Dec. 28, 1965 C. E. BURNHAM 3,225,463

AIR VENTILATED INSOLE

Filed Oct. 12, 1962 2 Sheets-Sheet 1

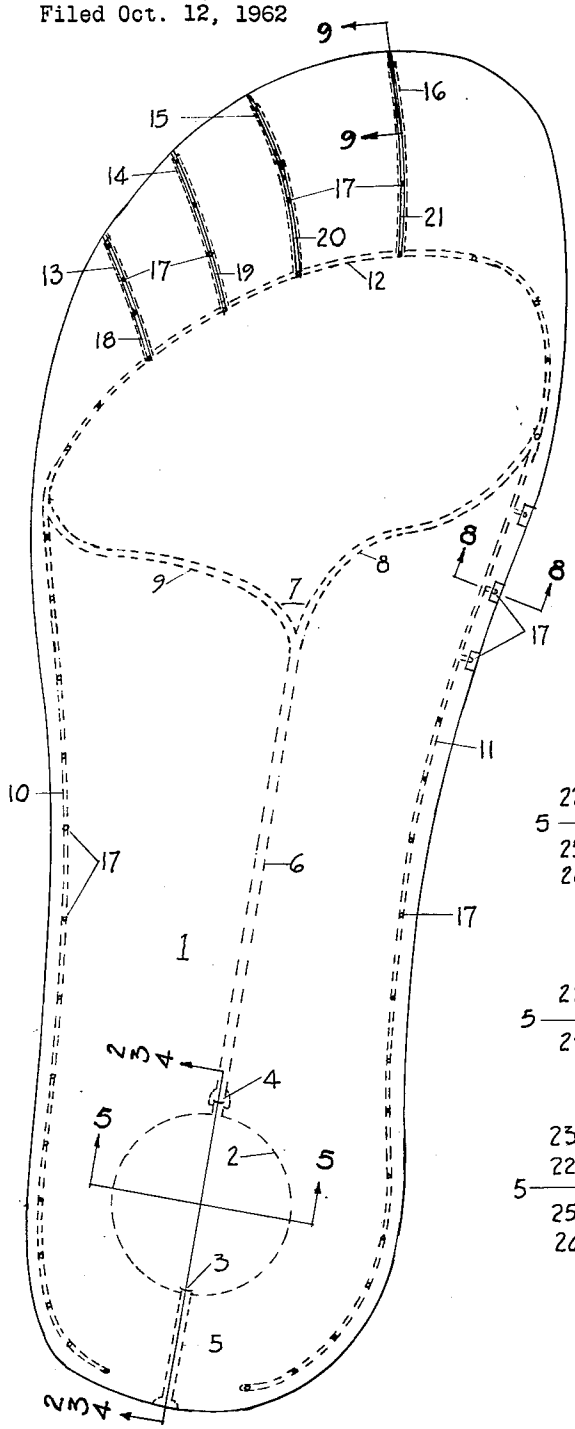

Fig. 1

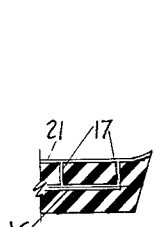

Fig 9

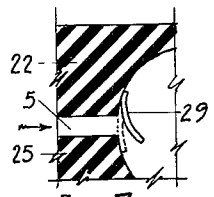

Fig. 7

Fig. 8

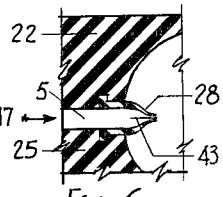

Fig. 6

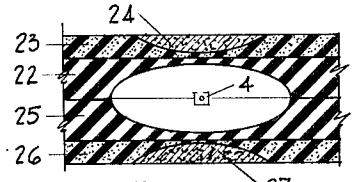

Fig. 5

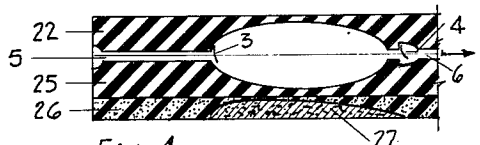

Fig. 4

Fig. 3

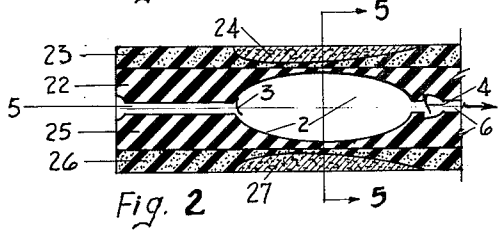

Fig. 2

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AIR VENTILATED INSOLE

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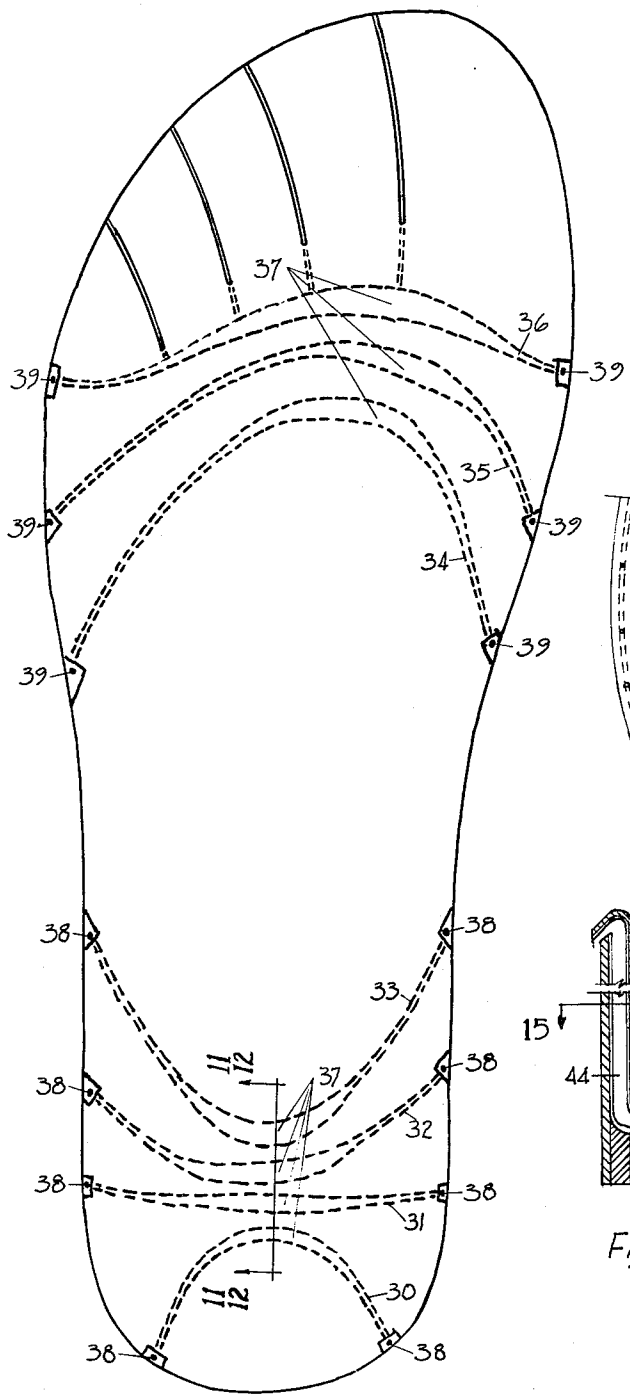

