Oct. 30, 1962 RYOJI OKUYAMA 3,060,599

VENTILATED RUBBER SHOE

Filed Oct. 14, 1960 2 Sheets-Sheet 1

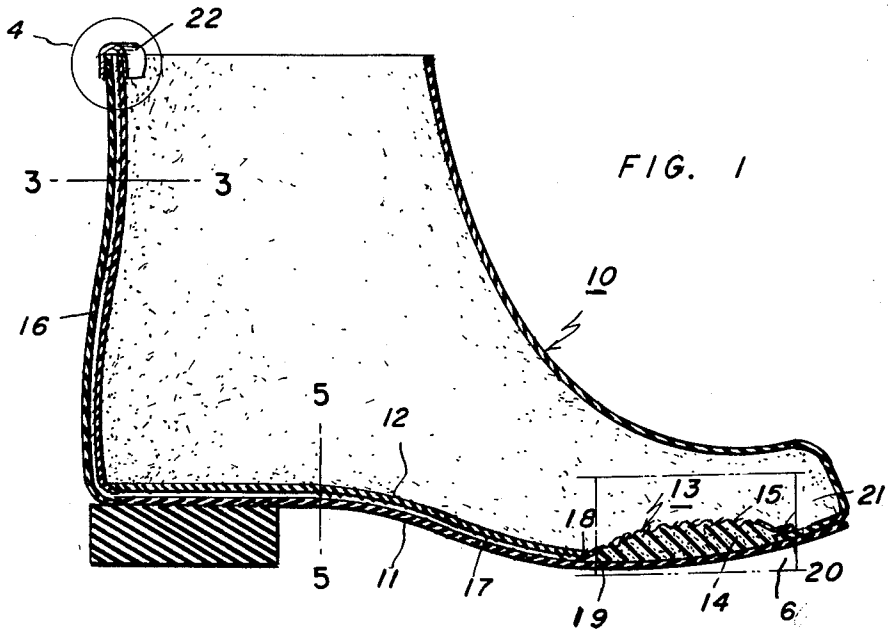
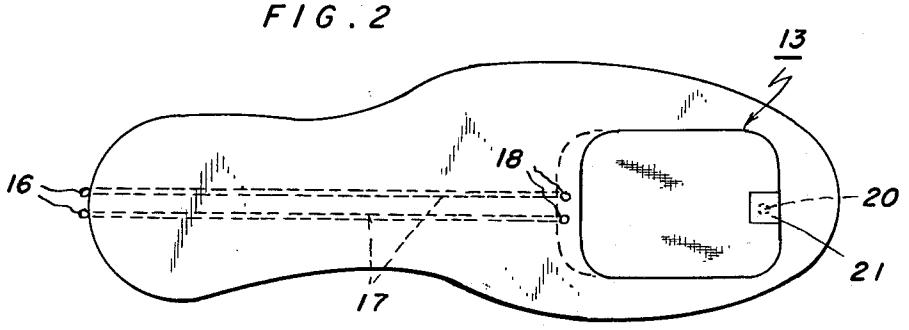


