

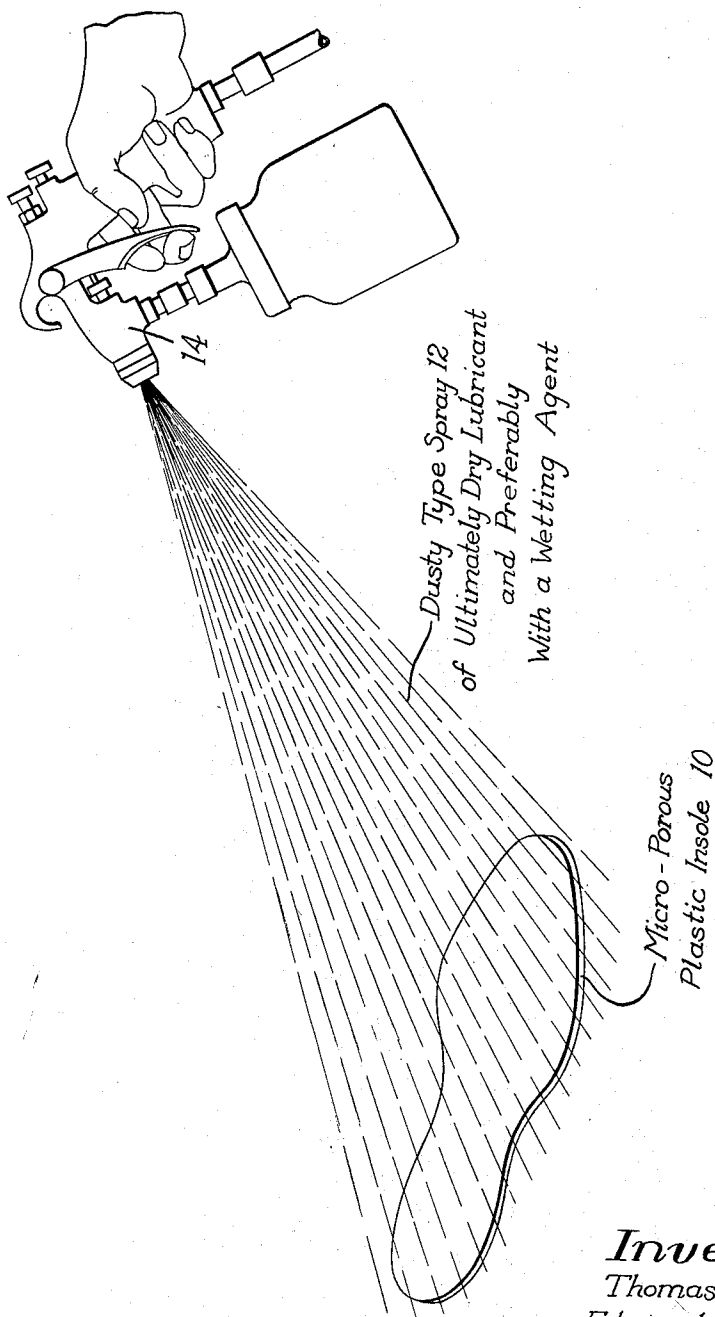
Jan. 25, 1955

T. C. MORRIS ET AL

2,700,625

MICROPOROUS, SHEET MATERIAL AND INSOLES FOR FOOTWEAR

Filed May 23, 1951



Inventors
Thomas C. Morris
Edmond A. Chandler
By their Attorney
Thomas H. Ryan.

MICROPOROUS SHEET MATERIAL AND INSOLES FOR FOOTWEAR

Thomas C. Morris, Lexington, and Edmond A. Chandler, Somerville, Mass., assignors to B. B. Chemical Co., Boston, Mass., a corporation of Massachusetts

Application May 23, 1951, Serial No. 227,904

5 Claims. (Cl. 117-104)

This invention relates to sheet material and insoles made therefrom for use in footwear, and more particularly to microporous plastic insoles and insole-material sheets especially suited to enhance foot comfort.