Fig 10

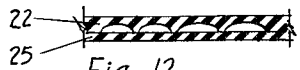

Fig 12

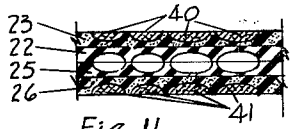

Fig 11

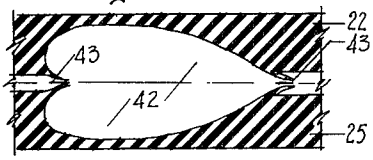

Fig 16

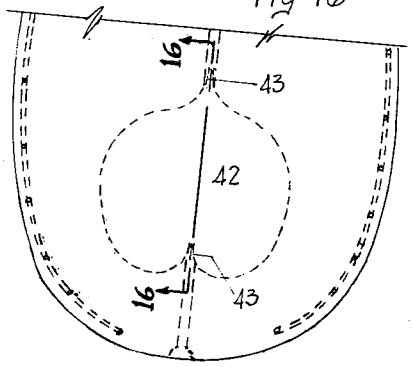

Fig 13

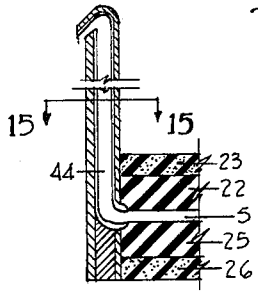

Fig 14

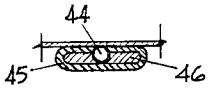

Fig 15

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AIR VENTILATED INSOLE

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2 Claims. (Cl. 36—3)

This invention relates to foot wearing apparel and more particularly to an air ventilated insole for a shoe.

