Dec. 15, 1942. H. B. LEWIS 2,304,936

PROTECTIVE ARMOR

Filed Aug. 28, 1940

Fig. 1.

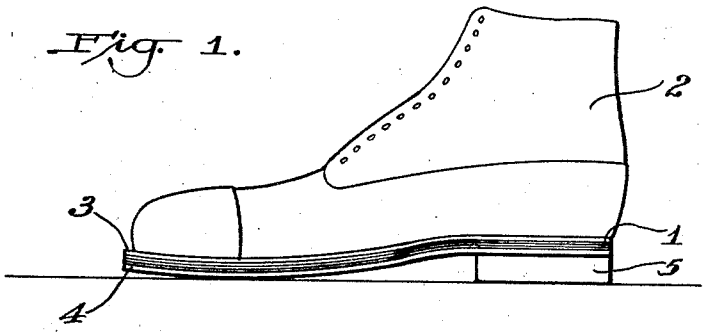


Fig. 2.

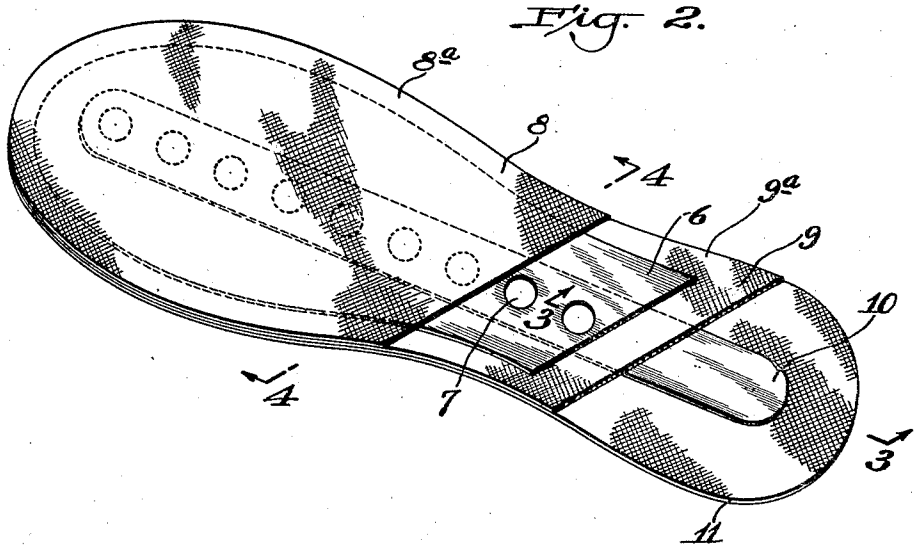


Fig. 3.

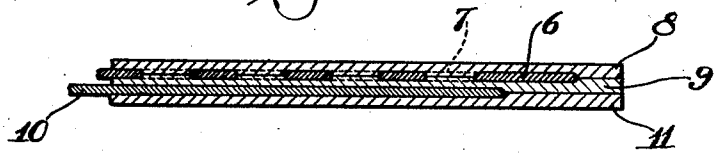
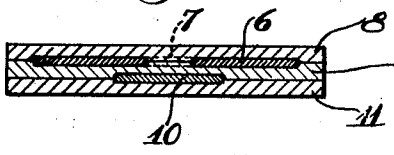


Fig. 4.



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PROTECTIVE ARMOR

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Application August 28, 1940, Serial No. 354,479

4 Claims. (Cl. 36—30)

This invention relates to a protector or armor which is adaptable to being incorporated into the sole structure of a shoe or boot and which is capable of providing adequate protection against injury as by the penetration of sharp objects as may be encountered in industrial use, and, more particularly, to an improvement in such a protector which is inexpensive, adequately flexible and in which the metal protective element employed is securely retained in its proper protective position during use.

It is among the objects of this invention to provide a protective armor which is inexpensive, adaptable, readily incorporated or attached to the sole structure of a shoe, sufficiently flexible for use under all conditions and of a unitary construction in which the protective element is adequately secured.

Further objects of this invention will become apparent from the description of one preferred embodiment which is illustrated in the drawing and in which:

Fig. 1 is a side elevation view of a shoe illustrating the protective sole in position;

Fig. 2 is a perspective view particularly in section and illustrating the preferred embodiment of the invention;

Fig. 3 is a sectional view taken along the line 3—3 of Fig. 2; and

Fig. 4 is a sectional view taken along the line 4—4 of Fig. 2.

In the application of a protective armor or plate 1 into a shoe 2, it is usually placed between an upper sole 3 and a lower or outer sole 4 and may extend across the full length of the shoe that is to include the heel 5. The extent of the sole will depend upon the construction of the heel since in some cases the heel itself is made of material which adequately protects this portion, and in such a case it may be necessary only to extend the sole into the heel sufficiently so that an adequate amount of overlie or overlap exists. The protective sole comprises a metal plate 6 shaped to conform to the contour of a sole and to amply cover and protect the foot. This metal plate may be made of any suitable material which possesses some degree of flexibility and provides protection by resisting penetration of sharp objects and it has been found that a stainless steel is suitable for this purpose. Specifically, a plate providing the necessary advantages can be made of a thick hard rolled 18 per cent chrome, 8 per cent nickel, stainless steel of .014" thickness.