A number of moisture- and air-impervious materials have been substituted for leather in the manufacture of shoes but such materials by reason of their low rate of water vapor transmission or transpiration have been found to cause discomfort and unhygienic conditions. Leather has been universally approved as an excellent material for footwear as it possesses characteristics which contribute to good hygiene, health and comfort. These characteristics are dependent principally upon the ability of leather to permit air and water or moisture to pass through it. Leather, however, despite its well accepted and broad use, does have disadvantages such as its susceptibility to fungus growth and general deterioration especially in the continued presence of foot perspiration with its salts and organic materials. Leather insoles in particular are subject to these disadvantages since, each in the finished shoe, serves as a reservoir for the absorption of perspiration. The ideal insole, accordingly, should not only serve as a satisfactory and reliable foundation upon which to build a shoe, but should be one which is at least equal to or better than leather in so far as moisture and air-permeability is concerned and also preferably superior to leather in its ability to resist deterioration during wear. Such an insole should be at least as flexible as leather, be softer than leather and yet adequately support the foot throughout the life of the shoe, must absorb perspiration, keep the foot relatively dry, and lose moisture by transpiration at a rate preferably greater than in the case of leather. It should be possible to prevent dermatitis by using an insole which tends to remain sanitary despite adverse conditions.

Synthetic, resinous, polymeric materials have been made which, when properly sintered in particle form into sheets, have been used as insole materials with considerable success. Such insoles satisfy the requirements set forth above as those of an insole more nearly approaching the ideal. A material of this nature is disclosed in United States Letters Patent No. 2,371,868, granted March 20, 1945, to Berg and Doriat. While the sintered plastic form of insole has been found generally satisfactory, it has sometimes proven to be uncomfortable in one respect, particularly during the initial wear or breaking-in period. This initial lack of comfort has been found to be due to the tendency of the plastic insole to adhere or stick to any contacting surface such, for example, as the surface of a sock on the foot of the wearer of the shoe. This characteristic of the insole has been termed "stiction," and its effect is to cause the sock to cleave to the plastic insole when the foot of the wearer is first inserted into the shoe, thus preventing or retarding relative motion between the sock and the insole. To overcome this, the wearer must make a noticeable effort completely to insert his foot into the shoe. This condition may bring about a pressure on the toes of the wearer because of the tension placed on the sock. In walking, relative motion may take place between the sole of the foot and the sock instead of between the sock and the insole and to some wearers this condition is most objectionable. This stiction effect gradually disappears as the shoe is worn but the first impressions formed conceivably may be so strong as to cause a prospective wearer to forego the advantages he

ultimately would secure from the use of porous insoles. The gradual disappearance of stiction is probably due to the exudation of oils from the foot to the insole in the exact quantity required. At first glance it would appear that a mere application of powdered talc, of an oil or of wax or some resin as an ingredient in the composition or as a coating, may be an obvious solution to the problem of stiction but this has not been the case. Either the stiction problem remains or the porosity and transpiration problems were accentuated in work heretofore carried out along this line—i. e.—the general application of the talc, oil, wax or resin would defeat the purpose for which a porous insole is used as a substitute for a leather insole.

Applicant has now found that an improved insole with a main body of synthetic, resinous, polymeric material can be made which will not only avoid the difficulties above referred to but will increase the advantages of the polymeric material in so far as its use in insoles for footwear is concerned. As herein illustrated, the insole or sheet material from which the insole may be cut, comprises a main body of microporous, resinous, polymeric material with an extremely small amount of a permeable adherent coating of a lubricant which is dry at body temperature and does not clog the capillary channels or pores and yet is effective in preventing stiction. Preferably, but not necessarily, a dispersing agent with a dual function is employed as a constituent in the surface coating, the second function being to enhance the moisture absorptive and transpiration ability of the porous plastic insole.