The skin of the human foot exudes perspiration in varying degrees depending on such factors as the temperature of the air surrounding the foot, the amount of physical activity being performed by the foot, and the natural propensity of some persons to perspire more than others. The comfort and health of the foot is greatly influenced by the rate of evaporation of the perspiration generated by the foot. If the perspiration evaporates rapidly, the foot will be cool and comfortable. The rate of evaporation is controlled by the relative humidity of the air surrounding the foot and the rate of air circulation around the foot and between the toes.

The relative humidity of the air surrounding the foot is difficult to control, but various methods have been devised to increase the circulation of air between the toes and around the foot. Open toed shoes, shoes with ventilating holes, and sandals have all increased the natural circulation of air around the foot. However, these methods are not applicable to a regular shoe which substantially encases the entire foot with leather.

Accordingly it is the primary object of the present invention to provide an air ventilated insole for use with regular shoes.

It is another object of the present invention to provide an air ventilated insole which can be incorporated in the shoe during manufacture or inserted at a later time.

Still another object of the invention is to produce an air ventilated insole which utilizes the motion of walking to create a forced draft circulation of air around the foot and between the toes.

It is a further object of the invention to provide a simple and inexpensive air ventilated insole.

A still further object of the invention is to produce an air ventilated insole which is adaptable to any type of shoe.

These and other objects of the invention will be apparent from the following detailed description taken in conjunction with the accompanying drawings wherein:

FIG. 1 is a plan view of one form of an insole made in accordance with the invention;

FIG. 2 is a cross-section on line 2—2 showing the air pump;

FIGS. 3 and 4 are cross-sections similar to FIG. 2 illustrating modifications of the air pump;

FIG. 5 is a cross-section on line 5—5 of the air pump;

FIG. 6 is a cross-sectional view of a "finger" air valve;

FIG. 7 is a cross-sectional view of a flap air valve;

FIG. 8 is a cross-section on line 8—8 of a peripheral air vent;

FIG. 9 is a cross-section on line 9—9 showing the trough, air holes and passageway.

FIG. 10 is a plan view of a modification of the air ventilated insole;

FIG. 11 is a cross-section on line 11—11 illustrating the insole and air passageways;

FIG. 12 is a cross-section similar to that of FIG. 11 modification of the insole and passageways;

FIG. 13 is a partial plan view of the insole illustrating a modification of the air pump;

FIG. 14 is a cross-sectional view of the rear portion of a shoe showing one form of air inlet passageway;

FIG. 15 is a cross-section on line 15—15 showing the attachment of the air passageway to the shoe; and

FIG. 16 is a cross-section on line 16—16 showing the modification of the air pump illustrated in FIG. 13.

Turning now to the drawings, FIG. 1 illustrates the construction of an air ventilated insole 1. The insole can be used as an insert in any conventional footwear such as in sneakers, loafers or sandals and can also be manufactured into an insole in a regular shoe modified in a manner to be described subsequently. The insole can be constructed of rubber, leather or any other suitable material. The insole 1 has a compressible and expansible chamber 2 located in the heel portion of the insole. The chamber 2 is adapted to operate as an air pump and is provided with an inlet valve 3 and an exhaust valve 4. A passageway 5 connects inlet valve 3 to the outside air. Passageway 6 connects exhaust valve 4 to the air distribution system indicated generally by 7. The air distribution system 7 is composed of branch passageways 8 and 9, peripheral passageways 10 and 11, connecting passageway 12 and toe passageways 13, 14, 15 and 16. Passageways 10, 11, 13, 14, 15 and 16 are provided with outlet holes 17 to permit the escape of air.

