March 2, 1943. H. B. LEWIS 2,312,841

PROTECTIVE ARMOR

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Fig. 1.

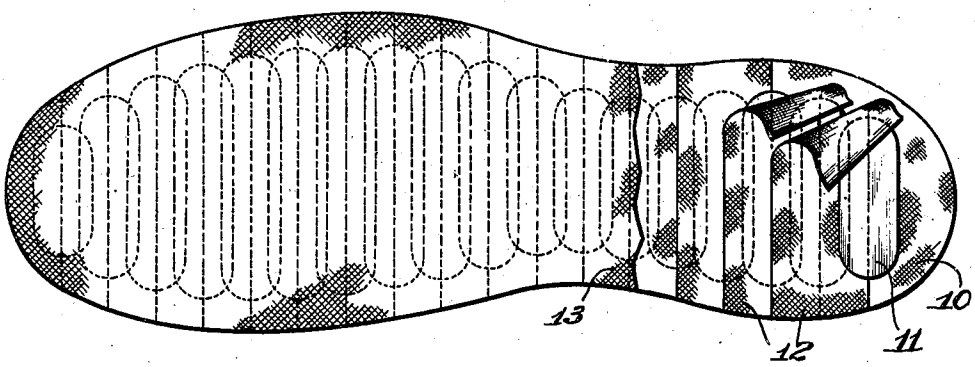


Fig. 2.

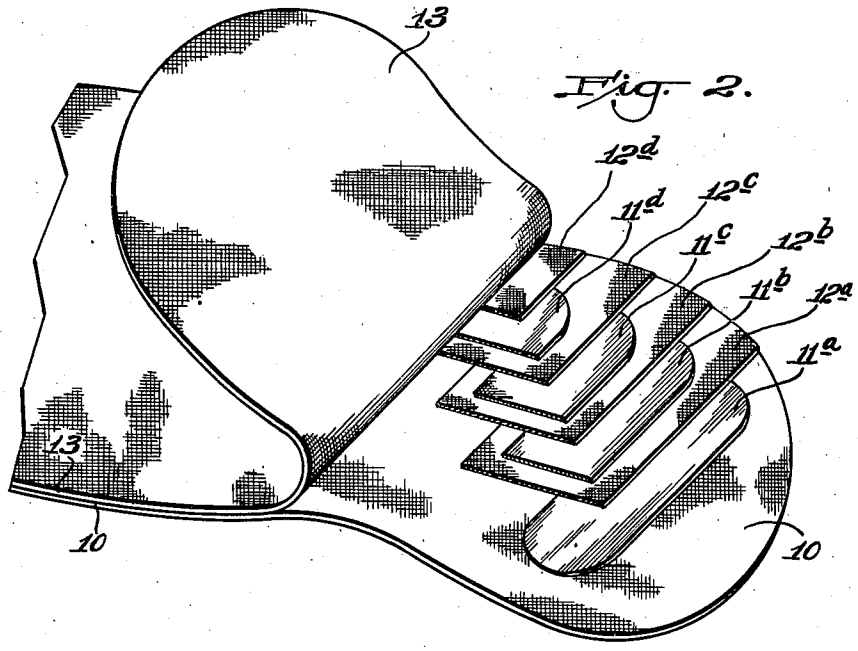
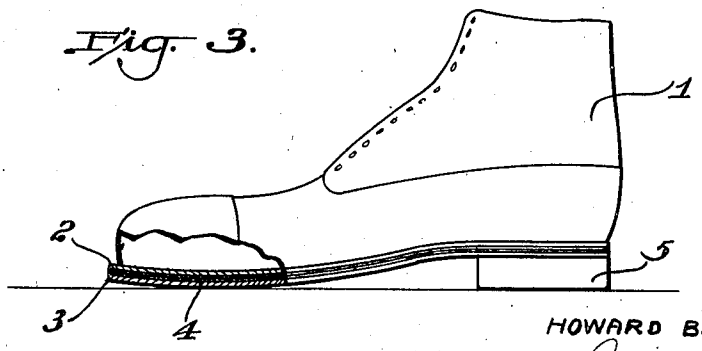


Fig. 3.



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PROTECTIVE ARMOR

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4 Claims. (Cl. 36—30)

This invention relates to a flexible metal protector adaptable to the sole structure of shoes, boots and the like to prevent the penetration of sharp objects and, more particularly, to an improvement in a flexible metal protector which is inexpensive, sufficiently flexible and affords adequate protection.

It is among the objects of this invention to provide a flexible metal protector such as may be made in the form of a sole which can be readily incorporated into the sole structure of shoes and boots and without modification, which may be made of a material capable of providing ample protection against all hazards which may be encountered in idustrial use and which, itself, is inexpensive and adequately flexible to prevent discomfort by the addition of this protective means.

Other objects of this invention will become apparent from a description of a preferred embodiment which is illustrated in the drawing and in which;

Fig. 1 is a plan view partly in section of a preferred embodiment of my invention;

Fig. 2 is a fragmentary perspective view of the same embodiment and illustrates the fabrication or assembly of the several parts used in the construction; and

Fig. 3 is a side elevation of a shoe and partly in section showing the protector or armored sole interposed between the inner and outer sole of the shoe.