FIG. 1

FIG. 2



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FIG. 3

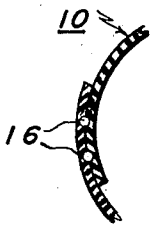


FIG. 4

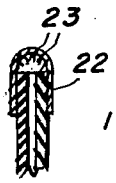


FIG. 6

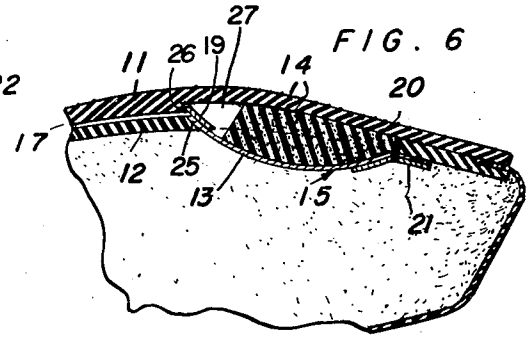


FIG. 5

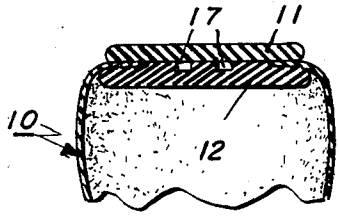


FIG. 7

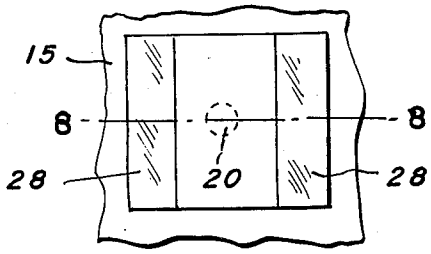


FIG 8

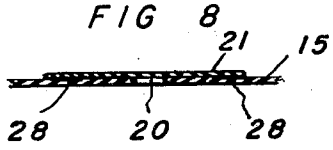
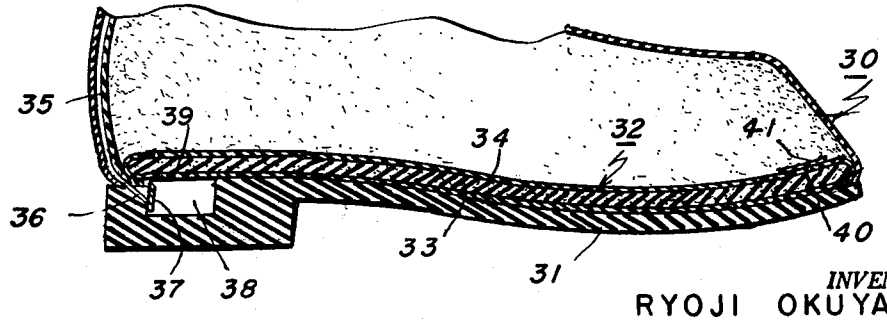


FIG. 9



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VENTILATED RUBBER SHOE

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Filed Oct. 14, 1960, Ser. No. 62,723
1 Claim. (Cl. 36—3)

This invention relates to a new rubber shoe and has as its primary object to provide a rubber shoe which will be comfortable at all times, that is, during both hot and cold weather. To this end the invention utilizes the pressure of the foot in walking to force fresh air into the shoe to replace the air therein thus keeping it pure by driving out the stale air and its contained moisture. The shoe therefore feels cool in summer and warm in winter for the close moist air which would otherwise be present contributes both to the sensation of uncomfortable warmth in summer and the chillness in winter.

To the attainment of these and other objects and ends, the invention contemplates the provision of an air chamber in the sole of the shoe into which air is drawn from the atmosphere and from which air is forced into the interior of the shoe as the wearer alternately lifts his foot and lowers it in walking. Preferably, the air chamber is filled with sponge rubber or equivalent resilient material having numerous interconnected air cells and at least one wall of the chamber is formed of a thin membrane of elastic gum.

The thin membrane constitutes at least a part of the upper surface of the sole or insole of the shoe thus defining a chamber having a resilient, collapsible wall. The air chamber is provided with a valved inlet opening and an air intake passage extends from the inlet opening to the top edge of the upper. It is one of the features of this invention to form the portion of this air intake passage which traverses the upper in the seam in the back cover of the sole and heel. The air chamber is also provided with a valve controlled discharge opening which opens into the interior of the shoe preferably in the region of the toe, to insure thorough ventilation of all parts of the shoe as the forced air moves back from this region to escape about the ankle.

The aforementioned and other objects and features of the invention will be made fully apparent to those skilled in the art from a consideration of the following detailed description taken in conjunction with the accompanying drawings in which:

FIG. 1 shows a longitudinal section through a shoe embodying a preferred form of the invention.

FIG. 2 shows a top plan view of the sole of the shoe shown in FIG. 1.

FIG. 3 is a fragmentary section taken on the line 3—3 of FIG. 1.

FIG. 4 is a detail showing on an enlarged scale the circled portion 4 of FIG. 1.

FIG. 5 shows a section on the line 5—5 of FIG. 1 being on an enlarged scale and inverted for convenience in explanation.

FIG. 6 is a detail on an enlarged scale and inverted of the enclosed portion 6 of FIG. 1.

FIG. 7 shows on an enlarged scale a plan view of a valve used in the present invention.

FIG. 8 is a section taken on the line 8—8 of FIG. 7.

FIG. 9 shows a longitudinal section through a portion of a shoe embodying a modified form of the invention.