The operation of the air ventilated insole is dependent upon the walking action of the wearer. As the wearer steps forward, the heel portion of the foot strikes the ground first thereby compressing air pump 2. The compression of the air pump forces air out of the chamber through exhaust valve 4 into passageway 6 and then into the distribution system 7 where the air is vented through holes 17 to cool the foot. Troughs 18, 19, 20 and 21 are provided to increase the circulation of air in between and around the toes.

When the heel leaves the ground, air pump 2 expands and fresh air is drawn into the pump through passageway 5 and inlet valve 3. The cycle of alternate compression and expansion of the air pump is repeated each time the wearer steps down and lifts up his heel, thus insuring a constant forced draft circulation of air around the foot.

Since the same cycle of alternate compression and expansion can be obtained with an air pump located in the ball portion of the insole, it is contemplated that the insole could be constructed with the air pump located in that position. If the air pump is located in the ball portion of the insole, the connecting passageway 6 can be eliminated and the airflow paths from pump to toes shortened considerably with a concomitant increase in the velocity of the air flow around the toes.

The air ventilated insole can be changed, altered, or modified in varying ways to reduce costs and simplify construction. For example, it is possible to eliminate exhaust valve 4 because the compression of passageways 6, 8 and 9 by the ball of the foot acts as a natural valve during the expansion of the air pump.

It is contemplated that the insole would be manufactured in two pieces with the necessary depressions formed in each piece to produce the air pump and passageways when the two pieces were mated together. If the two pieces are constructed of a moldable material, the depressions producing the air pump, passageways and venting system can be formed as an integral part of each piece. Since the entire ventilating system can be integrally formed in two matable pieces, the air ventilated insole offers the shoe manufacturer a simple and relatively inexpensive means for producing ventilated shoes. It eliminates the separate, complicated and expensive heel air pumps taught by the prior art and provides a means for ventilating heelless shoes such as sneakers and the like as well as regular shoes.

FIG. 2 illustrates the general construction of the air pump. The upper portion of the insole is composed of two layers **22** and **23**; the upper most layer **23** having an insert **24** of a material with substantially less flexibility than the upper layers **22** and **23**. The lower portion of the insole is similarly composed of two layers **25** and **26** with an insert **27** in the lower layer **26**. Insert **27** is also substantially less flexible than the lower layers **25** and **26**. The upper insert **24** distributes the pressure of the heel over the air pump in such a manner that the rearward portion of the air pump is compressed first. The pressure distribution is produced by the airfoil shape of the upper insert. The lower insert **27** tends to maintain the air pump in its original configuration so that the lower portion of the air pump will not be substantially deformed by the pressure of the heel. Of course, the upper and lower portions of the insole may each consist only of the layers **22** and **25** with inserts **24** and **27** omitted or positioned over and under the air pump in the layers **22** and **25**

FIG. 3 illustrates a modification of the air pump. Since the greatest deformation will occur in the upper portion of the air pump, it is possible to make the lower portion of the air pump completely flat as shown in FIG. 3. This will increase the relative compression of the air in the air pump and thereby create a much stronger air draft in the distribution system.

FIG. 4 shows a further modification of the insole which utilizes only one insert. Insert **27** is located underneath the air pump and tends to maintain the air pump in its original configuration so that the lower portion of the air pump will not be substantially deformed by the pressure of the heel.

FIG. 5 is a cross-section of the air pump taken at right angles to the cross-section illustrated in FIG. 2 showing the symmetrical nature of the two inserts **24** and **27**.

FIG. 6 shows one of many possible forms of construction for the inlet and exhaust valves of the air pump. The valve **28** is called a finger valve because its construction resembles the five fingers of a hand which are pressed together at their tips to form a roughly conical shape. The spaces between the fingers are designated as slits which are identified as **43** in FIG. 6. If air is blown from the center of the hand i.e., from the palm towards the finger tips, the fingers will open allowing air to escape from the slits and from the small opening at the finger tips. If air is blown in the reverse direction, that is, from outside of the hand towards the finger tips, the air pressure on the outside of the fingers will tend to press the finger tips closely together, thus sealing the slits. From this description it can be seen that the finger valve **28** will permit the passage of air in only one direction. The valve may be formed as an integral part of the upper and lower portions of the insole.

FIG. 7 illustrates a simple flap valve also operable only in a single direction. The flap valve **29** may be formed as an integral flexible flap extending from either the upper or lower portions of the insole or may be a separate flap member attached to the upper or lower portions by adhesive or similar means.

