Nov. 4, 1969 H. BRAHM 3,475,836

AIR PUMPING INSERT FOR SHOES

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FIG. 1

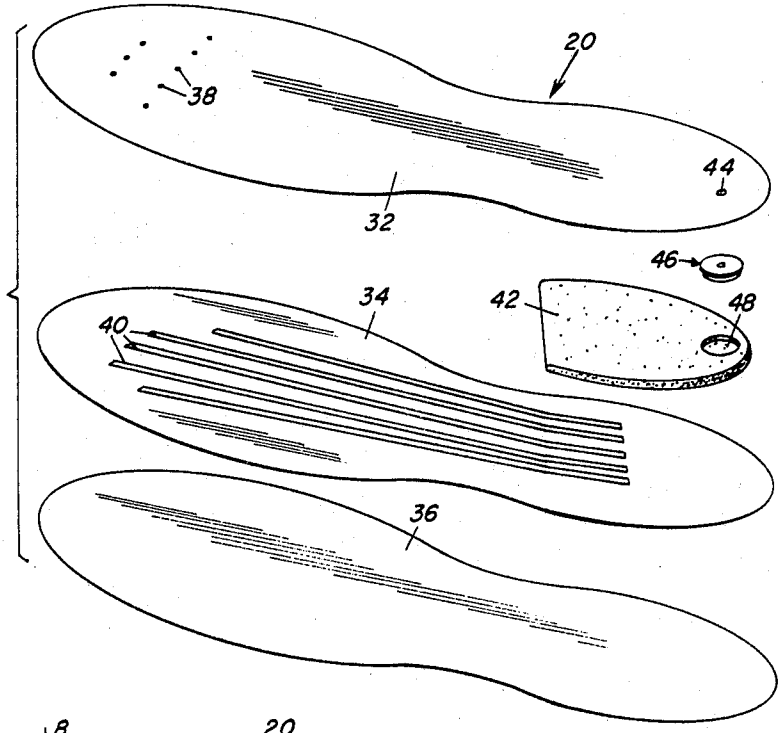
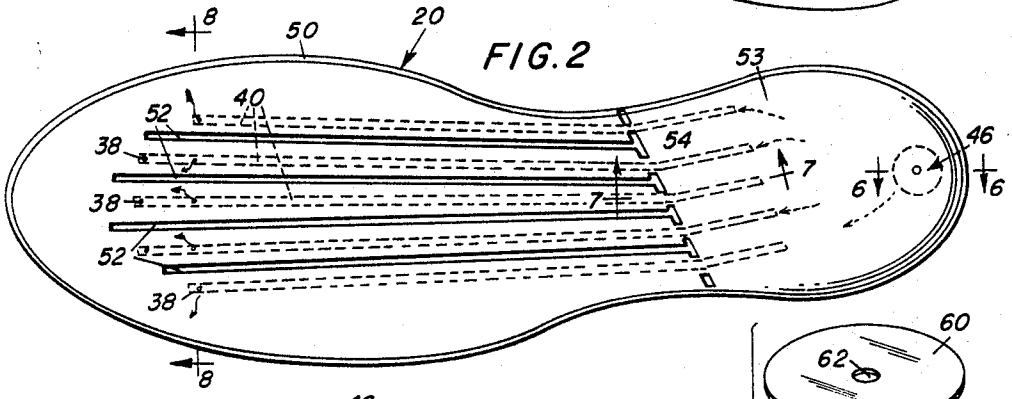


