April 27, 1943. G. H. BINGHAM, JR 2,317,880

RUBBER FOOTWEAR

Filed Aug. 31, 1942 2 Sheets-Sheet 1

Fig. 1.

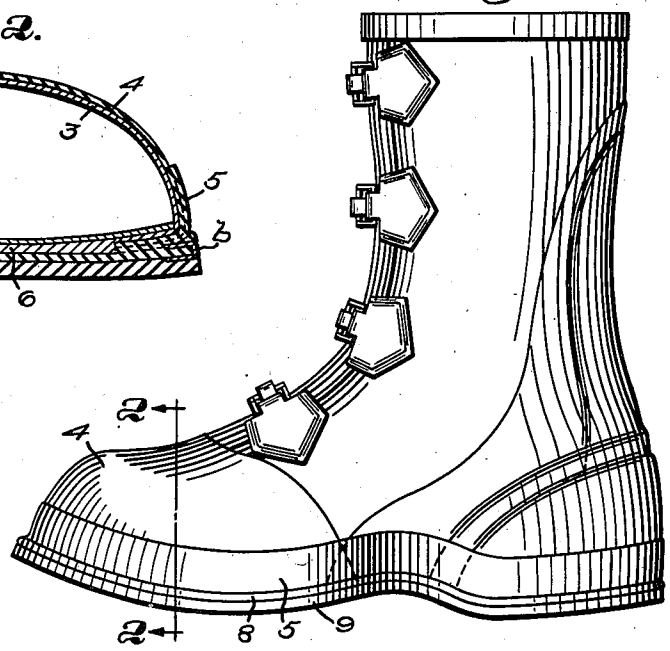


Fig. 2.

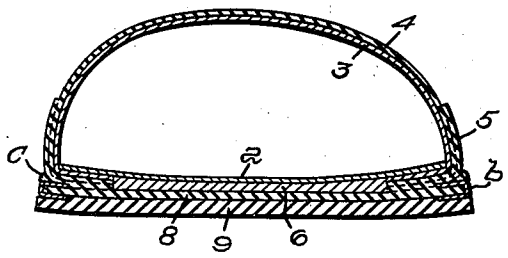


Fig. 3.

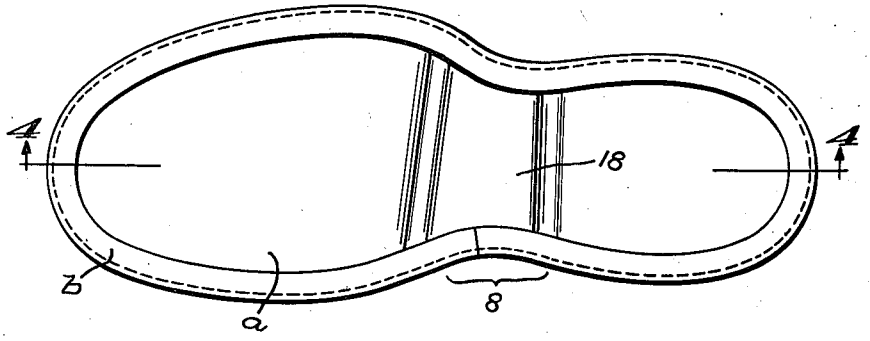


Fig. 4.



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RUBBER FOOTWEAR

Filed Aug. 31, 1942 2 Sheets-Sheet 2

Fig. 5.

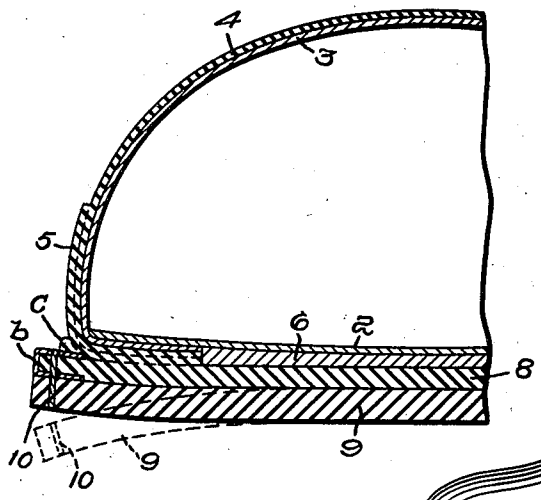


Fig. 6.

