July 16, 1963 R. G. KLINE ETAL 3,097,381

METHOD FOR MAGNETICALLY RETAINING AN INSOLE AND LAST IN ASSEMBLED ALIGNMENT

Filed May 23, 1962

2 Sheets-Sheet 1

Fig. 2.

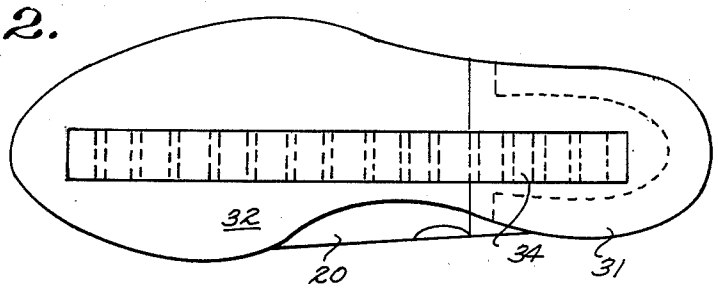


Fig. 1.

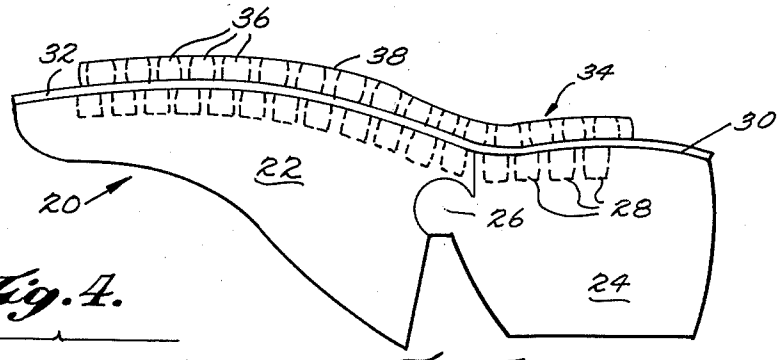


Fig. 4.

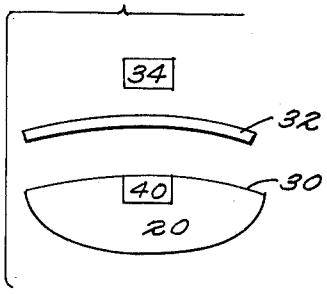


Fig. 5.

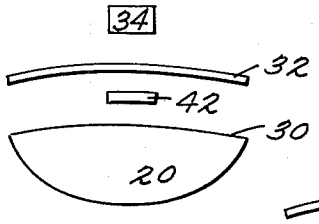


Fig. 7.

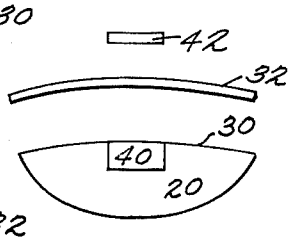


Fig. 3.

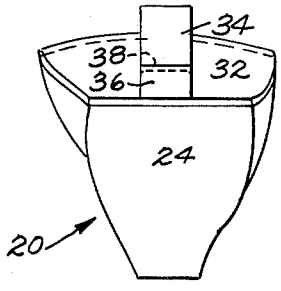
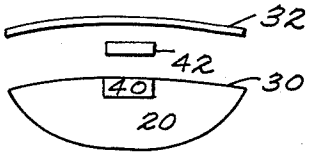


Fig. 6.



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Fig. 9.

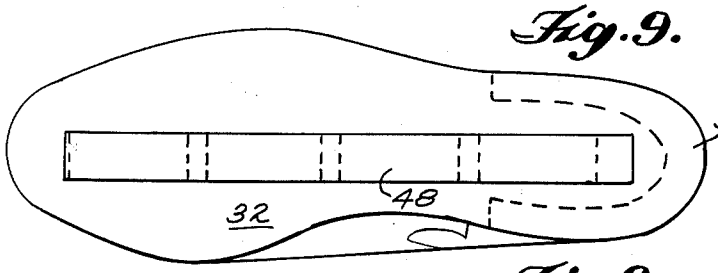


Fig. 10.

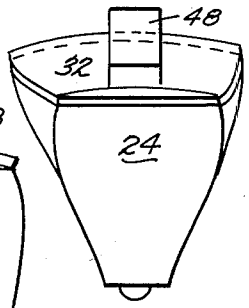


Fig. 8.