FIG. 8 shows the indentations which are necessary along the sides of the insole to provide a proper discharge of air through vents **17** in the two peripheral passageways **10** and **11**. For purposes of clarity, only three indentations are shown in FIG. 1. However, such indentations may be located along the entire length of passageways **10** and **11**. The indentations are formed by cutting wedge shaped portions from the outer edge of the insole. Vents **17** are cut in the sloping wall of the indentations and are connected to the peripheral passageways **10** and **11**. If the indentations are cut deeply enough they will expose a portion of the passageways **10** and **11** thus forming a natural vent.

FIG. 9 illustrates a toe passageway **16**, connecting vents **17** and trough **21**. A similar construction is used for the trough-passageway combinations **13** and **18**, **14** and **19**, and **15** and **20**.

A modification of the insole **1** is shown in FIG. 10. A series of tubes **30**, **31**, **32**, **33**, **34**, **35**, and **36** is disposed in the heel and ball portions of the insole. Each of these tubes has a widened portion **37** which operates as an air pump. The heel tubes **30**, **31**, **32** and **33** will force air out of the holes **38** every time the heel compresses the air pump portion **37** of the tubes. Similarly, the ball portion tubes **34**, **35** and **36** will force air out of holes **39** everytime the ball of the foot is pressed down on the air pumps **37**. FIGS. 11 and 12 illustrate two possible forms of construction for the widened portion of the heel and ball air pump tubes. In FIG. 11 the inserts **40** and **41** perform the same function as the inserts **24** and **27** described with respect to FIG. 2. FIG. 12 shows a modification similar to the modification illustrated in FIG. 3.

FIG. 13 illustrates a modification of the air pump which is adaptable for use in an insole.

A heart-shaped air pump **42** is formed with integral slits **43** in the base and apex of the cordate pump. The curving walls of the cordate pump at its base and apex coupled with the slits **43** define a finger valve similar to the finger valve discussed with respect to FIG. 6. The finger valves and their slits **43** are shown in cross-section in FIG. 16. Each valve is operable in one direction only; thus one valve is used as an intake valve while the other operates as an exhaust valve.

FIG. 14 is a cross-sectional view of the insole used in a regular shoe. In order to provide a source of fresh air, passageway **44** is connected from the air pump passageway **5** to the outside air.

The connecting passageway **44** may be located in the rear portion of the shoe or may be a separate passageway attached to the rear portion of the shoe by known means such as leather strippings **45** and **46** as indicated in FIGS. 14 and 15. Of course, this passageway may have a different cross-sectional shape than that indicated in FIG. 15. It is also possible to use a number of connecting passageways all terminating at the air pump passageway **5**.

Numerous modifications of the preferred embodiments of my invention will now be apparent to those skilled in the art and therefore, it is not intended to confine the invention to the precise forms shown herein, but rather to limit it in scope to the appended claims.

Having thus described and disclosed preferred embodiments of my invention, what I claim as new and desire to secured by Letters Patent of the United States is:

1. In a shoe, insole ventilating means comprising: an insole, means providing a pump in said insole having a cordate configuration in plan view and side elevation with a sharply curved base and an apex whose inwardly curving walls define slits which form air inlet and exhaust valves, respectively, for a compressible and expandable chamber in said pump, said sharply curved base being positioned in the heel portion of said insole for alternate compression and expansion by the heel of the wearer of the shoe while walking; and means providing a passageway in said insole fluidly connected at one end to said exhaust valve and terminating at the other end in vents located in the upper surface of the toe portion of said insole.

2. In a shoe, insole ventilating means comprising: an insole, means providing a pump in said insole having a cordate configuration in plan view and side elevation with a sharply curved base and an apex whose inwardly curving walls define slits which form air inlet and exhaust valves, respectively, for a compressible and expandable chamber in said pump, said sharply curved base being positioned in the heel portion of said insole for alternate compression and expansion by the heel of the wearer of the shoe while walking; and means providing a passageway in said insole fluidly connected at one end to said exhaust valve and terminating at the other end in means

forming a multiplicity of perforated passageways located in the upper surface of the toe portion of said insole and in means forming a perforated passageway disposed within the upper surface of the shank and heel portions of said insole along the periphery thereof.

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JORDAN FRANKLIN, *Primary Examiner.*