FIG. 2



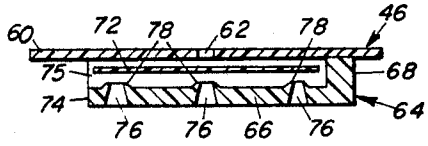


FIG. 5

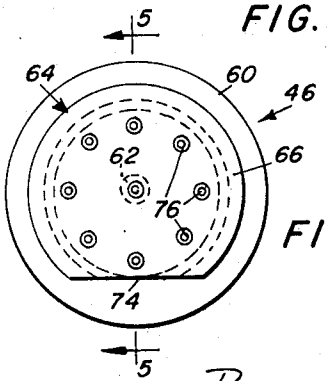


FIG. 4

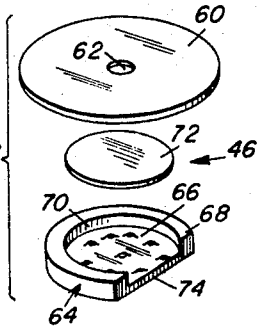


FIG. 3

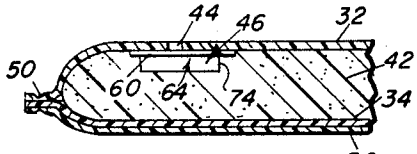


FIG. 6

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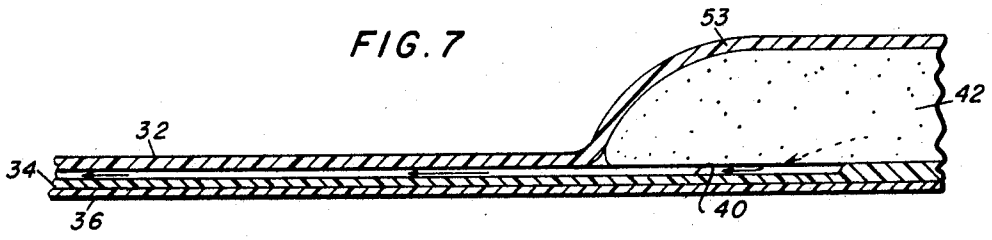
FIG. 7



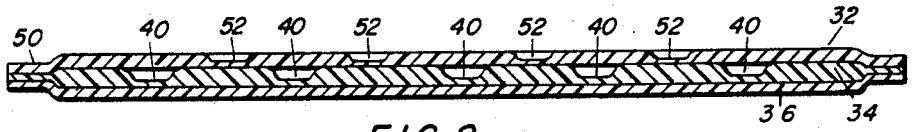


FIG. 8

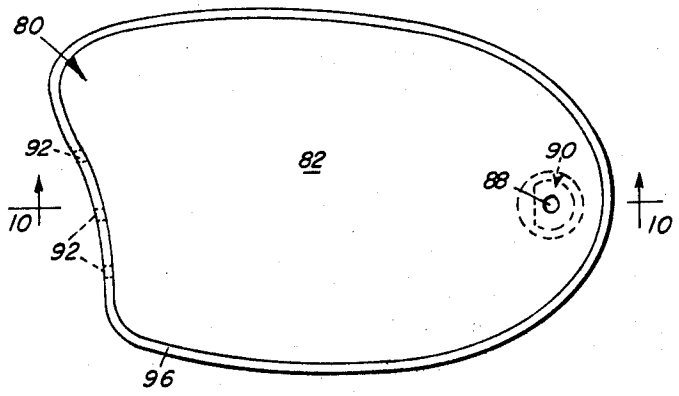


FIG. 9

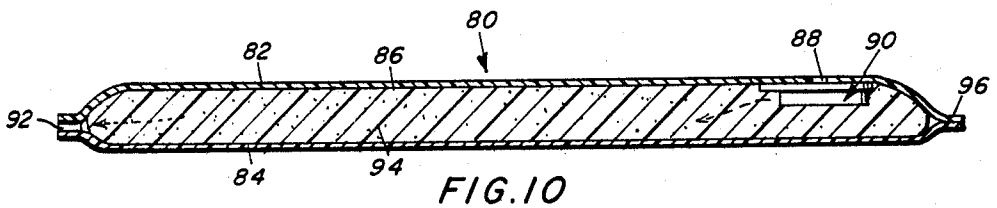


FIG. 10

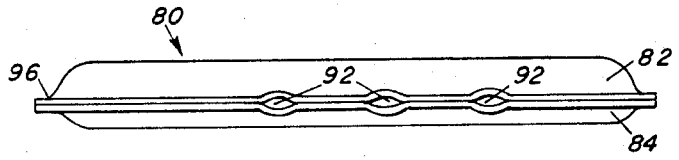


FIG. 11

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AIR PUMPING INSERT FOR SHOES