It is an object of this invention to provide an improved microporous insole, or sheet from which the insole may be made, of synthetic, resinous, polymeric material the surface of which exhibits advantageous characteristics for the advancement of foot comfort not heretofore realized.

To this end and with the above object in view, the invention will now be described in detail in connection with the accompanying drawing and will be pointed out in the claims.

In practicing the invention, an integral sheet or insole is first provided or is formed by sintering fine particles of resinous, polymeric material together into a unitary body having open capillary channels substantially determined in number and size by the size of the particles and then providing a lubricative surface on the sheet or insole while maintaining permeability. One way of producing such a main body of an insole is disclosed in the United States Letters Patent No. 2,371,868 above referred to. Another method for securing the initial main body (two different formulations) is included in the following description.

In the drawing, a main body of a microporous plastic insole 10 as above mentioned, is positioned so that a spray 12 of an aqueous wax emulsion or the equivalent preferably containing a dispersing and wetting agent may be directed against one side thereof by the use of a spray gun 14. Care is taken not to apply a full or complete liquid coating to the insole for if such a coating is built up it will be absorbed into the main body of the plastic sheet and interfere with the porosity as well as the transpiration ability of the insole. In order correctly to treat only the surface of the insole, where treatment is needed, the spray nozzle of the gun 14 is held some distance from the insole (about 14 to 18 inches) so that the spray material impinges upon the insole more in the nature of a dust than as a liquid. The wax emulsion or its equivalent must not be permitted to penetrate and fill the capillary channels at the insole surface. It is to be understood that the sprayed coating is so light that it is not possible to depict it in a drawing.

In practice it has been found expedient and advantageous to apply the dusty type spray by making repeated passes of the spray—i. e.—to move the spray gun back and forth several, and preferably, five to seven times. A De Vilbiss type CH spray gun equipped with G fittings and using 50 p. s. i. air pressure has been found satisfactory.

A spray material which is suitable is an aqueous carnauba wax emulsion containing 1½ lbs. of wax per gallon

dispersed with the aid of a wetting or dispersing agent in the form of pure Castile soap. Carnauba wax is especially chosen as it is a hard, dry and slippery material. Castile soap is selected as a preferred wetting or dispersing agent because it is substantially non-irritating to the skin and because it aids in promoting moisture take-up properties at the surface of the insole material.

One spray solution which has been found satisfactory is as follows:

1.5 lbs. #1 Carnauba wax
4.0 oz. Castile soap
1.0 pt. of water in which wax and soap are dispersed with heat
Water added to constitute one gallon

Another example of a spray:

2.0 lbs. shellac
3.0 qts. water
8.0 oz. borax
These are heated into a solution to which water is added to form one gallon

A third example of a suitable spray solution:

.75 lb. of casein
3.0 qts. water
Let stand for ½ hr., add—
2.0 fluid oz. of ammonia
Heat to 180° F. and agitate into solution
Add water to form one gallon

An example of a plastic composition which is suitable for the main body of the insole (prior to spraying in accordance with the present invention) is as follows:

Ingredients:	Parts by weight
VVNY	125
Methox	15
Hycar OR-15 (powder)	03.75
Calcium stearate	2.5
VIN	3.75

The VVNY is a copolymer of vinyl chloride and vinyl acetate.

The Hycar OR-15 is an oil resistant copolymer of butadiene and acrylonitrile.

Methox is di-methoxy ethyl phthalate—a plasticizer. The VIN is a resin stabilizer. It is a strontium compound in a ketone solution.

These ingredients are milled hot (about 135° C.) on a rubber mill and formed into a sheet.

The sheet is then chopped into small strips.

The strips are then chilled in Dry Ice for about five minutes after which they are chopped into pieces about 1/16 of an inch across and further ground or chopped into a fine powder (about 40 mesh).

The fine powder is then placed as a uniform layer (.25 inch depth) in a mold and is thoroughly heated to a temperature of 174° C. at which temperature a light pressure is applied to reduce the thickness to .110 inch.