Such material may be placed between two layers of fabric material 8 and 9 which is impregnated with a suitable bonding agent such as the phenolic resin or cellulose derivative materials or which can be a rubberized fabric material. These layers of material 8 and 9 are made to extend beyond the periphery of the metal plate 6 a sufficient amount so that their peripheral portions 8a and 9a respectively may be secured or sewed onto the upper and lower sole 3 and 4. In order to secure and retain the plate 6 in its proper position relative to the fabric layers and the soles 3 and 4 of the shoe 2 after the materials are placed together, the metal layer is placed between the two layers of fabric material and heat and pressure is then applied sufficient to set the impregnating material and embed the metal plate into each of the layers an amount equal to about one-half the thickness of the plate and a single unitary structure is provided of a thickness comparable to the thickness of the fabric layers. The outer peripheral portion of the fabric layers are bonded to each other and this in connection with the embedding of the metal layers retains the metal strip in position during use and thus prevents any inconvenience which may be had by the metal layer working out of position or which may cause discomfort and destroy the protective advantages of the sole.

In order to more securely retain or fasten the metal plate 6 in its proper position a series of openings 7 are formed in the material and extended along the length of the sole. These openings are of a size depending upon the extent of engagement required of the fabric layers within the openings and openings for an average size of shoe may be about ½" and if spaced as illustrated in Fig. 2 they will provide adequate retention. A further function of the openings is to increase the flexibility of the layer of metal material. Another metal strip 10 is positioned beneath the openings 7 in the strip 6 and so as to overlie these openings and between the fabric layer 9 and an adjacent or lower layer 11. This strip 10 may be made of a material similar to that in layer 6 and extends sufficiently to adequately cover the openings.

The openings provided in the metal strip 6 perform a function of securing the metal to the fabric material. This is illustrated in Figs. 3 and 4 in which the metal material is shown actually embedded into the fabric materials and fabric material extends into the openings 7 to form a support or abutments to hold the metal material in position. Likewise, the supplement or overlying layer 10 becomes embedded in the

fabric layers 9 and 11 and because of its limit in size as compared to the protective layer 6, the fabric material extends beyond its limits a considerable amount and by bonding to an adjacent layer is sufficient to retain the metal in position.

In the construction of the sole the several layers of material are placed in position and then by the application of heat and pressure the fabric material becomes bonded together while the metal layers become embedded into the fabric material and thus the assembly is formed into a unitary construction having a uniform thickness and possessing sufficient flexibility for the intended purpose. The structure can then be inserted into a shoe as by placing it between the upper and lower soles and attached to the soles by any of the available means as by sewing or any other expedient and the bonded peripheral fabric portions are of a sufficient extent to accommodate any such means of attachment. Also, these bonded portions aid in retaining the metal strips in position.

It is obvious that when placed in a shoe a metal strip during flexure tends to work itself out of position and some means is necessary for retaining the protective plate in position during all uses or movements. The preferred embodiment described performs this important function while providing the necessary flexibility required to not impair the comfort of the shoe. The insole is inexpensive in construction and is adaptable to the many types of sole construction.

I have explained the principle and mode of operation of my invention, and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. A protective means comprising a plurality of layers of fabric material impregnated with formable and bonding material, a flexible metal protective layer between a pair of layers of fabric material and substantially completely embedded in the layers of fabric material and containing a series of openings of predetermined size to effect bonding of the overlying fabric material in the openings and in which the overlying portions of the fabric layers are bonded to each other, the openings being disposed in particular longitudinal arrangement, and a narrow longitudinal metal layer between a pair of fabric layers and overlying the openings in the first-mentioned metal layer.

2. A protective means comprising a plurality of layers of fabric material impregnated with formable and bonding material, a thin flexible metal protective layer between a pair of fabric layers and containing a plurality of openings arranged in a single row longitudinally of the layer and each having a predetermined size, each layer of fabric material having a peripheral portion extending beyond the metal layer, the fabric layers being bonded to each other within the openings to enclose the integral fabric material about the metal layer and to embed completely the metal layer in the overlying layers of fabric material to secure the metal layer in proper relative position, a thin narrow strip of metal between a pair of the layers of fabric material and positioned to overlie the openings in the metal layer, the layers of material having a peripheral portion extending beyond the metal strip and being bonded to each other to enclose fabric material about the strip and embed the strip in the overlying fabric material to secure the second metal layer in proper relative position and the layers of fabric material being integrally bonded together to form a composite structure.

3. A protective means comprising a plurality of layers of fabric material, a flat thin flexible metal protective layer between a pair of the fabric layers and containing a single series of relatively large openings in alignment along the length of the metal layer and in which the overlying portions of the fabric layers are bonded to each other, a narrow metal strip between one of the layers of fabric material overlying the protective metal layer and another of the layers of fabric material and overlying the openings in the protective metal layer, the metal layers being completely embedded in the overlying layers of fabric material and each of the fabric layers containing a peripheral portion extending beyond the metal layers and securely bonded to the peripheral portion of an adjacent layer of fabric material forming a composite integral structure operative to retain the metal layers in position during use.

4. A protective means comprising a plurality of layers of moldable material, a flat, thin flexible metal protective layer between a pair of layers of moldable material and containing a single series of relatively large openings in alignment disposed along the length of the metal layer and within which the overlying portions of moldable material are bonded to each other, a narrow metal strip between one of the layers of moldable material completely overlying the openings of the first mentioned protective metal layer and another adjacent layer of moldable material, the metal layers being completely embedded in the overlying layers of moldable material and each of the layers of moldable material containing a peripheral portion extending beyond the metal layers and securely bonded to the peripheral portion of the adjacent layer of moldable material forming a composite integral structure operative in combination with the joinder within the openings of the protective metal layer to retain during use the metal layers in position relative to the overlying moldable material.

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