March 4, 1947. P. J. WENTWORTH 2,416,888

METHOD OF MANUFACTURING SHOE SOLES AND THE LIKE

Filed Nov. 2, 1942

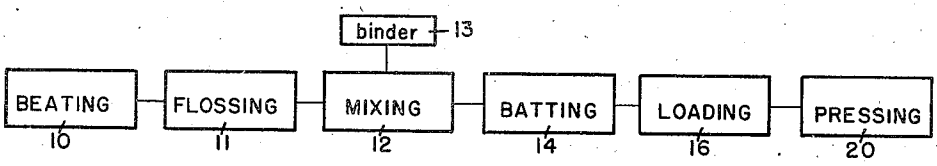


FIG. 1

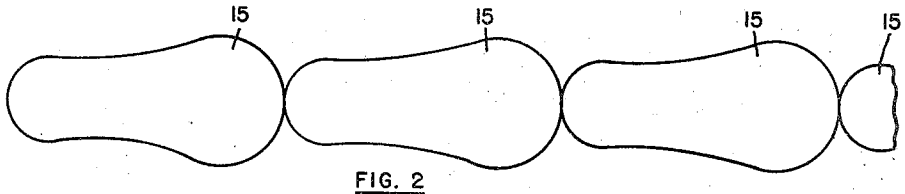


FIG. 2

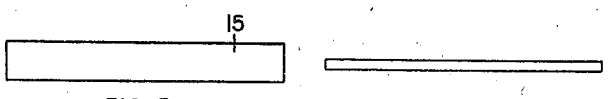


FIG. 3

FIG. 4

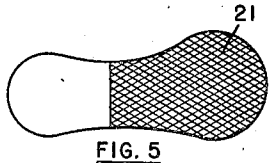


FIG. 5

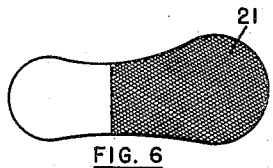


FIG. 6

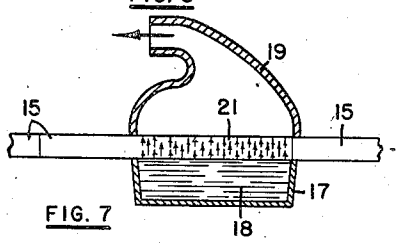


FIG. 7

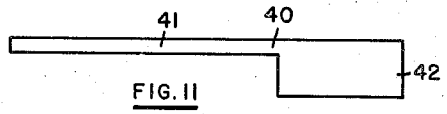


FIG. 11

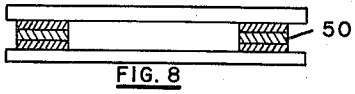


FIG. 8

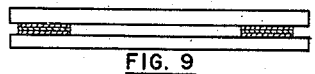


FIG. 9

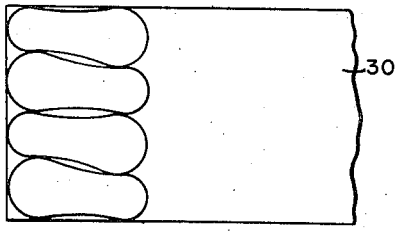


FIG. 10

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METHOD OF MANUFACTURING SHOE SOLES AND THE LIKE

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2 Claims. (Cl. 18—47.5)

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This invention relates to a new method of manufacturing shoe soles and the like.

An object of the present invention is to provide a new method of producing a shoe sole which may, by way of example, be used as a substitute for leather, which has the appearance of leather, but which is less expensive, lighter in weight and far more durable than the best leather of corresponding thickness.

Another object of the invention is to provide a method of treating leather substitute so that it is not adversely affected by moisture, and will not dry out or crack with the passing of time.

A further object of the invention is to provide a new method of treating a leather substitute so that it may be fabricated from inexpensive, readily obtainable, non-critical raw materials.

Still a further object of the invention is to provide a method whereby leather substitute may be loaded or impregnated with predetermined quantities of wear materials for controlling the wearing characteristics of the product.

Another object of the invention is to provide a treatment for leather substitute whereby it may be fabricated in any desired thickness.

These and other objects are attained by the means described herein, and disclosed in the accompanying drawings, in which:

Fig. 1 is a diagrammatic view illustrating the sequence of steps followed in practicing the invention.