The resultant sintered layer is cooled and removed from the mold as an integral sheet material for insoles, the sheet being highly porous and of suitable strength for the purpose contemplated.

A porous plastic insole with a main body made and composed as stated above constitutes an excellent insole which is purposely made somewhat stiff for some types of shoes but, as heretofore stated, it meets with objections from some wearers because of the stiction characteristics—but when that insole has been sprayed with a wax emulsion in accordance with the present invention the stiction effect is no longer present.

An additional formulation for a main body of a more flexible insole is as follows:

Ingredients:	Parts by weight
VVNY	65.49
Methox	16.32
Santicizer #141	16.32
Titanox A-M. O.	0.58
Cadmium Red	0.61
Chromium Green	0.30
Chrome Orange	0.16
Tween #20	0.22
	100.00

The Santicizer #141 is a plasticizer. It is an alkyl-aryl phosphate in the form of a colorless liquid.

The Titanox A-M. O. is a titanium dioxide pigment.

The Tween #20 is a wetting agent. It is a polyoxy-alkylene derivative of sorbitan monolaurate and at 25° C. it takes the form of an oily liquid and is soluble in water.

The ingredients of the additional main body formulation given above are milled and reduced into a fine powder which is sintered into an integral micro-porous sheet. The surface of the sheet is provided with a permeable sprayed coating the main portion of which may be either wax, which is preferred, or an equivalent such as shellac, casein, blood serum or a suitable lacquer. Ouricury wax may be used and is suitable in an emulsion form. The wax or equivalent material deposited upon the porous sheet or insole, as heretofore stated, must be lightly applied in order to be permeable and it must be adherent to the plastic and comprise a lubricant which is dry at about body temperature (in the neighborhood of 98.6° F.).

Having described our invention, what we claim as new and desire to secure by Letters Patent of the United States is:

1. An insole of particles of polyvinyl resinous material plasticized with about 40 to 100% of its weight of a plasticizer, said particles being sintered into an integral layer with open capillary channels, and one side of said layer having a light surface coating in the nature of a dust, the particles of said dust being adherent to said sheet and comprising carnauba wax which layer is air permeable and lubricative.

2. Insole material in the form of particles of polyvinyl resinous material plasticized with about 40 to 100% of its weight of a plasticizer, said particles being sintered into an integral layer with open capillary channels, and one side of said layer having an air-permeable lubricating surface coating in the nature of a dust adherent to said layer and comprising carnauba wax and Castile soap.

3. Insole material in the form of particles comprising polyvinyl resinous material plasticized with about 40 to 100% of its weight of a plasticizer, said particles being sintered into an integral layer with open capillary channels, and one side of said layer having a discontinuous deposit of fine particles of a lubricant, all of said particles being adherent to the surface of said layer and being hard at body temperature, the number of said particles being insufficient materially to alter the air permeability of said insole material.

4. Insole material in the form of particles comprising polyvinyl resinous material plasticized with about 40 to 100% of its weight of a plasticizer, said particles being sintered into an integral layer with open capillary channels, and one side of said layer having a discontinuous deposit of fine particles of a lubricant comprising wax that is hard at body temperature, all of said particles being adherent to the surface of said layer, the number of said particles being insufficient materially to alter the air permeability of said insole material.

5. Insole material in the form of particles comprising polyvinyl resinous material plasticized with about 40 to 100% of its weight of a plasticizer, said particles being sintered into an integral layer with open capillary channels, and one side of said layer having a discontinuous deposit of fine particles of a lubricant comprising wax that is hard at body temperature and a wetting agent, all of said particles being adherent to the surface of said layer, the number of said particles being insufficient materially to alter the air permeability of said insole material.

References Cited in the file of this patent

UNITED STATES PATENTS

1,218,982	Clapp	Mar. 13, 1917
2,017,449	Thompson	Oct. 15, 1935
2,095,129	Drew	Oct. 5, 1937
2,371,868	Berg et al.	Mar. 20, 1945