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Int. Cl. A43b 7/06
U.S. Cl. 36—3 10 Claims

ABSTRACT OF THE DISCLOSURE

This invention relates to air pumping inserts for shoes comprising an insert having a heel portion with a pumping chamber having a resilient cushion member therein. A one-way airlet valve is mounted in the rearward end of the heel portion and a plurality of outlets are provided in the forward end of the insert. In the normal course of walking, intermittent heel pressure on the heel portion of the insert produces air flow through the inlet valve upon release of heel pressure and pumping such air outwardly through the outlets in the forward portion of the insert upon application of heel pressure on the heel portion of the insert.

Despite the highly developed state of the shoe art today, problems such as foot perspiration are prevalent in conventional shoes. The introduction of fresh air in the shoe with each step will help solve the problem of lack of proper ventilation which is conducive to perspiration and the development of foot discomfort, odors and illnesses. It is with this thought in mind that the air pumping insert for shoes has been developed.

In view of the above, it is an object of this invention to provide an air pumping insert for shoes that will fit smoothly and comfortably within the shoes in the manner of an insole or cushion.

It is another object of this invention to provide an air pumping insert for shoes wherein the pumping action is produced in the normal course of walking by the application and release of pressure on the heel portion of the insert by the heel of the wearer.

It is a still further object to provide an air pumping insert wherein the air is drawn in through a valve in the rearward end of the heel portion of the insert and forced out through openings in the forward end portion of the insert.

It is a still further object to provide an air pumping insert for shoes comprising generally coextensive top and bottom layers of air tight material, said layers being peripherally sealed to form an air tight insert, a pumping chamber formed in the insert, a resilient cushion placed in said pumping chamber, a one-way air inlet valve mounted in the top layer adjacent the rearward end of the pumping chamber, and air outlet means provided in the end of the insert opposite that of the inlet valve.

Other objects and advantages of this invention will become more apparent when considered in conjunction with the following detailed description and drawings showing two preferred forms of this invention.

Description of the drawings

FIG. 1 is an exploded view of the air pumping insert of this invention in the form of an insole;

FIG. 2 is a top plan view of the insole of FIG. 1;

FIG. 3 is an exploded and enlarged view of the valve provided in the air pumping insert;

FIG. 4 is an enlarged bottom plan view of the valve of FIG. 3;

FIG. 5 is a cross sectional view taken along line 5—5 of FIG. 4;

FIG. 6 is an enlarged partial cross-section taken along line 6—6 of FIG. 2 illustrating the position of the valve in the insole of FIG. 1;

FIG. 7 is an enlarged partial cross-sectional view taken along line 7—7 of FIG. 2;

FIG. 8 is an enlarged cross-sectional view taken along line 8—8 of FIG. 2;

FIG. 9 is a top plan view of another embodiment of the air pumping insert of this invention in the form of a heel cushion;

FIG. 10 is an enlarged cross-sectional view taken along line 10—10 of FIG. 9, and

FIG. 11 is an enlarged end elevational view of the heel cushion of FIG. 9.

An air pumping insert in the form of an insole is illustrated in FIGS. 1–8. Referring to FIG. 1, the air pumping insole **20** comprises a top layer **32**, an intermediate layer **34** and a bottom layer **36**. The top layer **32** is provided with a plurality of holes **38** in the toe portion of the insole which holes are adapted to cooperate with longitudinal air channels **40** formed in the intermediate layer **34** as best illustrated in FIG. 2. A resilient heel cushion **42** is positioned between the top layer **32** and the intermediate layer **34** in the heel portion of the insole **20**.