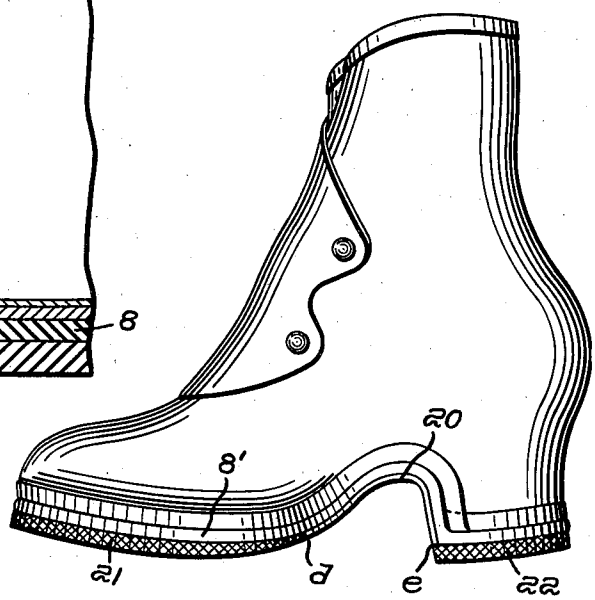
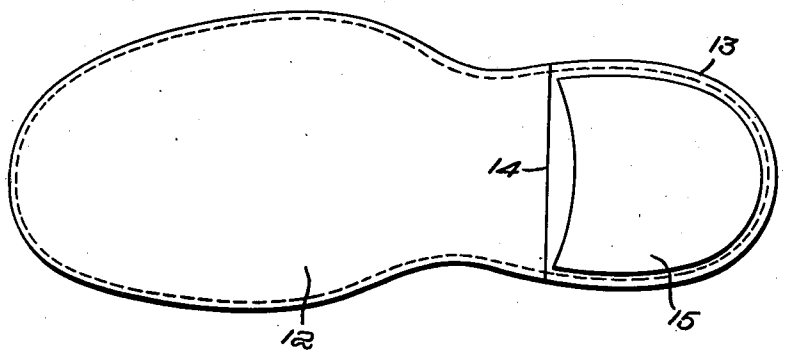


Fig. 7.



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UNITED STATES PATENT OFFICE

2,317,880

RUBBER FOOTWEAR

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Application August 31, 1942, Serial No. 456,815

7 Claims. (Cl. 12—142)

As explained in my pending application Serial No. 456,388, filed Aug. 27, 1942, the extremely limited supply of new rubber available, plus the extraordinary requirements of our armed forces for rubber goods of various types, makes it of the utmost importance to economize in every way possible in the use of this material so that the greatest serviceability which it can be made to yield shall be realized. Moreover, because the requirements of the Army and Navy must be supplied, at all costs, it is clear that there will not be sufficient rubber available to meet the essential needs of more than a relatively small proportion of the civilian population.

The present invention is concerned primarily with the relation of this situation to the production of rubber footwear. That is, the type of footwear in which the parts of the bottom structure are united by rubber or its equivalent. For convenience the various kinds of footwear of this type will be hereinafter included in the term "rubber shoes." As is well known to practically all users of rubber footwear, the repair of a worn-out bottom of a rubber shoe is difficult and unsatisfactory. So much so that, as a rule, when a rubber bottom has been worn through, the boot or shoe is regarded as useless and no thought is given to repairing it. Even when attempts have been made to do so, the results have practically always been extremely unsatisfactory.

The present invention deals with the problems presented by these conditions. It aims to devise a thoroughly practical method of making a rubber shoe which can be re-bottomed, either in whole or in part, as may be found necessary, and in an entirely satisfactory manner, thus restoring to the shoe substantially the original degree of bottom wear. The invention also involves a novel shoe structure.

In the application above referred to, two methods of making repairable boots and shoes are disclosed. One of them is presented more completely and in better form in said application, and the present case is a continuation-in-part of said application and is based on the other method there disclosed.

The nature of the invention will be readily understood from the following description when read in connection with the accompanying drawings, and the novel features will be particularly pointed out in the appended claims.