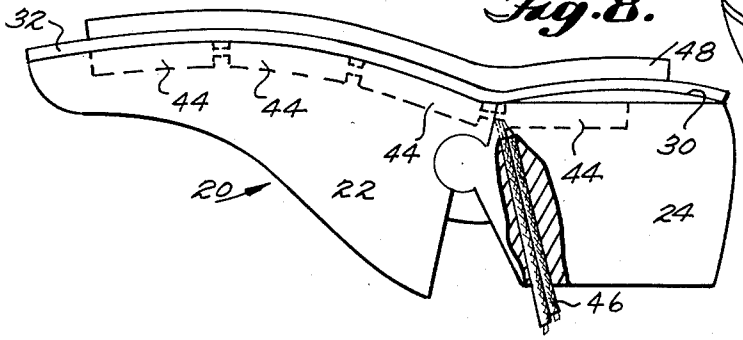


Fig. 11.

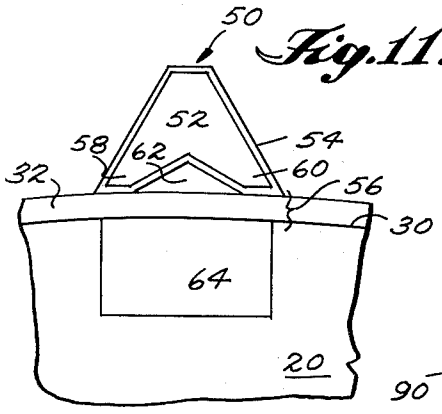


Fig. 13.

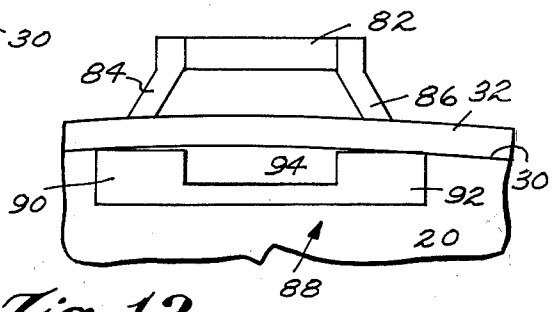
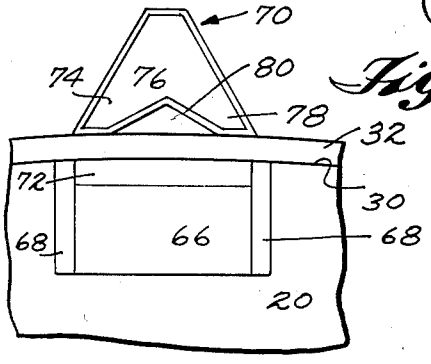


Fig. 12.



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METHOD FOR MAGNETICALLY RETAINING AN INSOLE AND LAST IN ASSEMBLED ALIGNMENT

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4 Claims. (Cl. 12—142)

This invention generally relates to the manufacture of footwear, and more particularly to a novel method for temporarily securing a shoe insole to the bottom of a related last as a step in the manufacturing procedure.

Regardless of the fastening means employed, the insole must be firmly retained in aligned position on the last so as to withstand the severe lateral and normal stresses imposed during the lasting operation that tend to displace the insole relative to the last bottom. At the same time, the retaining means must be such that upon completion of the lasting operation, it can be released to permit removal of the last from the shoe interior without leaving any vestiges of the fastening means to either discolor or permanently disfigure the foot contacting surface of the insole.

In the past, insoles have customarily been secured to conventional wooden lasts by suitable tack fasteners driven directly through the insole into the last bottom in order to retain the assembled components in aligned relation until completion of the lasting operation. The disadvantages of such a procedure are readily apparent in that each tack must be individually removed, either manually or by a mechanical tack puller, with the resultant destructive marring or gouging of the insole and permanent mutilation of the wooden last. Also, occasional shearing of the conventional tack head necessitates separate inspection of each shoe for the purpose of detecting and removing the imbedded portion.

The desirability of replacing the customary tack fastener with some other means to temporarily secure the insole to the last bottom has long been recognized by the industry. For example, the insole can be bonded directly to the last bottom by an adhesive material, such as tape which must be subsequently stripped off, or by a thermoplastic resin that can be removed only through the application of either heat or vibrational shock. In either event the adhesive material cannot be reused and must be continually renewed thereby resulting in excessive waste.