The top layer **32** is provided with a one-way air inlet hole **44** in the heel portion and a one-way air outlet valve **46** is secured to the bottom face of this layer in operative registration with said air inlet hole **44**. The resilient heel cushion **42** may have an opening **48** formed therein to accommodate the air inlet valve **46**.

The air pumping insole unit **20** is laminated together by means of a peripheral seal **50** which may be a heat seal, an adhesive seal, a stitched seal or a combination thereof. The main requirement being that the seal should be airtight. The air inlet valve **46**, as previously set forth, is secured to the bottom face of top layers **32** in registration with air inlet **44** by any suitable means.

Referring particularly to FIGS. 2, 7 and 8, the longitudinal air channels **40** provided in intermediate layer **34** are separated by means of interdigitated longitudinal seals **52** formed between the top and intermediate layers by longitudinal depressions in the top layer **32**. It should be noted that the longitudinal air channels **40** extend rearwardly into the heel portion **53** of the insole **30** while the longitudinal seals **52** terminate at the beginning of the heel portion **53** and are connected to cross seals **54**. These cross seals are laterally spaced so as not to block the air channels **40** which extend into the heel portion of the insole. It is further contemplated that air channels **40** may be eliminated and by merely using longitudinal seals **52** provide a plurality of air passages which would direct air to the outlets **38** in the top layer.

As best illustrated in FIGS. 3–5, the one-way air inlet valve **46** comprises a circular top **60** having a centrally disposed inlet **62**. The valve body **64** has a circular base **66** with an annular upstanding peripheral portion **68** forming a circular opening **70** into which fits the valve disc **72**. It should be noted that a chordal section is cut away from a portion of the valve body **64** to provide a flat chord-like face **74** and outlet **75**. The valve unit **46** is assembled by dropping the valve disc **72** into body opening **70** and then securing the circular top **60** to the upstanding annular body portion **68**. As indicated in FIG. 5, the valve body base **66** is provided with a plurality of holes **76** which are tapered with the greater dimension being on the bottom face of the base **66**. The upper ends of the tapered holes **76** are surrounded by annular raised portions **78** upon which valve disc **72** comes to rest when air is passing inwardly through the valve inlet **62**.

As indicated in FIGS. 2 and 6, the one-way air inlet valve **46** is mounted in the heel portion **53** by securing

circular top 60 of the valve to the underface of top layer 32 by any suitable means with the chordal face 74 directed toward the toe end of the insole whereby air entering through the opening 44 in the top layer and valve inlet 62 will be directed out the open portion 75 of the valve body 64 into the cushion member 42 from which air will be pumped forward through air channels 40 and out holes 38. It should be noted that valve 46 moves freely with the top layer 32 as that layer flexes in use.

The air pumping insole of FIGS. 1–8 functions as follows. First of all, the insole 20 is placed within a shoe in such a manner that the heel portion 53 of the insole is positioned snugly in the heel portion of the shoe with the air valve inlet facing upwardly. The insole unit should correspond reasonably close with the shoe size so that with the heel portion of the insole unit properly positioned, the toe portion of the insole will extend forwardly enough to provide a smooth comfortable surface for the remainder of the foot. The shifting of the weight on the foot as in the normal walking produces the pumping action in the insole 20 as follows. At the time when most of the individual's weight is carried by the heel, the resilient cushion 42 in the insole heel portion 53 is compressed thus causing the valve disc 72 to use and close off valve inlet 62 due to the pressure in the heel portion forcing air through holes 76 and the open face of the valve body. This same pressure causes air to flow toe-ward through the cellular cushion 42 into air channels 40 and out into the toe portion of the shoe through holes 38. Thus the toe portion of the shoe is furnished with fresh air.