In the drawings,

Figure 1 is a side elevation of a lumberman's shoe or an Army shoe constructed in accordance with this invention;

Fig. 2 is a vertical, sectional view on a larger scale and taken approximately on the line 2—2, Fig. 1;

Fig. 3 is a plan view of a midsole forming part of the shoe shown in Figs. 1 and 2;

Fig. 4 is a vertical, sectional view on the line 4—4, Fig. 3;

Fig. 5 is a vertical, sectional view of a portion of the forepart of a shoe made in accordance with this invention, and illustrates a slight variation from the construction shown in Fig. 2;

Fig. 6 is a side view of another shoe embodying the invention; and

Fig. 7 is a bottom view of a combined outsole and heel which can be used either in a new shoe or for repair purposes.

Referring first to Figs. 1 and 2, the article there shown is much like the well-known four-buckle boot of the type worn by lumbermen and workers in various other industries. In manufacturing such a boot the various parts of the upper are cut out of rubber or rubberized fabrics, the nature and composition of which will depend upon the specifications to which the shoe is built, and these parts are assembled in suitable order upon a last, starting with an insole 2 placed on the last bottom. For example, such parts may consist of a fabric lining 3, a vamp 4 of sheeted rubber, and a foxing 5 also of rubber. A filler of rag stock, or some other suitable material, shown at 6, is then placed over the central portion of the insole which is not covered by the margin of the upper material, if the thickness of the lasted-over parts of the upper requires the use of such filler. So far as the foregoing operations are concerned the process is like those commonly followed in the orthodox methods of making shoes of this type. Usually at this stage of the process a heavy unvulcanized rubber outsole is placed in position to cover the entire bottom of the lasted assembly. Because the parts are either made of unvulcanized rubber, or those parts which are to adhere to each other are heavily rubberized, a good adhesion of these elements, one to the other, is produced, and such adhesion is improved by rolling and pressing. Next, according to the customary operation, the entire structure is vulcanized, thus causing the parts to weld to each other so securely that the entire assembly becomes substantially an integral unit.

Applicant's method departs from the orthodox practice at the point where the outsole customarily is applied to the lasted assembly. At this point applicant applies a midsole 8, which has previously been completed, to the bottom of

this assembly. Such a midsole comprises a sole-shaped body *a*, the composition of which will depend somewhat on considerations of quality and the allowable expense, but which may, for example, consist of a sheeted rag stock compounded chiefly or entirely with reclaimed rubber and having ample tensile strength, thickness, and the other characteristics adapting it for use in this particular portion of the shoe. If desired, it may be reinforced on one or both faces by a layer of rubberized fabric, such as duck. Preferably the margins of this sole-shaped body piece are bound with a strip *b* of reinforcing material which usually consists of a suitable grade of sheeted uncured rubber, either with or without a fabric backing. The nature of this strip will depend upon the character and style of the shoe in which it is to be used. It is intended to produce a finished edge, to be vulcanized securely to the upper, to seal the edges of the midsole body, if necessary, against penetration of water thereinto, as when said body includes a fabric top, and to make a good abutting surface for the outsole. To the upper surface of the binder strip *b* a rubber sealing strip *c* often is applied, as shown in Figs. 2 and 5, this strip extending around the entire margin of the midsole unit **8**.

After this midsole unit has been cemented to the bottom of the assembly above described, the shoe is cured either by vulcanization with heat or by a cold cure, as may be desired. The customary methods of preparing and assembling these parts so as to ensure their firm initial adhesion to each other are followed so that when the cure has been completed, the various parts of the assembly will then be united into substantially an integral structure, just as they are in the orthodox methods of making rubber shoes. Consequently, the shoe at this time has a waterproof bottom structure, and if the upper has been made of waterproof materials, then the entire structure so produced is waterproof.

Next the outsole **9** is secured to the bottom of the midsole. The manufacture of this outsole has been completed by some suitable method, as by molding and vulcanizing it to its final size and shape, or by dieing it out to the desired size from either molded or calendered sheet stock of suitable vulcanized composition. It may be secured to the midsole either by cementing, as shown in Fig. 2, or by stitching, as shown in Fig. 5, or both. If it is cemented, either with or without stitching, care should be taken to control the adhesion so that the outsole subsequently can be removed when worn out and replaced with a new one. Control of the adhesion of the outsole to the midsole can be effected in any one of several ways, examples of which are as follows:

(1) By using unvulcanizing cements which may have a base of natural rubber, latex, synthetic rubber, or suitable combinations of the same. Often they contain other water-insoluble reinforcing agents. These cements should only be used in connection with stitching.