It is therefore the primary purpose of this invention to detachably secure an insole to the bottom of a related last without perforating the foot contacting surface of the insole or interposing an adhesive material between the assembled components to form a temporary bond that must be subsequently released either by stripping or through the application of external heat or by vibrational shock.

A principal object of the present invention resides in the utilization of a magnetic force for temporarily retaining an insole and related last in assembled relation in order to prevent relative displacement of the aligned components during the lasting operation.

A further object of this invention is the provision of specially designed magnets and magnetic materials constructed to resist and withstand the severe lateral and normal stresses imposed during the lasting operation that tend to displace the insole relative to the holding member and last.

A still further object of the present invention resides in the provision of specially designed magnets and magnetic materials which serve to secure an insole to the bottom of a related last regardless of the surface contour of the latter component.

Another object of this invention is the provision of specially designed magnets and magnetic materials that may be used repeatedly without requiring replacement; which are thoroughly reliable, effective and relatively simple in construction, and otherwise well adapted to the purposes for which the same are intended.

Other objects and the entire scope of the present invention will become apparent from the following detailed description and by reference to the accompanying drawings. It should be understood, however, that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent as the description herein progresses. Reference now being made to the accompanying drawings which form a part hereof, wherein like numerals refer to similar parts throughout and in which:

FIGURE 1 is a side elevational view, partially in section, of an insole and related last retained in assembled alignment by magnetic means in accordance with the present invention;

FIGURE 2 is a top plan view, partially in section, of the assembled insole and last illustrated in FIGURE 1;

FIGURE 3 is an end view, partially in section, of the assembled insole and last illustrated in FIGURE 1;

FIGURE 4 is an exploded schematic view showing the insole positioned between a magnet imbedded in the last and a separate magnetic holding member;

FIGURE 5 is an exploded schematic view similar to FIGURE 4 except that the insole is positioned between a strip of magnetic tape material applied directly to the last and a related magnetic holding member;

FIGURE 6 is an exploded schematic view of a modified embodiment wherein the holding member is in the form of a strip of magnetic tape material applied along the inner face of the insole;

FIGURE 7 is an exploded schematic view of another modified embodiment similar to FIGURE 6 except the holding member is applied directly to the outer face of the insole;

FIGURE 8 is a side elevational view, partially in section, of an electro-magnetic last constructed in accordance with the present invention for retaining an insole in assembled alignment;

FIGURE 9 is a top plan view, partially in section, of the assembled insole and electro-magnetic last illustrated in FIGURE 8;

FIGURE 10 is an end view, partially in section, of the assembled insole and electro-magnetic last illustrated in FIGURE 8;

FIGURE 11 is a sectional view of a magnetic holding member constructed in accordance with the principles of the present invention;

FIGURE 12 is a sectional view similar to FIGURE 11 illustrating a modified imbedded magnet and associated holding member; and

FIGURE 13 is a sectional view of a modified magnetic holding member and associated magnetized last designed to effectively resist any forces tending to laterally displace the insole relative to the holding member and last.

Referring now to the accompanying drawings, and particularly to the embodiment illustrated in FIGURES 1 to 3, inclusive, the numeral **20** generally designates a shoe last formed from wood, plastic or similar material having the usual toe and heel portions, **22** and **24**, respectively, pivotally interconnected at **26** to permit collapsing and subsequent removal of the unit from a manufactured shoe

in the customary manner. Located along the approximate longitudinal center line of the last 20 are a plurality of magnetic members 28 composed of ferromagnetic material which becomes magnetized under the influence of a magnetic field. The magnetic members 28 are imbedded in recesses countersunk in the toe and heel portions of the last and preferably are shaped to blend with the contoured surface of the last bottom 30. If a heel plate is required, the central portion thereof must be removed to permit installation of the magnetic members 28, as shown in FIGURE 2, leaving only a marginal shoulder 31 of U-shaped outline. By performing the aforementioned modifications, a conventional last can be easily converted to receive the magnetic members.

