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MANUFACTURE OF FOOTWEAR

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This invention relates to the manufacture of cemented footwear and more specifically to the treatment of outsoles to facilitate the attachment thereof to the shoe bottom, or vice versa. For simplicity of description I will hereinafter refer particularly to the former.

More particularly the invention relates to a method of treating outsoles having their attaching faces provided with a coating of a waterproof cement (i. e. one which does not become sticky or tacky when exposed to water at room temperature) which is activatable by certain solvents, and particularly a thermoplastic cement which is thus also activatable by heat, by means of which the cement will be softened or "activated" for attachment to the shoe bottom, and the outsole will be simultaneously mulled or tempered or the temper thereof will be maintained so as to facilitate the application and contouring thereof to the shoe bottom by means of a pneumatic press or other sole attaching equipment.

A principal object of the invention is to provide a method for so treating such outsoles whereby reduced operating costs, minimum damage to the outsoles, and improved shoe quality are attained.

Another object is to provide a method for treating such outsole which reduces the activating time and the time necessary for the shoe to be held in the sole attaching press.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

In the manufacture of cemented shoes it has already been suggested to use thermoplastic, i. e. heat-activatable cement for permanently attaching the outsole to the shoe bottom and to activate the cement by heating it in various ways, e. g. by subjecting it to the influence of an electrostatic or electromagnetic field, or directly with radiant heat or a steam jet. It has likewise been proposed to heat-activate the cement while protecting the uncoated portion of the leather outsole from drying out. It has also been suggested to condition outsoles by mulling or tempering them in an atmosphere of steam or water vapor. It has been further suggested simultaneously to activate and temper such miscellaneous cemented portions of shoes, such as box toes, heel breast flaps and McKay channel flaps, by means of steam or vapor, and heat. Finally it has been suggested to activate various cements on soles and other portions of shoes by applying a solvent or solvent vapor thereto.

Heretofore, however, it has not to my knowledge been proposed simultaneously to treat the cemented outsoles with a mixed water and solvent vapor, whereby one may simultaneously mull or temper the outsole, or maintain the temper thereof, and activate a waterproof cement particularly a thermoplastic one which is heat and solvent activatable.

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By this novel means I have discovered such outsoles can be quickly and easily treated to activate the cement while simultaneously tempering the soles or maintaining their previous temper, at a lower temperature than if steam alone is used and without the danger of spotting or staining the soles which often occurs with higher temperatures. The activating time is also reduced as is the danger of forming an explosive or highly inflammable mixture or having a fire hazard as is the case where solvent alone is used.

The invention accordingly comprises the several steps and the relation of one or more steps of such steps with respect to each of the others thereof, which will be exemplified in the method hereinafter disclosed, and the scope of the invention will be indicated in the claims.

In carrying out my novel method the solvent and water may be placed in or introduced as required into any suitable apparatus where they can be vaporized to form a solvent-water vapor mixture to engage the cemented side of the sole to be treated. One form of suitable apparatus is shown in the Wells Patent 2,334,232, issued November 16, 1943, which, although devoted exclusively to the tempering of uncemented leather soles by means of water vapor, shows a chamber for supporting the soles underneath which is a water bath that is heated and through which air is blown to facilitate the transfer of the water vapor from the fluid chamber to the space surrounding the sole.

A preferred form of apparatus is shown in the copending application of William C. Card, Serial No. 525,911, filed March 10, 1944, which discloses apparatus in which the cemented soles are treated with water or solvent vapor while held on a curved foraminous support which maintains the mold in the sole or molds the sole during the treatment. This apparatus may readily be used for carrying out my improved method.

In accordance with my novel method the solvent selected in any particular case is one which readily activates the cement by solvent action and which is volatile along with a sufficient amount of water vapor for the purposes described.

If activation of a previously tempered sole is

desired, the solvent and heating temperature may be so selected that a sufficient amount of the solvent will be vaporized to activate the cement while at the same time only sufficient water may be vaporized to prevent drying out of the sole; whereas if it is desired simultaneously to temper the sole and activate the cement, the solvent and heating temperature may be so selected as to supply both sufficient solvent vapor and hot water vapor to temper the sole and to furnish some heat to assist in activating the cement.

In either case, the solvent may be one which is miscible with the water or one which is immiscible; but in the latter case, and particularly where activation of the cement on a pretempered sole is desired, the mixture may be aerated, whether or not the mixture is simultaneously heated, in order to assist in providing a proper flow of the vapor mixture into contact with the sole. If, as is usually the case, the vapor pressure of the solvent differs from that of the water so that there is a tendency for one to evaporate more rapidly than the other, replenishment of each is controlled to maintain the desired vapor mixture.

While it is obvious from the above that a wide variety of solvents may be used to activate various substantially waterproof activatable cements in use in the industry, I have found that with a neoprene adhesive, i. e. a polymerized chloroprene, a mixture of water and an aromatic hydrocarbon such as xylol or chlorinated solvents such as trichlorethane or ethylene dichloride may be used; whereas with adhesives of a butadiene polymer such as "Hycar" or "Chemigum" a mixture of water and methyl isobutyl ketone or methyl ethyl ketone or such solvents as acetone, 2-nitropropane, or "Cellosolve" acetate, may be used. With adhesives such as polyvinyl acetate or polyvinyl butyral I have found that a mixture of water and one of such solvents as butyl lactate, ethanol, acetone. etc., will give satisfactory results.

The ratio of the solvent used to the water may, of course, be varied in accordance with the conditions above set forth, and the results desired; but I have found that the use of from .5% to 5% of solvent, by volume on a liquid basis, is a desirable range. With such mixtures when using heat to evaporate the water and solvent, for example, at a vapor temperature of from 50–95° C., I have found it possible to activate cemented outsoles within a space of from 5 to 30 seconds, and in any event within a time of one minute.