(2) By using cements of the so-called "self-curing" or "cold-curing" types which have a rubber base of some variety and contain the necessary curing agents to produce vulcanization at normal temperatures. The strength of the adhesion produced by them in the finished shoe may be controlled:

(*a*) By the use of diluents, such as talc, powdered mica, clay, and the like.

(*b*) By adjusting the quantity or character, or both, of the vulcanizing agents, the proportion of these agents used or the quality of those selected being such as to produce a union having ample strength for the purposes of this invention, but one having a degree of strength considerably less than that which could be obtained with a good grade of vulcanizing cement of normal compositions applied in accordance with the usual technique followed in making a permanent adhesive union.

(*c*) Because the rubber outsole to be secured to the midsole is vulcanized, the strength of the adhesion that can be produced between these two sole members with the aid of vulcanizable cements, depends very largely on the degree to which the upper margin of the outsole and the surface of the midsole binding, if made of vulcanized rubber, are roughened prior to the application of cement to these surfaces. If a thorough job of roughening is performed and a good grade of self-curing cement is used, then a permanent union of the outsole to the midsole can be produced. On the other hand, if these surfaces are merely buffed lightly so that the abrasive union does go deeply into them, then the union will not be strong. This fact also may be utilized in producing a union of the outsole to the midsole which has ample strength for wearing purposes but which can be readily broken when desired, and when so broken will permit the removal of the outsole.

(3) By cutting out a section of fabric, such as sheeting or duck, which has been spreader coated and then calender coated on one side, and cementing the latter side to the bottom of the midsole with a vulcanizable cement prior to vulcanization of the upper and the midsole. During this vulcanizing operation a permanent union of the fabric to the midsole is produced. The outsole later is applied to the lower surface of this fabric sheet by painting the lower surface of the latter with a self-curing rubber base cement and similarly coating the top of the outsole with the same, or a compatible, grade of cold-curing cement, the area to be cemented being first roughened. After the cement has cured it will be found that a good union has been produced between the two sole members, but this union can be broken, when desired, by inserting a dull knife blade between the fabric sheet and the outsole, thus breaking the adhesion at a local point. When this has been done the outsole can then be peeled off the fabric because the union between these two parts is very much weaker than that of the fabric to the midsole.

A modification of this method is to cement a similar sheet of spreader coated and calender coated fabric to the upper surface of the outsole before the latter is vulcanized, so that a secure union of these parts will be produced. Thereafter this outsole may be secured to the bottom of a midsole reinforced by the vulcanization thereto of a sheet of fabric frictioned and calender coated, as above described. The outsole may be secured to the midsole by cementing these two fabric surfaces together with a cold-curing cement. Such a product has abundant strength for wearing purposes, but the outsole can be removed in the manner just described, the separation taking place between the two sheets of fabric because the union is weaker at this point than that of the sheets to the respective sole members.

(4) By producing a substantially permanent adhesion of the rubber outsole to the rubber coating of the binder of the midsole, and a consider-

ably weaker adhesion of said rubber covering to the binder fabric itself. This may be done by making the binder strip from sheeting which is frictioned and calender coated on the side to be secured to the body of the midsole, and has simply a calender coating of rubber on its opposite side. The calender coating always contains a substantial percentage of gum rubber. Consequently, if the upper surface of the margin of the outsole is roughened and coated with a good grade of self-curing cement, and the vulcanized rubber coating on the bottom of the midsole binding is similarly treated, then a firm union of the outsole to the rubber coating of that portion of the binder which is folded over upon the bottom of the midsole body will be produced. However, when it is desired to remove the outsole a dull knife blade, or some similar instrument, can be forced between the binding and the outsole far enough to produce an initial rupture of the union securing these two parts together. Thereafter the outsole can be peeled off and it will carry with it that part of the rubber coating of the binder to which it has been united. This is not objectionable, however, for the reason that while it leaves the sheeting body of the binding strip exposed at the lower surface of the midsole, it still leaves a smooth outer surface to which a new outsole can be secured. In fact, when this securing operation is to be performed with the aid of cement, there is some advantage in having this fabric surface exposed in this way since the cement anchors itself more firmly to this fabric surface than it would to a vulcanized rubber surface unless care was taken to roughen the latter thoroughly. In this method the relatively weak union of the calendered coating of rubber to the fabric body of the binder strip is relied upon to break before any of the other adhesive unions will give way. And one advantage of this method is that the strength of the union of the calender coating to the fabric can be easily controlled.