Supported in superposed aligned relation with the bottom surface 30 of the last 20 is an insole 32 of conventional design which is retained in position by the force of magnetic attraction created between the magnetic members 28 and an associated holding member or keeper 34 containing a plurality of permanent magnets 36. Due to the irregular surface contour of the last bottom, the magnetic holding member 34 must be capable of flexible movement in order to accommodate a variety of irregular profiles. Universal movement can be accomplished by either enclosing the magnetic components 36 within a flexible jacket 38 of non-magnetic material, such as plastic or cloth, or by directly interconnecting the individual magnets in any well known manner. Moreover, flexible strips of permanent magnetic material could also be utilized to achieve this effect.

The holding number 34 is so arranged that when the permanent magnets 36 are moved into proximity of the magnetic members 28, magnetism will be induced and a magnetic field produced across the zone of attractive interaction forcing the insole 32 against the last bottom 30 and retaining the latter components in constrained contact. When holding member 34 is withdrawn, attractive intertion between the magnets and magnetic members will be interrupted allowing the last to be separated from the insole. Conversely, it should be noted that permanent magnets 40 could be substituted for the magnetized members 28 imbedded in the last 20, as schematically illustrated in FIGURE 4 if the polarity between the holding member 34 and magnets 40 is such as to create an attractive magnetic force. As an alternate embodiment, a piece of single faced pressure sensitive tape 42 containing ferromagnetic material could be adhesively secured to the bottom surface 30 of the last 20 in place of the magnetic members 28, as shown in FIGURE 5. Conversely, the strip of pressure sensitive magnetic tape 42 could be adhesively secured to either the inner or outer surfaces of the insole 32, as schematically illustrated in FIGURES 6 and 7, respectively, when permanent magnets 40 are imbedded in the last bottom 30.

Electro-magnets can also be utilized to produce the required magnetic field. As shown in FIGURE 8, a plurality of electro-magnets 44 imbedded in the last bottom 30 are electrically interconnected with one another and coupled to a suitable source of electric current through lead wires 46. As in the case the magnetic members 28 illustrated in FIGURES 1 to 3, the central portion of the metallic heel plate 31 has been removed so as not to interfere with the field created by the individual electromagnetic units 44. When the electro-magnets 44 are energized, the field magnetizes and attracts the magnetic holding member 48 which in turn forces the insole 32 against the last bottom 30 retaining the same in assembled alignment and serving to resist separation until interruption of the electrical current supplied to lead wires 46. Again, the holding member 48 can be in the form of ferromagnetic material or a permanent magnet. Conversely, electro-magnets can be employed in the holding member to attract the magnetic material imbedded or secured to the last bottom. Thus, it should be understood that any combination of the preceding alternate embodiments can be employed without departing from the present invention. Moreover, the disclosed method for magnetically retaining an insole and related last in assembled alignment is applicable to all types of footwear made on a last, including men's, women's, children's and infants' shoes, slippers, moccasins, boots, or the like, whether right or left and regardless of size or type.

While the magnetic attraction developed between the holding member and associated magnetic member carried by the last will tend to resist separation of the insole from the last bottom in a direction normal to the surface of contact, the assembled components can nevertheless become misaligned when subjected to a lateral force substantially parallel to the surface of contact. Accordingly, one of the most important aspects of the present invention resides in the control of the magnitude and direction of magnetic flux produced by the magnetic field across the zone of attractive interaction where the insole and last come into contact. Referring now to FIGURE 11, the holding piece 50 consists of a plurality of permanent magnets 52 enclosed within a flexible, non-magnetic jacket 54. In order to concentrate the density of magnetic flux produced across the zone of attractive interaction, generally indicated by the numeral 56, the holding member 50 employs a pair of diverging leg elements 58 and 60 separated by a V-shaped channel 62. Holding member 50 is attracted downwardly towards the magnetic member 64 imbedded within the last 20 forcing the insole 32 into intimate contact against the last bottom 30. The cross-sectional shape of the holding member 50 is such as to concentrate the magnetic flux at the point where the localized field is deflected at an angle by the diverging leg portions 58 and 60 in its passage through the zone of attractive interaction 56. By reducing the cross-sectional area of legs 58 and 60, the flux density induced by the magnetic member 50 will be concentrated at the point where the supporting legs contact the insole 32, and by deflecting or changing the angle of the flux path, the holding member 50 will exert a restraining magnetic force at an angle to the normal so as to resist any lateral forces substantially parallel to the surface of contact which would tend to displace or misalign the insole 32 relative to the holding member 50 and last bottom 30 during the manufacturing operation. Since the interacting attractive force induced by the magnetic member 50 develops a magnetic flux with components in both lateral and normal directions to the surface of contact established between the superposed insole and last, these resultant force components serve to maintain the holding member, insole and last in assembled alignment.