Fig. 2 is a plan view of a series of interconnected sole batts as they leave the batting machine 14 of Fig. 1.

Fig. 3 is a side view of a sole batt of Fig. 2.

Fig. 4 is a side view of the sole batt of Fig. 3 on leaving the press 20 of Fig. 1.

Fig. 5 is a top plan view of a completed sole of the present invention wherein the outsole has been loaded and filled with a wear material.

Fig. 6 is a view similar to Fig. 5 wherein the outsole has been loaded with a greater quantity of wear material than the outsole of Fig. 5.

Fig. 7 is a view, partly in vertical section, of a device for impregnating the sole batt of Figs. 2 and 3 with a so-called wear material.

Fig. 8 is an end view, partly in vertical section, of a sole batt in a template of compressible material, such as cardboard, or the like.

Fig. 9 is a view similar to Fig. 8 wherein the sole batt and template have been subjected to the squeezing pressure of a pressure press.

Fig. 10 is a top plan view of a sheet of leather substitute material of the instant invention, from which four soles have been cut in a manner similar to that used in cutting soles from real leather.

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Fig. 11 is a side view of a composite outer sole made of the material of the instant invention, wherein the sole portion and heel portions are integrally formed.

In practicing the invention, a floss is prepared from the dry fibers of one or more substances such as horse weed, reclaimed leather, leather board heel scrap, paper board heel scrap, wood pulp, cloth-base paper pulp, cotton linters, or any other substances the fibers of which will not dissolve or disintegrate when subjected to moisture. These various substances may be readily reduced, while in a dry state, to short fibers by means of beating in a suitable machine, such as by way of example, a Stedman, or the like, denoted generally by the numeral 10. The prime requisite of the beating machine is to reduce the substances, while dry, to individual short fibers which are as long as possible yet too short to card.

The short fibers thus produced are dry and may be stored indefinitely, or they may be fed directly to flossing machine 11, in which the short fibers are pneumatically collected, gathered, and lightly compacted into a light fluffy mass hereinafter referred to as floss. In some instances, it may be desirable to feed the short dry fibers from two or more substances into the flossing machine for providing a floss through which the various types of fibers are uniformly distributed.

The floss may be stored for future use or it may be transferred or fed directly to mixing machine 12 in which it is thoroughly mixed with a suitable binder consisting of one or more of such substances as cellulose nitrate, rubber (para) cement, reclaimed rubber cement, para rubber cement with Kumar gum, shellac, rosin, pitch, and the like until the resultant mass acquires a putty-like consistency. If desired, the binder material may be conveniently stored in a container 13 from which it may be fed by gravity, or otherwise, into mixing machine 12. The mixing operation should continue until each fiber of the floss is individually coated with binder material whereupon the resultant mass will acquire a soft, pliable, spreadable, putty-like texture. The quantity of binder material added to the floss, depends upon the particular type of binder material, or mixture of binder materials being used, the required quantity being just sufficient to convert the floss into a putty-like mass, hereinafter referred to as batter. The batter may be removed from mixing machine 12 and hermetically sealed in containers for future use, or it may be fed directly into a

batt forming machine 14 which includes suitable means for depositing or otherwise shaping the batter into a series of interconnected sole batts 15, see Fig. 2, or the batt machine may deposit the batter in a large sheet 30 (Fig. 10) of uniform thickness. The thickness of the batts thus formed will be determined by the ultimate use to which the product formed from such batts will be put, however, by way of example, if it be assumed that the finished product is to be a seven iron sole, then batt 15 may be approximately seven-eights of an inch in thickness. The batts thus formed will be moist by reason of the volatile ingredients of the binder, wherefore it is desirable that such batts be set aside in order that the volatile solvents of the binder may evaporate therefrom. If desired the volatile ingredients may be permitted to evaporate into the atmosphere, or the batts may be caused to pass through a suitable drying device, not illustrated, for accelerating the evaporation of the volatile ingredients. After the volatile ingredients have thus been dissipated, the resultant dry batt is characterized by its lightness in weight and sponginess of texture. Such dry batts may be stored for months at a time or they may be compressed at once into a tough, dense, pliant leather-like substance. The amount by which a dry batt is reduced in thickness incident to compression determines the density and other physical characteristics of the resultant product, wherefore it is obvious that if the dry batt of Fig. 3 be compressed to the thickness of a seven iron sole, the density of such a sole will be less than the density of a five iron sole compressed from the same batt.