In the drawings, reference numeral 10 indicates generally the upper of a rubber shoe having a sole 11 and an insole 12. An air chamber 13, which comprises a body of sponge rubber 14 and a covering membrane 15 is set in the fore part of the sole in a position to be engaged by that portion of the foot anterior to the arch so that it receives the weight of the wearer at each step in walking. Air is supplied to the chamber 13 by way of air intake passages 16 which are positioned in the seam of the outer cover at the back of the ankle and heel of the shoe. These passages extend downwardly from the top edge of the cover to connect with passages 17 formed between the sole 11 and the insole 12. The passages 17 lead to inlet orifice 18 provided in the membrane 15. These orifices are normally closed by a valve 19 which opens in response to the suction within chamber but which closes in response to pressure within the chamber to prevent a reverse flow of air through the passages 17 and 16. A discharge orifice 20 is provided in the membrane 15 at the forward end of the chamber 13 which orifice is controlled by a discharge valve 21 arranged to permit the discharge of fresh air from the chamber into the interior of the shoe and to prevent the reverse flow of air from the shoe to the chamber. It will be evident that whenever the air chamber 13 is pressed the air contained in the sponge rubber within the chamber is forced through the outlet orifice 20 into the toe part of the shoe, and that as the pressure is relieved, the air chamber expands due to the elasticity of the sponge rubber 14, thereby sucking in fresh outer air through the passages 16 and 17. The valves 19 and 21 prevent the reverse flow of air regardless of the manner in which pressure is applied to the membrane. It will be understood that the valves 19 and 21 could be omitted since in the normal movement of walking, the right and left feet alternately come up and down each foot stepping down on the ground, touching it with the heel and then with the toe. In this normal walking movement the sole is pressed down from the heel to the toe and the air in the air chamber 13 is naturally pressed out toward the outlet orifice 20, the inlet orifice 18 (FIG. 1) being more or less obstructed at this time. As the rolling action of the foot is completed, the pressure is applied in the area of the discharge or outlet orifice thus tending to obstruct air flow back through this orifice while the pressure to the rear of the air chamber is relieved thus tending to draw air through the inlet orifice. Thus a portion of the objects of invention may be attained by resort to the valves 19 and 21. However, it is preferred to use these in order to assure that there will be no reverse flow of air under any condition and in view of the ease with which such valves may be supplied, as will hereinafter be set forth, this added assurance is well worth the slight additional expense.

In the manufacture of the shoe so far described, the air intake passages 16 may be easily formed in the usual seam at the rear of the upper, in the position shown in FIG. 3, by inserting vulcanized elastics coated with materials which prevent sticking in the seam between the overlapped edges of the outer cover before the vulcanization of the shoe and thereafter pulling them out. The upper ends of the air intake passages are thus positioned at the

top of the shoe where there is little chance that moisture or dirt may be drawn in. This favorable positioning of the air intake is further enhanced by the provision of a cover **22** over the upper ends of the passages **16**. The cover is in the form of an inverted U. The legs of the U being fixed to the inner and outer sides of the seam and the middle or curved part forming a semicircular shield over the upper ends of the passages **16**. As seen in FIG. 4 the curved portion of the cover is provided with inwardly projecting bristles **23** so that air may pass through the central portion of the curved part to the intake passages **16** while the entrance of dirt or water is inhibited. In view of this protection there is little likelihood that either of the passages **16** may become clogged, however the provision of two passages **16** assures a supply of air to the chamber **13** even if one of the passages should become obstructed.

The passages **16** lead to the passages **17** in the sole of the shoe. These passages are easily provided by forming grooves in the underside of the insole **12**. In manufacturing, the insole is placed upside down as shown in FIG. 5 so that the underside thereof having the previously formed grooves faces upwardly. The sole **11** is laid on the insole with the edges of the upper **10** inserted on all sides between them, care being taken that the passages **16** register with the passages **17**.

The air chamber **13** is formed by providing a rectangular hole in the forward part of the insole **12**. The rear side of this hole is formed of a slanting cut **25** and the membrane **15** is cemented or otherwise secured to the surface of the slant and to the other sides of the hole in a manner to fully close the same. The membrane **15** is of thin gum rubber or similar flexible, impervious sheet material, and capable of being readily expanded by the body of sponge rubber **14**. The sole **11** is also provided with a slanting cut **26** registering with and continuing the slanting surface provided by the cut **25** so that when the two soles are joined together a single slanting surface is provided within which lies the inlet orifice **18**. The body of foam rubber does not extend into the area adjacent the inlet so that a free space **27** is provided in this portion of the chamber permitting the valve **19** to open without obstruction. It will be seen that when the sole **11** is cemented or similarly secured to the insole, the closure of the air chamber **13** and of the passages **17** becomes complete so that an air tight structure is provided save for the intended inlet and discharge outlets.