Referring now to FIGURE 12, in order to further concentrate and intensify the magnitude of magnetic flux, magnetic member 66 imbedded in the last 20 may be somewhat modified by employing permanent magnets surrounded by a magnetic core casing 68 of iron or similar ferromagnetic material which becomes magnetized through induction. In order to reduce leakage between the central portion of magnetic member 66 and holding member 70 of magnetized material, a non-magnetic insulating material 72, such as plastic wood or the like, may be used to fill the intermediate gap between the magnetic member 66 and the contacting surface 30 of the last bottom. Thus, the magnetic field circuit will follow a path from the magnetic member 66 through the bushing or casing 68 and across the zone of attractive interaction where insole 32 is positioned to the lower leg 74 of the holding member 70 whereupon it will pass through the core 76 of magnetized material downwardly through the opposite leg 78 and again across the zone of attractive interaction to the opposite side of the casing 68. Since the central portion of the holding member 70 and magnetic member 66 are separated by an air gap 80 as well as non-magnetic material 72, the flux density will be intensified and distorted at the point where the magnetic field passes through the insole 32 from the core casing 68 to the diverging legs 74 and

78 of the holding member 70, which constitutes the zone of attractive magnetic interaction. While the magnetized bushing or core casing 68 is shown with upwardly extending leg portions, it should be understood that the magnet 66 may be in the form of a curved or U-shaped member as long as the terminal portion which contacts the bottom surface 30 of the last is of reduced cross-sectional area in order to concentrate the magnetic flux at that point.

With the foregoing in mind, it is also possible to vary the magnetic characteristics of the holding member 70 in the manner shown in FIGURE 13 by employing a permanent magnet 82 supported upon a pair of diverging legs 84 and 86 at its opposite edges which are composed of ferromagnetic material. These legs are constructed so that the cross-sectional area of the leg is less than the cross-sectional area of the magnet thereby concentrating the magnetic flux at the areas of contact with the insole 32. Moreover, legs 84 and 86 flare outwardly with the maximum divergence at the point of contact with the insole so as to deflect or distort the magnetic field from the normal. An associated magnetized member 88 is shown imbedded in the last 20 with upwardly extending end portions 90 and 92 positioned adjacent the surface of contact 30. In order that the portion of the last above the magnetized member 88 retain the desired shape of the last bottom, the intermediate gap is filled with non-magnetic insulating material 94. By providing diverging legs 84 and 86, the magnetic flux density can be concentrated and directed across the zone of attractive interaction which exists between legs 84 and 86 and the related magnetized portions 90 and 92 respectively. Thus, the circuit of the flux path or magnetic field will be somewhat distorted at the zone of attractive interaction thereby more effectively serving to resist any forces tending to laterally displace the insole 32 relative to the holding member 32 and last 20.

The present invention will thus be seen to completely and effectively accomplish the objects enumerated hereinabove. Since magnetic members and magnetized material may be employed in either the holding member or the last without affecting the principles of this invention, it will be realized that various changes and substitutions may be made to the specific embodiments disclosed herein for the purpose of illustrating the principles of this invention,

without departing from these principles. Therefore, this invention includes all modifications encompassed within the spirit and scope of the following claims.

What is claimed is:

1. In the manufacture of footwear, a method for retaining an insole and last in assembled alignment comprising the steps of (1) aligning said insole and last in superposed relation, (2) placing a holddown member on said insole which is magnetically attracted toward said last and (3) forcing said insole into contacting engagement with said last by the magnetic interaction between said holddown member and said last.

2. The method of claim 1 wherein the magnetic interaction between said holddown member and last is localized to provide a restraining force effectively resisting lateral displacement of said insole relative to said last.

3. The method of claim 1 wherein the magnetic field created by said magnetic interaction is localized to intensify the force of magnetic attraction between said holddown member and said last.

4. In the manufacture of footwear, a method of retaining an insole and related last in assembled relation through cooperative interaction with a holding member comprising the steps of (1) constraining said insole between said last and said holding member which is magnetically attracted towards said last and (2) localizing the magnetic field created through the magnetic interaction between said last and holding member to provide a restraining force for effectively resisting displacement of said insole relative to said last and said holding member.

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