Experiment has conclusively indicated that once the batt has been compressed into a leather-like substance of a given thickness, said batt may thereafter be subjected to further compression for increasing its density and reducing the substance to lesser thickness, without adversely affecting the physical characteristics of the substance.

In those instances where it is desirable to dye or otherwise color the sole material, suitable coloring may be added directly to the batter while it is being mixed in mixing machine 12. In this manner the coloring material will be thoroughly and evenly distributed throughout the batter, the batt, and the leather-like substance formed therefrom.

The leather-like substance thus produced may be dyed, cut, tacked, stitched or channeled as easily and sucessfully as the best grade of cow leather. The leather-like substance is far superior to the best grade of cow leather in that it can be made of uniform thickness and uniform density, and in addition thereto it will not deteriorate or be otherwise adversely affected by moisture, nor will it crack or lose its inherent flexibility with the passing of time. The leather-like substance may be permanently attached to the slip sole of a shoe by means of glue thereby permitting the fabrication of shoes having soles and heels which are attached without nails or stitching, thereby providing a shoe ideally adapted for use in powder plants, and the like, wherein the danger from sparks and static electricity is ever present. Unlike leather, and other leather substitutes, the present product when attached to a shoe by means of gluing does not lose its inherent flexibility, wherefore the sole will not crack or become separated from the shoe incident to hard use.

If desired, the dry batts may be impregnated or loaded with a so-called wear material which will decrease the porosity of the batt and increase its density, whereby the density of the final product formed by compressing the impregnated batt will be greater than the density of an unimpregnated batt of the same thickness. Impregnation may be accomplished in a loading or impregnating device 16 in the manner disclosed in Fig. 7 wherein the numeral 17 denotes a container for wear material 18 in liquid form. The wear material 18 may comprise one or more of the following substances, coal tar pitch, Burgundy pitch, nigre gum, rosin, Kumar gum, shellac, or cellulose nitrate, it being understood that the wear material contained in container 17 will be in liquid form. In those instances where the wear material is, or comprises pitch or shellac, suitable means, not illustrated, may be provided for supplying heat to container 17 for the purpose of liquifying the substances. The wear material may be permitted to impregnate the batt solely by capillary action, or a vacuum may be employed within housing 19 for sucking wear material 18 upwardly through the batt. The wear material will very readily be drawn into and through the batt by reason of its porous nature. It has been found that by controlling the quantity, concentration, and type of wear material with which the batt is impregnated, the wearing characteristics of the resultant leather substitute may be accurately controlled between widely divergent limits, wherefore the sole of a dancing slipper may be impregnated with very little, if any wear material, whereas a workman's shoe could be so heavily loaded with wear material as to give almost indefinite service.

In those instances where it may be desirable to increase the wearing qualities of those portions of the outer sole of a shoe which are subjected to the greatest wear, such as the ball portion of the sole 21 of Figs. 5 and 6, wear material 18 may be localized to the ball portion, or more wear material may be loaded into the ball portion of the sole than to the other parts of the sole. By thus being able to control the wearing characteristics of a shoe sole, and more particularly by being able to control the wearing characteristics of various portions of a shoe sole, it is, for the first time, economically feasible to produce shoes which are built for certain specific uses.

Abrasion tests have conclusively proven that a leather substitute sole made according to the teachings of the instant invention will outlast leather soles of corresponding thickness as evidenced by the following grit test. A pair of ladies' shoes having seven iron soles, one of high grade leather and the other of leather substitute material hereinabove described, were mounted side by side above a sanding belt in such a manner that the ball portion of the soles of both shoes rested upon the sanding belt. The all leather sole wore through in one hour and forty-two minutes, whereas the sole made from the instant leather substitute showed no appreciable signs of wear.

The dry batts may be compressed by placing them in any suitable machine such as pressing device 20 of Fig. 1, which is adapted to exert a uniform pressure on the batt being compressed, thereby insuring uniform thickness and density of the resultant product. The exact degree or amount of compression to which a batt should be subjected in order to provide a leather substitute sole having a density and pliability similar to that of leather of the same thickness is not

accurately known since the instant leather substitue has been successfully made in the laboratory wherein the dried batts were compressed in a hand vise, the handle of which was approximately twenty inches in length. At the present time the instant leather substitute is being produced on a commercial scale by being compressed in a power press capable of developing six hundred tons per square inch. Suitable stops are utilized for accurately controlling the amount by which the thickness of the dried batts are reduced in the press. If desired, any type of finish may be given to the leather substitute, such as pebble finish, any type imitation grain, or any type of trade-mark may be embossed into the substitute leather during the pressing operation. Experiment has indicated that cleats, ribbing, and the like may be formed on the sole, wherein the ribs, cleats or the like may have densities less than, equal to, or greater than the density of the rest of the sole.