The inlet and discharge valves **19** and **21** are simple and inexpensive in construction yet effective in operation. This construction is illustrated in detail in FIGS. 7 and 8, and it will be understood that though the valve there shown is applied to the discharge orifice **20** the same structure may constitute the intake valve. The valve **21** consists of a small square or rectangular piece of thin elastic sheet material, such as latex or gum rubber, and which is positioned over the orifice **20** being secured to the membrane **15** along two opposite edges as indicated by the shaded areas **28**. Preferably, the small square of gum has a thickness of less than 0.1 millimeter. When air is forced through the orifice **20**, the valve being very thin, expands and is raised up. Thus the air can escape from the unstuck sides, while the valve completely prevents the flow of air in the reverse direction.

The shoe described so far in conjunction with FIGS. 1–8 ilustrates a practical instance in which an air chamber is set in the front part of the sole. It will be understood that the air chamber may be otherwise positioned, or that the entire insole may constitute such a chamber. Such a construction is illustrated in FIG. 9 in which an upper, indicated generally at **30**, is provided with a sole **31** and an insole **32**. The insole **32** consists of a body of sponge rubber **33**, or equivalent material having an air-tight covering **34** of imperforate sheet material. The covering **34** is preferably made with comparatively thick rubber plates for the upper and lower surfaces thereof

and the sides with thin elastic membrane so that the insole may expand up and down but be relatively stiff, or resistant to deformations within its surface area. The body of sponge rubber **33** maintains the insole **32** in an expanded state in the absence of pressure thereon and thus constitutes a collapsible and expansible air chamber. Air is supplied to this chamber by way of air intake passages **35** which correspond to the inlet passages **16** in the previously described form and which are protected in the same way. The passages **35** extend by way of passage **36** in the heel and valve **37** to a chamber **38** which is in continuous communication with the interior of the sole by way of an opening **39**. A discharge opening **40** having a valve **41** is provided in toe portion of the insole to permit the discharge of air from the chamber defined by the sole to the interior of the shoe. The valve **41** is structurally the same as that previously described in conjunction with FIGS. 7 and 8. The same may be said for the valve **37** save for the fact that it is applied to a relatively rigid base material rather than sheet material. The operation of the form of the invention disclosed in conjunction with FIG. 9 will be apparent from that of the form previously described.

It will be apparent that, with slight modifications, the form of the invention disclosed in conjunction with FIG. 9 may be applied to ordinary ready-made shoes and that it may be manufactured and sold as a separate insole for use in such shoes. In such case, the intake passage **35** could take the form of a fine rubber tube directly connected with the interior of the insole by way of a suitable valve, for example a valve positioned within the air chamber defined by the insole in the manner analogous to that disclosed in FIG. 6.

From the preceding description, it will be evident that when the ventilated rubber shoe of this invention is used, outer fresh air is supplied at each step to the interior of the shoe in the region of the toe, and the air in the shoe is constantly refreshed and kept clean. When ordinary rubber shoes are worn for a long time during even moderately warm weather, the feet feel sweltery due to the fact that the air in the limited space between the foot and the cover soon becomes saturated with moisture since rubber lacks porosity and the power to absorb. Heat is not dissipated and the resulting unwholesome condition in the shoe tends to promote water eczema and other skin diseases. In the winter such shoes are likewise uncomfortable since the moisture saturated air is soon chilled and causes a cold, moist feeling in the foot. The present invention obviates all of the disadvantages of such shoes that are due to the lack of porosity or permeability while retaining the obvious advantages of excluding the external moisture.

It will, of course, be understood that various changes may be made in the form, detail, arrangements and proportions of the various parts throughout the views without departing from the scope of my invention.

It will thus be seen that there is provided a shoe in which the several objects of this invention are achieved, and which is well adapted to meet the conditions of practical use.

As various possible embodiments might be made of the above invention, and as various changes might be made in the embodiments above set forth, it is to be understood that all matter herein set forth or shown in the accompanying drawing is to be interpreted as illustrative and not in a limiting sense.

I claim:

A ventilated rubber shoe including an upper and a sole, an inner sole comprising a flat body of porous elastic material covered by thin sheet material thereby providing an air-tight chamber normally maintained in its expanded condition by said porous elastic material, means to supply air to said chamber from a point adjacent the top edge of said upper at the heel portion of said shoe, said means including an inlet passage formed in a seam

of said upper, a heel having an air inlet chamber therein connected with said inlet passage, an inlet valve in said inlet chamber controlling the admission of air from said inlet passage, said thin sheet material of said insole having an opening communicating with said inlet chamber, said insole constituting an upper wall of said inlet chamber and closing the same except for the outlet provided by said opening in said thin sheet material of said insole, said thin sheet material of said insole having a discharge opening in the upper surface thereof adjacent the forward end thereof, and a valve controlling said discharge opening.

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