Next, as the weight of the foot shifts forwardly, downward pressure in the heel cushion 42 is removed and the valve disc 72 drops down against the annular portions 78 on the valve body base 66. This downward movement of valve disc 72 is produced by a suction action brought about by expansion of the resilient heel cushion 42 and that portion of the top and bottom layers surrounding same. This suction also causes air to enter through top layer hole 44 and valve inlet 62 into the heel portion of the insole unit. It should be noted that the valve 46 is positioned near the rear edge of the heel portion 53, thus in normal walking, the heel portion of the foot directly over the valve will be slightly raised and thus spaced from the valve when the weight is transferred to the ball of the foot, thereby providing ready access for fresh air. Admittedly, the same suction that opens the valve, i.e. causes the valve disc 72 to drop down against the annular elements 78, could cause some air to be drawn in through holes 38 in the toe portion of the insole. As a practical matter, this does not occur due to the resistance of the necessary air travel path, namely, holes 38 and air channels 40.

It is obvious that many variations in construction can be made to the specific embodiment described in FIGS. 1–8, and further that many different materials could be used. For example, the top layer 32 can be made from plastic such as vinyl, or even a fabric could be used as long as it is treated so as to be airtight. When a plastic is used, the outer surface which would be engaged by the foot could be embossed to simulate a woven fabric. In a further variation, the top layer 32 could be composed of two layers of material such as a plastic and a woven fabric thereby providing an airtight layer on the underside and a woven surface on the foot engaging side.

In the areas where cold weather is prevalent, the use of a plastic layer having a reflective coating for the top layer 32 would be advantageous. The reflective surface would face the foot thereby causing the heat of the foot to be reflected back toward the foot. Obviously, this reflective feature could be embodied in either layer 34 or 36 if needs so dictate.

The intermediate layer 34 and bottom layer 36 may be made from the same materials used in making top layer 32. As a practical matter, there are situations where the intermediate and bottom layers can be one unitary layer. The resilient heel insert 42 is preferably made of vinyl foam although other such materials can be used. The particular foam material used should be porous and provide for air passage therethrough, not all foams are of this character. The valve 46 is most advantageously made from plastic.

The peripheral outer seal 50 which secures the various layers together in the finished insole form is advantageously a heat seal but other types of seal may be used particularly when airtight fabrics are used rather than plastic.

An air pumping insert in the form of a heel cushion is illustrated in FIGS. 9–11. This heel cushion 80 comprises a top layer 82 and a bottom layer 84 with a resilient cushion 86 therebetween in an air pumping chamber 94. As in the air pumping insole unit illustrated in FIGS. 1–8, this heel cushion unit 80 has an air inlet hole 88. A one-way inlet valve 90 is secured to the underface of top layer 82 in alignment with air inlet 88 in the same manner as that in the air pumping insole. The valve 90 is exactly like that illustrated in FIGS. 3–5 and operates in the identical manner.

The heel cushion 80 is provided with a plurality of air outlets 92 in the forward peripheral portion of the unit. These air outlets 92 function to allow air to escape from within the cushion area and serve to restrict return flow when a vacuum is created in the cushion area. These air outlets operate to open when pressure is created within the cushion chamber 94 and tend to some extent close when this pressure is removed. As best shown in FIGS. 10 and 11, the outlets 92 are formed by providing small openings in the peripheral seal 96 between the top layer 82 and bottom layer 84.

The operation of the heel cushion unit 80 is substantially like that of the insole unit 20, namely, pressure of the heel causes the pumping chamber 94 to force air out through air outlet 92. This same pressure causes the valve disc to close off the air inlet 88 thereby preventing exodus of air therethrough. Upon release of pressure on chamber 94, a suction is created which substantially closes air outlets 92 and also causes the valve disc 72 to come to rest on the annular elements 78 thereby allowing air to enter through air inlet 88. This pumping action is repeated as weight is placed on and thus removed from the heel cushion to accomplish the air flow desired.