As disclosed in Fig. 11, it is possible and economically feasible to form a composite outer sole 40 which comprises an integral sole portion 41 and heel portion 42. Such a composite outer sole may be fabricated from a preshaped batt in which the thickness of the heel portion as initially formed in the batt would be appreciably thicker than the thickness of the batt comprising sole portion 41. After such a batt has been dried, the heel portion may be heavily loaded or impregnated with a dense type of wear material, the main ingredients of which may comprise pitch and/or rosin, whereas the sole portion 41 may be less heavily impregnated with the same type of wear material, or it may be impregnated with a wear material such as nigre gum, cellulose nitrate, Kumar gum, or shellac. The impregnated batt may then be allowed to dry after which it may be compressed to the form illustrated in Fig. 11 for providing a composite sole including integral sole and heel portions which will outlast heels and soles of high grade cow leather. As herein before stated, the instant leather substitute is ideally adapted to be secured to the support surface of a shoe by means of gluing, or the like, wherefore stitching or tacking operations may be entirely dispensed with.

Substitute leather soles made in accordance with the instant teachings may be bent, twisted and flexed indefinitely without cracking or showing other signs of disintegration or wear. This phenomenon is attributed to the fact that the floss which is mixed with the binder is composed of fibers which are of the length too short to card with the result that all of the flexing or bending movements to which a sole is subjected are taken by the elastic substances of the binder and not by the fibers themselves. This theory is borne out by experiments which showed that when a floss was prepared from fibers which were long enough to card they would become interfelted to such an extent that they would break incident to flexing and/or bending of the sole.

The batter as it leaves mixing machine 12 may, if desired, be deposited in a suitable template having the desired outline of the finished sole. After the volatile ingredients have evaporated from the batter, the dried batt may be removed from its template and impregnated with wear material, or it may be subjected directly to the compressive action of press 20. An outstanding feature of the instant leather substitute resides in the fact that no lateral distortion occurs during the pressing operation, wherefore the size or outline of a batt

before and after being pressed is substantially identical, wherefore it is not necessary to trim the soles as they leave the pressing machine, thereby reducing manufacturing costs considerably.

If desired, the batter from mixing machine 12 may be deposited in a compressible template 50, see Fig. 8, which is fabricated from compressible material such as strawboard, or the like. The batt housed within its template may then be subjected to the action of pressing machine 20 whereby the finished sole and template will be compressed by the same amount and wherein the finished leather substitute sole will be neatly mounted within a circumscribing frame in which the sole may be sold directly to the ultimate purchaser. If desired, suitable instructions, and the like, may be printed upon the faces of the template either before or after being compressed in press 20.

In those instances where the leather substitute is provided in sheet form 30 (Fig. 10) it may be used in a manner similar to tanned cow leather, that is, soles may be suitably stamped or cut therefrom by any suitable mechanism, not illustrated. It should be understood, of course, that other articles may be cut from strip 30, such as belts, book covers, gaskets, floor covering, blocks, and the like. In this connection, it will be observed that the instant leather substitute does not become slippery like leather and rubber, when wet, wherefore it is ideally adapted for shoe soles, floor coverings and other usages in which its quality of not becoming slippery when wet would be advantageous.

It should be understood that the batter need not necessarily be fed to a batt forming machine 14 in order that batts be formed. If desired the batter may be manually deposited in sheet form, or in templates, or the like.

In those instances where a rubber containing compound, such as rubber cement, rubber (para) cement, reclaimed rubber cement, or para rubber cement with Kumar gum, is used as a binder and mixed with a floss made from the fibers of animal hide (leather) and/or the fibers of the vegetable kingdom, the resultant batter may be deposited in suitable templates supported upon a coarse mesh cloth, or the like. The coarse mesh cloth will adequately support the batter while facilitating evaporation of the volatile ingredients of the binder. The resultant dry batt may be compressed into a tough, dense, waterproof, pliable leather-like substitute, without external application of heat. In other words no heat of vulcanization is required during the compression process. However, if the batt should be impregnated with a pitch or rosin-base wear material, then sufficient heat should be applied to the batt incident to the compressing operation for the purpose of plasticizing the wear material incident to the compression of the batt.