It should be observed that in all of these methods the breakable union is an adhesive union,—in some cases between the outsole and the midsole binding, and in other cases between the coating of the midsole binding itself and the fabric body of the binding.

The adhesives used may be those commonly employed in the manufacture of rubber footwear, such as one of those having a base of natural or synthetic rubber, or it may be a latex cement, a solvent cement, or one of those made with, or including, synthetic resinous materials. Of the synthetic rubbers, Buna, neoprene, and Thiokol are much used as an ingredient of, or as a base for, rubber cements, and it is a common practice to include some of the resinous materials, either natural or synthetic, in these cements to improve their adhesive properties. Examples of these resinous materials are rosin, the polyterpines, casein adhesives, ester gums and Cumar resin. In all of these cases, also, the union preferably is produced only between the upper margin of the outsole and the coated binding of the midsole, no union of the main body of the outsole to the corresponding portion of the midsole usually being necessary or desirable.

As is well understood by those skilled in this art, the nature of the cement used in making a cemented union of two rubber parts to each other should be selected in accordance with the composition of those parts when the strength of that union is to be controlled. In the ordinary manufacture of rubber shoes this is not necessary because the only object is to make a permanent union and no adjustment or control of strength is involved, but it does have to be considered in practicing this invention. Thus, if an outsole is composed entirely, or practically so, of reclaimed rubber, and contains little or no gum rubber, then a better grade of cement must be used to produce a strong union of that outsole to the midsole than wuold be the case if the outsole contained, say, 20% or 25% of gum rubber. The nature of the cement used will also depend on the curing method to be followed. That is, whether it is to be vulcanized by heat or by a cold cure.

The line of stitching is of advantage in making any of these adhesive unions because the cement customarily is applied only around the margin at opposite sides of the line which the stitching is to follow, and the stitches hold the surfaces to be united securely to each other while the cement hardens or cures, as the case may be. Usually there is no need of cementing the meeting surfaces of either the midsole unit or the outsole within the bound area of the former, although this can be done, when desired, and the adhesion can be controlled in the manner above described. If the bottom of the body portion of the midsole is covered with a fabric, as in the preferred construction, that fact facilitates the matter of making any adhesive union between the two sole members inside the marginal area a readily breakable one. And the cemented union is of advantage in holding the outsole on the shoe after the portions of the stitches exposed at the tread surface of the sole have worn off and when, consequently, the strength of the stitched seam is greatly reduced.

Preferably the outsole is composed almost entirely of reclaimed rubber with suitable fillers and curing ingredients, in order to reduce the quantity of new or gum rubber used to a minimum. If an outsole having such a composition is molded under high pressure, say from one to three or four thousand pounds per square inch, it can be made to have wearing qualities comparing favorably with those of the outsoles commonly used heretofore in shoes of the orthodox types. When crude rubber is available in quantity the composition of the outsole can be correspondingly changed to make use of its properties. But an outsole of a low grade composition containing little or no crude can be so improved as to wearing qualities by molding under high pressure that from this standpoint alone the absence of a higher proportion of crude can be largely compensated for.

Also, a large proportion of the crude rubber in the upper can be replaced with reclaimed rubber or with equivalents or substitutes for rubber.

When the outsole is worn out it may be removed by cutting along the upper surface of the outsole at its junction with the binding *b*, Fig. 5, thus severing the stitches **10**, if the outsole has been stitched to the midsole. When a separation of the sole members has once been started, as indicated in dotted lines in Fig. 5, the entire outsole can then be readily taken off, whether originally secured by stitching or cement, or both, provided the instructions above described are followed in cementing. Next the lower surface of the midsole should be cleaned, washed with gasolene, or the like, and a new outsole **9** can be secured to the bottom of this member by stitching, cementing, or both, as may be desired.

