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CONDUCTIVE FOOTWEAR AND METHOD OF FORMING THE SAME

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The present invention relates to a method of treating materials to render them electrically conductive.

More specifically, the invention relates to a method of treating materials such as leather, which is utilized in the manufacture of footwear such as shoes, shoe soles, shoe heels, inner soles for shoes, bottom filler material for shoes, shoe linings or liners, heel pads or liners and the like to render them electrically conductive.

The invention is also concerned with the specific materials by means of which such materials going into footwear are treated to render them conductive as well as to the conductive footwear and materials themselves.

Footwear which has been treated in accordance with the principles of the present invention is found to be effectively conductive so that static electrical charges are not readily gathered on the human body, yet such charges, if gathered, are practically instantaneously discharged through the shoe or other article of footwear to the supporting surface which constitutes an electrical ground or discharge body for the condenser action of the human body. Thus the invention will be found useful in treating footwear designed for use by surgeons, nurses and other attendants in the operating room where the fumes of ether or other combustible gases or vapors are apt to be present. The invention will also be of use in treating footwear designed for use in certain industrial trades such as in powder plants and other places where explosives are manufactured, as well as in gunnery turrets or powder magazines on board warships and in other places, where extreme caution is required to prevent accumulation and accidental discharge of static electrical charges from the human body or from the clothing worn thereon.

Conductive footwear other than that formed of rubber or rubber composition has previously been rendered conductive by the provision of metallic plugs or inserts which extend through the sole of the shoe and make simultaneous contact with the body and with the supporting surface. Footwear of this character is likewise possessed of certain limitations among which are the discomfort to the user and the danger of marring the supporting surface, the inability of such inserts to remain firmly anchored in the shoe, as well as the objectionable noise encountered when the shoes are in use. The principal objection to the use of such metallic inserts resides in the fact that by such means only a limited portion of the shoe is rendered conductive. Thus electrical contact between the foot and the ground is established only when the shoe is supported or maintained squarely on the supporting surface or at least is supported in such a manner that the particular metallic insert makes simultaneous contact both with the foot and the ground.

The present invention is designed to overcome the above noted limitations that are attendant upon the use of conductive footwear as heretofore constructed and toward this end the invention contemplates the provision of a method of treating ordinary leather or the like, exclusive of rubber, whereby it is rendered conductive for the purposes set forth above without resorting to the use of special conducting inserts, condensers, galvanic devices or the like. By such a method the entire shoe or other article of footwear is rendered conductive and efficient electrical contact will be made between the ground and the foot of the user regardless of the particular posture assumed by the user and regardless of his characteristic walk.

This being the principal object of the invention, another object thereof is to provide such a method of treating leather materials which, apart from rendering the materials conducting, will not chemically or physically modify the original properties of the materials such as their elasticity, softness, porosity, tractive properties, absorbent properties, color and appearance, ability to receive and retain a polish, etc.

Another object of the invention is to provide a method of rendering theh leather materials of a conducting nature which may be carried out inexpensively in a simple manner and which requires no complicated or time-consuming procedure, consisting as it does, of a few relatively simple treating steps leading to the completed product.

Yet another object of the invention is to provide a shoe which, although it is of a conducting nature, resembles in appearance the ordinary shoe and which, for all practical purposes may be treated as such.

Another object of the invention is to provide such a method which is lasting, i. e. which may be initially performed upon an ordinary shoe and which will outlast the life of the shoe without requiring further treatment of the shoe after a prolonged period of use.

A still further object of the invention is to provide a novel solution for treating leather which is extremely effective in its conductive effect upon the finished product yet which at the

same time has no deleterious effect upon the feet of the wearer of the shoe.

Other objects and advantages of the invention not at this time apparent will appear presently as the nature of the invention is better understood.

According to the present invention the leather materials which are to be rendered conductive are first subjected to a wetting process by means of which they are rendered receptive to a subsequent treatment wherein they are rendered electrically conductive. Materials such as leather, certain treated fabric materials and certain compositions are ordinarily of a water-repellant nature and are therefore, not readily receptive to treatment with aqueous solutions such as are employed herein during the treatment for electrical conductivity. For this reason, it is necessary to first subject these materials to a wetting process as will appear presently.

Specifically, in the treatment of leather, the leather is first submerged in an aqueous solution of an ester of an aliphatic sulphodicarboxylic acid and allowed to remain in this solution for a period of at least three hours and preferably longer. The nature of the specific solution employed may vary considerably but it has been found that certain esters of an aliphatic dibasic acid such as maleic and/or fumaric acid which is at present sold commercially under the trade-mark name "Aerosol" is admirably adapted for use as a wetting agent when mixed in the proportion of about eight ounces of the chemical Aerosol to one gallon of water, the solution being formed in the hot state.

In thus mixing the wetting solution, any residue which occurs may be dissolved in the solution by the addition of about one pint of methyl or ethyl alcohol and prolonged heating.

The leather is placed in the solution preferably while the latter is hot and allowed to soak in the hot solution for at least three hours, although the longer the period, the more effective will be the treatment. Although it is preferable to maintain the solution heated, it is not essential to do so, and the leather may be treated at room temperatures, if desired. During the treatment of the leather in this manner the solution is covered to prevent escape of volatile or other constituents. Where heating is resorted to it is preferable that the temperature of the bath be maintained at about 130° F. for the duration of the treatment.

After removal of the leather from the wetting solution, it is allowed to dry or at least to become partially dry. Normal drying in a dehumidified atmosphere is preferable but if desired, the drying operation may be facilitated by the application of heated air or the like.

The final treatment of the leather which has been rendered receptive to aqueous solutions by the above outlined wetting process, consists in submerging the leather in a solution which will impart to it conductive characteristics. This solution may consist of a mixture of the chlorides of lithium, calcium and sodium in the proportions of 3:1:1 respectively, dissolved in water. 1½ pounds of the lithium chloride may be dissolved in water and the calcium and sodium chlorides added in amounts of one-half pound each, sufficient to bring the total solution content up to one gallon. The leather is allowed to remain in this solution for at least three hours after which it may be removed and allowed to dry or may be forcibly dried.

The above described conductive solution may be maintained heated during the treatment, or treatment may take place at room temperatures as desired.

Leather for shoes or shoes themselves which have been treated as outlined above will be found to have admirable conducting qualities and will be well adapted for use in operating relays, power plants and the like as set forth previously.

Specifically it has been found that a shoe of ordinary design produced from material which have been treated as outlined above will have a definite conducting capacity which may be measured through any portion of the shoe from the inside to the outside thereof. Ordinarily for a shoe having a complete bottom sole of average thickness, measurements made by means of an ohmmeter employing test prods will measure a resistance somewhere in the neighborhood of 250,000 ohms when the test prods are placed firmly against the sole opposite each other from the inside to the outside thereof.

The invention is not to be limited to the exact method herein set forth or to the specific materials or solutions employed in carrying out the method as various changes in the method are contemplated as well as are variations in the ingredients employed in making up the conductive solution above referred to. Only insofar as the invention has particularly been pointed out in the accompanying claims is the same to be limited.

What is claimed is:

1. The method of treating leather materials to render the same conducting which comprises applying a wetting agent thereto and thereafter submerging the materials in an aqueous solution of lithium, calcium and sodium chlorides in the proportion of substantially three parts of the lithium chlorides and one part each of the other chlorides, while maintaining the solution at a temperature of approximately 130° F.

2. A conductive shoe including a sole portion, said sole portion being formed of leather impregnated with lithium, calcium, and sodium chlorides, the proportion of said chlorides present in the leather being substantially 3:1:1.

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