral edges are covered by foxing 20. This protective covering may be made from any suitable flexible wear resistant material, such as rubber or rubber-like materials, and the outsole portion 16 may be thickened and patterned to improve traction with the ground. This arrangement provides a hollow space for the reception of intermediate core 14.

Suitable means is provided for releasably attaching the footpad 10 to the underside of the boot 12, such as an ankle strap 22 and a toe harness 24 or any other suitable means, the toe harness including a cross strap 26 and a front strap 28 extending forwardly therefrom. The ankle strap 22 and toe harness 24 are suitably anchored to the footpad 10. The aforementioned straps may be made of any suitable material, such as webbing, leather or elastic materials.

The principles of the invention may also be used to construct footwear having a built-in blast protective footpad as shown in FIGS. 4 and 5. Molded footwear, such as rubber overshoes, and combat boots of the direct molded type, i.e. the type in which the uppers are directly molded to rubber lowers, are examples of footwear particularly adaptable for construction with built-in blast attenuating footpads. In FIG. 4 a combat boot 30 constructed in this manner is shown. As there indicated, this boot includes the usual upper portion 32 and a bottom portion or

lower 34 comprising a honeycomb core 36 (FIG. 5) having a covering 38 completely encasing the same. The core 36 conforms in peripheral outline to the outline of usual lower. It may be arched somewhat, as indicated at 40 in FIG. 4, to support the arches of the wearer. The covering 38 protects the core 36 from wear and damage by water or the like in the normal use of the boot 30. The thickness of this covering preferably is increased on the downwardly facing side of the core 36 to provide a wear resisting tread surface on the sole, shank and heel of the boot. In footwear having an upper 32 molded directly to the lower 34, this covering 38 should be of a moldable rubber or rubber-like material to permit direct molding of the upper to the sole, shank and heel portions of the covering.

The core 36 may be made from the same material as the core 14 previously described. While FIGS. 4 and 5 disclose a combat boot, it is to be understood that blast attenuating cores may be built into an overshoe designed normally to be worn over combat boots or other footwear. Likewise a blast attenuating core could be built into slip-on type rubbers or sandals for use in special circumstances.

From the above description of the blast attenuating footpad of the present invention, it will be observed that this footpad increases the distance between the bottom of the foot of a wearer so protected and the top side of a buried anti-personnel mine thereby lessening the effect on the lower extremities of the wearer of any underfoot blasts to which the wearer may be subjected. The extent of this distance can, of course, be varied by varying the thickness of the cores 14 in the one case and 36 in the other as previously explained. At least as important from the standpoint of the degree of protection afforded a wearer of the improved footwear of the present invention is the energy absorbing capacity of honeycomb of the type from which the cores 14, 36 are made. Material of this type has heretofore been used to absorb shock produced upon impact of aerially delivered materials with the ground. The walls of the honeycomb, which extend perpendicularly to the layers of the wall (as shown in FIGS. 2 and 5) are of sufficient rigidity to support the weight of the wearer, and are resistant to, but nevertheless capable of being permanently crushed and deformed by the upwardly traveling blast energy of an exploding mine. By virtue of this inherent capacity of honeycomb, the protection afforded by the cores, 14, 36 is, in effect, doubled because protection is afforded by virtue of both elevation above the ground and by virtue of the energy absorbing capacity of the honeycomb cores. In tests, it was determined that a core 1" to 2" thick would reduce the effects of the blast sufficiently to protect a wearer of the footpad against the most serious damage, although it would not be likely completely to eliminate injury to the wearer.

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 my invention or the scope of the subjoined claims.

I claim:

1. Protective footwear for attenuating the blast of an anti-personnel mine, said footwear comprising an upper and a protective sole extending from the toe portion to and including the heel portion of the foot, said sole comprising a ground-contacting lower layer, and an upper cover layer, and an intermediate layer comprising a core of non-elastic honeycomb material between said lower and upper layers of said sole, the walls of said honeycomb material being perpendicular to said lower and upper layers of said sole and being of sufficiently rigidity to support the weight of the wearer so as to space him from the ground and from an exploding mine, and said walls being resistant to but nevertheless capable of being permanently crushed and deformed by the upwardly directed energy of the blast of an exploding mine, whereby said blast energy is dissipated in overcoming the crush- and deformation-resistance of said honeycomb material.

2. Protective footwear according to claim 1, wherein said honeycomb material is a paper honeycomb.

3. Protective footwear according to claim 1, wherein said lower and upper layers of said sole are connected by a peripheral side wall so as to define a hollow space for said honeycomb core.

4. A detachable protective sandal for attenuating the blast of an anti-personnel land mine, said sandal comprising a protective sole extending from the toe to and including the heel portion of the foot, said sole comprising a ground-contacting lower layer, and an upper cover layer, and an intermediate layer comprising a core of non-elastic honeycomb material between said lower and upper layers of said sole, the walls of said honeycomb material being perpendicular to said lower and upper layers of said sole and being of sufficient rigidity to support the weight of the wearer so as to space him from the ground and from an exploding mine, and said walls being resistant to but nevertheless capable of being permanently crushed and deformed by the upwardly directed energy of the blast of an exploding mine, whereby said blast energy is dissipated in overcoming the crush- and deformation-resistance of said honeycomb material; and means for removably connecting said sandal to a conventional shoe.

5. Protective sandal according to claim 4 wherein said honeycomb material is a paper honeycomb.

6. Protective sandal according to claim 4, wherein said lower and upper layers of said sole are connected by a side wall so as to define a hollow space for said honeycomb core.

7. A detachable protective sandal for attenuating the blast of an anti-personnel land mine, said sandal comprising a protective sole extending from the toe portion to and including the heel portion of the foot, said sole comprising a ground-contacting lower layer and an upper layer, and a peripheral side wall connecting said layers so as to define a hollow space, an intermediate honeycomb core of paper material in said hollow space, the walls of said honeycomb material being perpendicular to said lower and upper layers of said sole and being of sufficient rigidity to support the weight of the wearer so as to space him from the ground and from an exploding mine, and said walls being resistant to but nevertheless capable of being permanently crushed and deformed by the upwardly directed energy of the blast of an exploding mine, whereby said blast energy is dissipated in overcoming the crush- and deformation-resistance of said honeycomb material; and means for removably connecting said sandal to a conventional shoe.

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