The new outsole may be of the same or a dif-

ferent form from that with which the shoe was originally equipped. Also, if it so happens that the forepart section or the heel section only of the outsole is worn through, the worn section alone can be removed and replaced by a correspondingly shaped new section. And, because the rate of wear of the shoe bottom at the heel end usually is much more rapid than at the forepart, this part of the sole may be made separate from the main body of the outsole to facilitate the replacement of the heel end alone. Such a construction is shown in Fig. 7 where the forepart section **12** is separate from the heel section **13**, the two abutting along the line **14**. These abutting surfaces preferably are overlapped on an inclined plane. Also, the section **13** may be equipped with a raised heel **15**, inset from the edge of the section to facilitate stitching, as illustrated in Fig. 7. In fact, this method permits any of the variations in outsole or heel constructions disclosed in my pending applications above referred to. Such a division of the outsole, as just described, also affords an opportunity to make the heel section with a higher percentage of gum and therefore with better wearing qualities than the forepart so as to produce a shoe bottom having a more nearly uniform rate of wear. And any of these tread members can be equipped with cleats, hob nails, or the like, to increase the wearing properties of the shoe.

Compensation for the difference between the shape of a last bottom and the contour of an outsole molded under high pressure may be produced by any of the methods disclosed in my applications above mentioned. Such compensation often is desirable in the shank and it may be produced by securing suitably shaped pieces of rubberized stock to the upper or lower surfaces, as desired, of the insole, or to the upper surface of the midsole body *a*, as shown at **18**, Figs. 3 and 4.

Another variation of this invention is illustrated in Fig. 6 which shows a high arch woman's waterproof gaiter or overshoe. If a molded outsole is used on a shoe of this shape it is difficult to make it conform to the curvature of the arch. I have found, however, that this difficulty can be overcome by making the shank portion **20** of the outsole of very thin stock, applying this section extending from, say, the point *d* to the point *e*, to the midsole **8'** before vulcanization, and later securing the outsole **21** and the heel **22** independently to the appropriate portions of the midsole after vulcanization has been completed, either by stitching, cementing, or both, as desired. There is practically no wear on the shank piece **20** so that when either of the sections **21** or **22** become worn to such a degree that replacement is desired, that operation can be performed at either or both heel or forepart, as may be found necessary.

The removal of the outsole from the shoe, when secured thereto in any of the ways above described, can be readily effected without material damage to the midsole or the upper. Usually very little labor is involved in preparing the midsole for the attachment thereto of a new outsole, and this operation can be quickly and efficiently performed by any competent cobbler equipped with the usual machinery for making repairs of this nature.

While I have herein shown and described preferred embodiments of my invention and the methods of manufacture which I consider preferable, it will be evident that the invention may be embodied in other forms and that some variations in the manufacturing procedure can be made within the spirit and scope of the invention. This is particularly true as to the methods of making a separable or breakable union between the outsole and the midsole. Other methods for producing this result will readily suggest themselves to those skilled in the manufacture of rubber footwear.

Broad claims covering the subject-matter common to this application and my earlier copending application Ser. No. 456,388 are presented in the latter case and the claims of the instant application are limited to subject-matter not specifically claimed in the earlier case.

Having thus described my invention, what I desire to claim as new is:

1. That improvement in methods of making rubber shoes, comprising the steps of assembling an insole and the parts of the upper with each other on a last, lasting the upper to the insole, producing a vulcanizable midsole unit with a waterproof covered edge, applying said midsole unit to the bottom of the lasted assembly so produced, adhesively securing said parts to each other, vulcanizing the assembly so made and thereby securing all of said parts permanently together and producing a shoe having a waterproof bottom structure, thereafter securing the marginal areas of an outsole and the midsole unit together with a vulcanizable cement and so adjusting the adhesion produced in this manner that the adhesive union will be serviceable for wearing purposes but may be readily broken in the finished shoe to permit the clean removal of the outsole from the midsole unit.