The choice of materials specifically set forth with respect to the air pumping insole of FIGS. 1–8 is likewise applicable to the heel cushion of FIGS. 9–11.

As will be obvious to one skilled in the art, the air pumping inserts described by the foregoing specification can readily be incorporated in the shoe at the time of manufacture as an integral part thereof. Whether an integral part of the shoe or an added member, the inserts provide added cushioning in walking as well as air pumping.

As a matter of convenience, the bottom surface of the insert may be provided with a suitable type of adhesive means so as to securely position and retain the insert in the desired location in the shoe.

I claim:

1. An air pumping inset in the form of an insole for shoes, said insole comprising top, intermediate and bottom layers of airtight material, said three layers being peripherally sealed to form an airtight unit, an air pumping chamber formed in the heel portion of the unit between the top and intermediate layers, a resilient cushion in said air pumping chamber, an air opening formed in the heel portion of the top layer adjacent the rearward end of the unit, a one-way air inlet valve secured to the underside of the top layer in alignment with the air opening in said top layer, said inlet valve comprising a body having a circular base, an upstanding annular peripheral portion extending from said base and forming a circular opening, a chordal section of the annular portion being cut away to provide an outlet in the form of a side opening, a valve disc fitted within the circular opening, said upstanding annular portion being secured to the underside of the top cover in alignment wtih the air inlet, air

outlets formed in the forward portion of the top layer and a plurality of separate channels extending into the pumping chamber for conveying air from the pumping chamber to the air outlets.

2. An air pumping insert in the form of an insole for shoes, said insole comprising top, intermediate and bottom layers of airtight material, said three layers being peripherally sealed to form an airtight unit, an air pumping chamber formed in the heel portion of the unit between the top and intermediate layers, a resilient cushion in said air pumping chamber, an air opening formed in the heel portion of the top layer adjacent the rearward end of the unit, a one-way air inlet valve secured to the underside of the top layer in alignment with the air opening in said top layer, air outlets formed in the forward portion of the top layer and a plurality of separate channels extending into the pumping chamber for conveying air from the pumping chamber to the air outlets.

3. The invention as set forth in claim 1 and wherein at least one of the three layers has a reflective coating which coating faces upwardly toward the bottom of the foot.

4. The invention as described in claim 1 and wherein the circular base of the valve body has a plurality of holes providing communication between the bottom of the base and the circular opening in said body.

5. The invention as described in claim 4 and wherein the valve base holes are tapered inwardly from the base bottom and an annular protuberance extends around each of the holes on the upper face of the valve base.

6. The invention as described in claim 1 and wherein longitudinal seals are provided between the top and intermediate layers to separate the longitudinal air channels from each other.

7. The invention as described in claim 6 and wherein spaced seals are provided between the top and intermediate layer laterally of the longitudinal air channels to further direct the air flow in said air channels.

8. The invention as described in claim 1 and wherein at least one of the layers is provided with a heat reflective coating directed upwardly toward the foot.

9. The invention as described in claim 1 and wherein the valve is provided with an apertured top cover secured to the underside of the top layer with its opening in registration with that in the top layer and is adapted to move with the top layer as it flexes in use.

10. An air pumping insert for shoes comprising generally coextensive flexible top and bottom layers of airtight material, said layers being peripherally sealed to form an airtight insert, a pumping chamber formed in the insert, a resilient cushion placed in said pumping chamber, an air inlet formed in the rearward end of the top layer, a one-way air inlet valve secured to the underside of the top layer in alignment with the air inlet, said inlet valve comprising a body having a circular base, an upstanding annular peripheral portion extending from said base and forming a circular opening, a chordal section of the annular portion being cut away to provide an outlet in the form of a side opening, a valve disc fitted within the circular opening, said upstanding annular portion being secured to the underside of the top cover in alignment with the air inlet, and air outlet means provided in the end of the insert opposite that of the inlet valve.

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