In adapting a metal protector to an ordinary construction of a shoe or boot, it is usually made in such a manner that it is formed as a protective or safety sole 4 and placed between the inner sole 2 and the outer sole 3 of a shoe 1 such as illustrated in Fig. 3. The safety sole generally extends the full length of the shoe, that is, it extends sufficiently to include the heel 5 and thus is adaptable to protect the shoe 1 throughout its length, but should the heel itself serve as an adequate protector, it would not be necessary to extend the protective sole 4 further than to sufficiently lap the material of the heel.

My protective sole 4 includes a metal armor or plate which is preferably made of a non-corrosive metal and which affords ample protection for all uses. Because of my construction, it is not necessary that the material itself be of a nature that can be bonded to material in order to amply secure the metal in its proper protective position, although this characteristic, if present, can be utilized to an advantage. The material, which may be used, can be a commercial stainless steel or carbon steel, or any other protective material and the selection will depend upon the results desired and the limits of cost in manufacture.

The protective sole incorporating my invention is made of a support 10 which is a fabric material impregnated with a bonding agent such as a phenolic resin or cellulose derivative material or rubberized fabric material. A plurality of metal elements 11 made of thin flat sheet metal of suitable material and having some degree of flexibility are positioned on the support. A feature of this invention is that a material can be used, which may be a rigid metal material or material having a thickness that is not adequately flexible for use in shoes and boots, yet by fabricating in a certain manner the whole assembly is made sufficiently flexible so as not to interfere with the comfort of the article in which it is incorporated and it provides increased protection. Each of the elements 11 should extend transversely across the sole, that is, extend across the width of the sole, but should terminate short of the full width of the fabric material to define a peripheral portion of fabric material extending beyond the protective metal layer and should be of such a width in the direction of the length of the sole that the necessary or desired flexibility is provided. In other words, supplying the metal elements or strips 11 of a narrower width to increase the number of strips or elements used in the construction will improve or increase the flexibility of the sole. Furthermore, the width of these members should vary to some extent depending upon their position in the sole. For instance, greater flexibility is required in the vicinity of the ball of the foot and in this location the elements should be made relatively narrower in width than in the location of the heel.

These protective elements or flat pieces of metal are arranged over the support 10 in a successive manner in the direction of the length of the insole to define a layer of metal over the area of sole to be protected and they are arranged in relation to each other so that each strip overlies or overlaps its adjacent strip a certain amount. The extent of overlap will depend again upon the position of the strip in the sole. It is necessary that this amount of overlap be sufficient so that when the sole is flexed to its maximum the amount of overlap will be sufficient to continue a complete layer of metal over the sole and not allow any gap to

exist between the pieces. It is apparent that the extent of overlap needed can be readily determined and this requirement does not lessen or interfere with the extent of flexibility. Providing an excess of overlap of material will not destroy the advantageous results gained by the application of this invention.

In order to adequately and securely position the metal strips or elements in their proper protective and related positions, pieces or strips of fabricated material 12 which may be similar to that used in providing the overlying layer or support are fastened or patched to the support in a particular manner and extend completely across the width of the support. The width, or dimension of the strip in the direction of the length of the sole, of each of these strips may depend upon the position of the strip upon the support and the width of the metal strip which it is to retain and secure. For most purposes, these strips can be of about the same width and be large enough so that they are attached to the peripheral portion of the support 10 extending beyond the protective strips 11 and thus define pockets. The base of the strip forming the bottom of the pocket is to be of a sufficient size so that by its engagement with an underlying strip or the support 10 it is able to restrain its metal insert against movement in that direction.

Referring specifically to Fig. 2, a flat metal strip 11*a* is positioned onto the fabric layer or support 10 and retained in position by means of a fabric strip 12*a*. The support 10 is shaped similar to the shape of the soles 2 and 3 of the shoe and the portion represented in Fig. 2 is that of the heel portion. The fabric strip 12*a* impregnated with a bonding agent extends the full width of the support 10 and it extends and is attached to the peripheral portion of the support in the direction of the length of the support a distance sufficient so that it is securely bonded to the support and the free or unattached portion accommodates the metal strip 11*a*. The next or adjacent metal strip 11*b* is positioned over the fabric strip 12*a* securely bonded to the support 10 through the under strip which in turn is attached to the support. A similar strip 12*b* overlies the metal strip 11*b* and holds it in place by engagement with the underlying fabric material. Successive strips 11*c* and 11*d* are held in place by their respective fabric strips 12*c* and 12*d*. In manufacturing practice, the fabric strips 12 would probably be tacked in place and the metal elements or inserts placed in position onto the support 10 and then by the application of heat and pressure the fabric material would be bonded together so that the support contains in addition to its fabric strip 10 the overlying transversely extending strips 12 and carry the protective layer of a plurality of metal strips secured in proper related position.