2. That improvement in methods of making rubber shoes, comprising the steps of assembling an insole and the parts of the upper with each other on a last, lasting the upper to the insole, producing a vulcanizable midsole unit with a rubber covered fabric edge binding independent of said upper, applying said midsole unit to the bottom of the lasted assembly so produced, adhesively securing said parts to each other with the edge of said midsole exposed at the edge of the shoe bottom, vulcanizing the assembly so made and thereby securing all of said parts permanently together and producing a shoe having a waterproof bottom structure, thereafter cementing the marginal area of a preformed outsole to said midsole binding with a self-curing cement and thereby securing the midsole unit and the outsole together, then stitching said preformed rubber outsole to the projecting marginal portion of the midsole, and so predetermining the strength of the adhesive union between said outsole and said midsole that it will be serviceable but can be broken in connection with the cutting of the stitches between the outsole and midsole, thus permitting the removal of the outsole for replacement by a new one.

3. A method according to preceding claim 2, in which the plane of cleavage of the outsole from said midsole in removing the outsole is predetermined by making the union of the outsole to the rubber covering of the binding of the midsole much stronger than that of the covering to the fabric of the binding, whereby upon separation of the outsole from the midsole the rubber cover of the binding will be torn from the fabric leaving the fabric of the binding exposed at the bottom of the midsole.

4. That improvement in methods of making rubber shoes, comprising the steps of assembling

an insole and the parts of the upper with each other on a last, lasting the upper to the insole, producing a vulcanizable midsole unit with a waterproof covered edge, applying said midsole unit to the bottom of the lasted assembly so produced, adhesively securing said parts to each other, adhesively securing a shank covering piece to the bottom of the shank portion of said midsole unit, vulcanizing the assembly so produced, and thereby securing all of said parts permanently together and producing a shoe having a waterproof bottom structure, thereafter securing preformed rubber outsole and heel sections to the corresponding portions, respectively, of the bottom of the midsole unit by a vulcanized adhesive union, and so adjusting the strength of said union that it is serviceable for wearing purposes but is readily breakable in the finished shoe to permit the removal of said heel and sole sections for replacement with new sections.

5. A rubber shoe comprising an upper, an insole, the lower margin of the upper being turned inwardly and lasted over the lower margin of the insole, a midsole unit comprising a waterproof body portion having edges covered with waterproof binding material, all of said parts, including said unit, being vulcanized together into an integral structure, a part of the binding for the midsole unit being exposed at the edge of the shoe bottom, outsole and heel sections independently secured to the corresponding portions of the bottom of said midsole unit by adhesive unions which are secure for wearing purposes but are breakable in the finished shoe to permit the removal of said sections for replacement with new ones, said shoe having an upwardly curved arch portion between said sections and an outer covering for said arch portion connecting said sole sections.

6. A rubber shoe comprising an upper, an insole, the lower margin of the upper being turned inwardly and lasted over the lower margin of the insole, a midsole unit comprising a waterproof body portion having edges bound with waterproof material, said edge binding being independent of said upper except for its connection therewith produced by vulcanization, all of said parts, including said unit, being vulcanized together into an integral structure, a part of the binding for the midsole unit being exposed at the edge of the shoe bottom, outsole and heel sections independently secured to the corresponding portions of the bottom of said midsole unit by adhesive unions which are breakable in the finished shoe to permit the removal of said sections for replacement with new ones, said heel section including a raised heel inset from the edge of its section by a narrow margin, and a line of stitching securing said margin to the margin of said midsole unit.

7. That improvement in methods of making rubber shoes, comprising the steps of assembling an insole and the parts of the upper with each other on a last, lasting the upper to the insole, producing a vulcanizable midsole unit with a waterproof covered edge, applying said midsole unit to the bottom of the lasted assembly so produced, adhesively securing said parts to each other, vulcanizing the assembly so made and thereby securing all of said parts permanently together and producing a shoe having a waterproof bottom structure, thereafter securing the marginal areas of the outsole and the midsole unit together with a vulcanizable cement and so adjusting the adhesion produced in this manner that the adhesive union will be serviceable for wearing purposes but may be readily broken in the finished shoe to permit the clean removal of the outsole from the midsole unit, and stitching said outsole to said midsole through the cemented areas.

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