In certain instances the binder material may include, or be rich in wear material, wherefore the floss would be mixed with binder and wear material, in mixing machine 12, thereby eliminating the later step of loading a dry batt with wear material. Substances such as cellulose nitrate, shellac, rosin, coal tar or Burgandy pitch, and the like, comprise a class of binders which are rich in wear material.

In those instances where cellulose nitrate is used as the binder substance, the resultant batter and dry batt obtained therefrom are highly inflammable. However, after such a dry batt has been compressed to a dense, pliant leather-like substance the highly inflammable nature of the cellulose nitrate is so modified during the process

of compression that the resultant leather-like substitute is no more inflammable than tanned cowhide. The cellulose nitrate leather-like substance will not actively burn, but smolders like punk.

It will be observed that the instant composition of matter differs greatly from other leather substitutes now on the market which are fabricated from water-laid felted fiber base materials which are impregnated with various types of binders. The instant composition of matter is made from dry fibers which are mixed, in a dry state, with a binder, until the individual fibers are thoroughly coated with the binder material, after which the thoroughly coated fibers are deposited as a batt, which may be then impregnated with wear materials or which may be compressed without first having been impregnated into a leather substitute which is ready for use immediately upon leaving the compressing machine.

If desired, the batter may be extruded through suitable dies into long hollow lengths of tubing which, after drying, may be used as an insulating sheathing for electric wires, and the like. The hollow tubing thus produced may be utilized in its dried state, without further compressing, or the tubing may be impregnated with wear materials such as pitch, rosin, nigre gum, or shellac for the purpose of sealing the pores of the tubing for precluding the passage of moisture therethrough. The hollow tubing may likewise be subjected to the compressive action of a suitable roller die, or the like, for converting the porous batt material into a dense, pliant, waterproof material having excellent electrical insulating qualities.

The batter may likewise be extruded from a suitable die or orifice in solid cords which may be used for calking purposes in the dry batt form and in compressed form. Laboratory tests have indicated that the tensile strength of such cords is increased when the floss fibers are in the neighborhood of one-fourth inch or more in length, however, excellent results may be obtained from floss, the fibers of which are too short to card.

It should be understood that the amount by which a batt is compressed determines, to a large extent, the density of the resultant product. In those instances where the present composition of matter is used as a leather substitute, the batt may be compressed until its density has been increased, by way of example, to the density of leather. The resultant product will then have acquired a toughness and pliability equal to or in excess of high grade leather of corresponding thickness. However, the comparison of the density of the leather substitute with the density of leather is exemplary, and not restrictive, and in many instances the density of the leather substitute will greatly exceed the density of real leather.

The addition of Kumar gum to the rubber containing binders eliminates or lessens the elastic

qualities of such compounds without impairing their ability to function as a flexible bond for the fibers.

What is claimed is:

1. The method of selectively increasing the wearing characteristics of those portions of a substitute leather outsole which are subjected to wear, which method comprises the steps of thoroughly intermixing organic dry, short fiber flock with a sufficient quantity of rubber dissolved in a volatile solvent to produce a plastic mass, of distributing said plastic mass in a mat of uniform thickness, of evaporating the rubber solvent from said mat of forming individual outsoles from said mat, of impregnating those portions of said outsoles which will be subjected to wear with pitch, and of them uniformly compressing the entire outsole shaped mat by an amount sufficient to increase its density and pliability to that of leather.

2. The method of manufacturing a composite one piece shoe sole including integral heel and outsole portions, which method comprises the steps of forming a mat from a batter comprising organic short fibered flock, the individual fibers of which are coated with a binder characterized by its ability to bond the fibers into a dense leather-like substance when subjected to the application of pressure, of forming said mat with a heel portion and an integral outsole portion, of impregnating said heel portion with a dense wear resistant substance and of impregnating said outsole portion with a less dense wear resistant substance, and of then compressing said mat by an amount sufficient to impart a dense, tough, substantially non-pliable composition to said heel portion, and a less dense, tough, pliant composition to said outsole portion.

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