While this assembly just described may be used as the protective means, it is preferred to use a second fabric layer overlying the strips 12 and referred to as fabric layer 13 of material and of a size and shape similar to layer 10 and bonded to the strips 12 and to the layer 10. With this arrangement, the several parts are positioned properly onto other parts or in their relative positions and attached, if necessary, and then by the application of heat and pressure the layer 13 is bonded to the outer side of the strips of material 12 and these in turn to the layer 10 or in the event that the strips 12 do not extend across the full width the layer 13 is bonded directly to the support 10. After the application of heat and pressure the whole assembly is made compact and unitary while containing a protective plate or armor which is flexible in nature and provides the necessary protection against injury by penetration of sharp objects. The peripheral portion of fabric material which completely surrounds the sole is utilized in fastening or attaching the sole to the sole of the shoe as by means of sewing or nailing.

In manufacture, the metal strips 11 are placed onto the support 10 by means of a method comparable to shingling, that is, starting from one side of the support one of the metal strips 11 is positioned onto the support followed by its accompanying fabric strip 12 and then another metal strip is positioned adjacent the first metal strip and so as to overlap this strip. Its fabric strip is then placed over the second metal strip. This method is followed until the length of the sole is sufficiently covered. The other layer 13 is then positioned over the assembly. The whole assembly is then set to form a unitary sole.

With this arrangement a single metal layer is provided which is so constructed that the protective layer is retained in its proper position relative to the fabric layers and the sole of the shoe and is adequately retained and secured in this position during use while supplying the necessary flexibility required for such an installation and providing adequate protection. A further advantage of this invention is that materials can be selected which themselves do not bond to impregnated material, but it is obvious that should material be used that in itself is bondable, it would additionally secure the elements in their proper relative positions. One of the purposes of this invention is to provide an arrangement or construction which in itself does not depend upon the bond of the metal material to the support and which is capable of retaining the metal layer in its proper position without impairing the comfort of a shoe.

Another advantage of my invention is that it permits a variation in the degree of flexibility throughout the length of the sole so that greater flexibility can be provided in the vicinity of the ball of the foot and less can be provided in the heel as represented in Fig. 2. This is accomplished, as heretofore mentioned, by proper selection of a width of protective strip and using narrower strips where greater flexibility is desired. Also, by arranging the metal strips so that the overlying and underlying strips of each metal element extend across the full width of the element to form in effect two complete layers of protective metal, metal strips of less thickness can be used and this provides a more flexible layer. Obviously, this complete overlap of each element can be accomplished by providing or positioning the elements in relation to each other so that this amount of overlap occurs.

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 flexible protector metal sole having a portion of greater flexibility than the remaining portion comprising a fabric support impregnated with a bonding agent, a fabric material bonded

to the support and having thin flat receiving portions extending transversely of the sole and successively along the length of the sole, a thin flat insert of protective metal in each of the receiving portions and arranged to overlap an adjacent insert to define a continuous layer of flexible protective metal and the inserts being narrower in width at the location of greater flexibility.

2. A protective sole having a portion of greater flexibility than the remaining portion comprising a pair of layers of fabric material impregnated with a bonding agent, a plurality of relatively thin metal elements extending transversely of the sole and having a width in the direction of the length of the sole depending upon the location of the element relative to its position on the sole, the elements being arranged in overlying relation, the metal elements being of a length less than the width of the sole at their respective locations to define a peripheral portion of fabric material extending beyond each end of the metal elements, the narrower elements being positioned in the portion of the sole of greater flexibility, and means bonded to the layers to accommodate each of the metal elements to retain and secure the elements in overlying relation and in their respective position, and comprising a plurality of fabric layers extending transversely of the sole and successively arranged along the length of the sole and defining a pocket for each metal element, and each layer being bonded securely to each overlying layer and to its peripheral portion retaining its element in proper position.

3. A flexible protective sole comprising a sole-shaped fabric sheet, a plurality of narrow thin metal strips extending transversely of said sheet with their ends spaced inwardly from the adjacent edges of the sheet and with their longitudinal marginal portions disposed in overlapping relation with one another, a plurality of separate fabric strips extending transversely across substantially the full width of said sheet with their longitudinal marginal portions disposed in overlapping relation with one another, said fabric strips being disposed between said metal strips in overlapping engagement therewith and each fabric strip extending outwardly in all directions beyond the edges of one of the metal strips engaging it to provide a projecting side portion lying in face-to-face relation with an overlapping fabric strip, a second sole-shaped fabric sheet overlying said strips, and means bonding together the engaging faces of the fabric strips and sheets to thereby form closed fabric pockets in which the metal strips are retained.

4. A flexible protective metal sole having a portion of greater flexibility than the remaining portion, comprising a fabric support, a fabric material attached to the support and having thin flat receiving portions extending transversely of the sole and successively along the length of the sole, a thin flat insert of protective metal in each of the receiving portions and arranged to overlap an adjacent insert to define a continuous layer of flexible protective metal, and the inserts being narrower in width at the location of greater flexibility.

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