In the making of shoes utilizing the features of my invention, the shoe upper may be lasted in any conventional manner and preferably the attaching faces of the shoe bottom and outsole are roughed and then coated with a solution of waterproof, thermoplastic cement, such as one of the types previously mentioned, and allowed to dry. The outsole is preferably tacked to the heel seat of the shoe and then placed in a chamber such as that shown in the previously mentioned Card application where it is subjected to the action of the mixture of water vapor and solvent vapor to activate the cement. The shoe and outsole are then quickly placed in a sole attaching press and held under pressure until the cement sets sufficiently to secure the parts together.

As specific examples of my invention, but not by way of limitation, the following data is given. In each case, after activating the cement, the outsole was clamped to the shoe bottom in a shoe press at 50 lbs. per square inch pressure.

I. When using "Chemigum N" base cement, I obtained excellent adhesion by activating the sole as follows:

Test	Solvent used	Solvent in liquid mixture	Temp. of vapor mixture	Activating time
		Per cent	*°C.*	*Seconds*
(a)	Methyl isobutyl ketone	0.5	90	10
(b)	Methyl isobutyl ketone	1.0	90	5
(c)	Methyl ethyl ketone	1.0	65	10
(d)	2-nitropropane	1.0	90	10
(e)	"Cellosolve" acetate	1.0	90	10
(f)	Trichlorethane	1.0	90	5

When a test was made to activate the same cement with heated water vapor alone, at 90° C. no adhesion was obtained even after treating for 6 minutes, and long before this time the leather was injured both by the heat and by water staining.

II. When using a neoprene base cement I obtained excellent adhesion by activating the sole as follows:

Test	Solvent used	Solvent in liquid mixture	Temp. of vapor mixture	Activating time
		Per cent	*°C.*	*Seconds*
(g)	Ethyl dichloride	1.0	65	10
(h)	Carbon tetrachloride	2.0	50	10

When a test was made to activate the same cement with heated water vapor alone, at 50° C. no adhesion was obtained even after treating for 3 minutes.

III. When using a polyvinyl acetate base cement I obtained excellent adhesion by activating the sole as follows:

Test	Solvent used	Solvent in liquid mixture	Temp. of vapor mixture	Activating time
		Per cent	*°C.*	*Seconds*
(i)	Butyl lactate	2.0	65	10
(j)	Methyl ethyl ketone	2.0	50	10
(k)	Acetone	2.0	50	10

When tests were made to activate the same cement with heated water vapor alone, at 50° C. no adhesion was obtained even after treating for 3 minutes, and at 65° C. no adhesion was obtained in 1 minute and only partial adhesion in 2 minutes.

IV. When using a polyvinyl butyral base cement I obtained excellent adhesion by activating the sole as follows:

Test	Solvent used	Solvent in liquid mixture	Temp. of vapor mixture	Activating time
		Per cent	*°C.*	*Seconds*
(l)	Methyl isobutyl ketone	1.0	75	20
(m)	Methyl ethyl ketone	1.0	65	10
(n)	Butyl "Cellosolve"	2.0	75	10
(o)	Ethyl acetate	2.0	75	10

When a test was made to activate the same cement with heated water vapor alone, at 75° C. no adhesion was obtained even after treating for 4 minutes, and the leather was injured both by the heat and by water staining.

I have also found that good results may be obtained by using mixed solvents along with water in the activating vapor mixture and particularly a mixture of high and low boiling solvent such as, for example, diacetone alcohol and methyl ethyl ketone along with the water to form an activating vapor mixture. In this way one may utilize the quick activating power of the

low boiling solvent and the relatively slow evaporating rate of the high boiling solvent.

Since certain changes may be made in carrying out the above method without departing from the scope of the invention, it is intended that all matter contained in the above description shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A method of activating a waterproof, solvent-activatable cement applied to outsoles for attachment to shoe bottoms, which comprises treating such cemented outsole with a mixture of water vapor and solvent vapor to activate the cement.

2. A method of activating a waterproof, solvent-activatable cement on pretempered outsoles for attachment to shoe bottoms, which comprises treating such cemented outsole with a mixture of water vapor and solvent vapor to activate the cement, while at least maintaining the temper of the outsole.

3. A method of activating a waterproof, thermoplastic and solvent-activatable cement on outsoles for attachment to shoe bottoms, which comprises treating such cemented outsole in the presence of heat with a mixture of water vapor and solvent vapor to activate the cement.

4. A method of activating a waterproof, thermoplastic and solvent-activatable cement on outsoles for attachment to shoe bottoms, which comprises treating such cemented outsole in the presence of heat with a mixture of water vapor and solvent vapor, and at a temperature sufficient to obtain activation of the cement within less than one minute.

5. A method of activating waterproof thermoplastic and solvent-activatable cement applied to outsoles for attachment to shoe bottoms, which comprises treating such cemented outsole in the presence of heat with a mixture of water vapor and solvent vapor, and at a temperature of from about 50° C.–95° C.

6. A method of activating waterproof, solvent-activatable cement applied to outsoles for attachment to shoe bottoms, which comprises preparing a mixture of water and cement solvent vaporizing the mixture, and subjecting such cemented outsoles to the action of such vapor until the cement thereon is activated.

7. A method of activating waterproof, solvent-activatable cement on tempered outsoles for attachment to shoe bottoms, which comprises preparing a mixture of water and cement solvent, vaporizing the mixture, and subjecting such cemented and tempered outsoles to the action of such vapor mixture until the cement thereon is activated.

8. A method activating waterproof, solvent-activatable cement applied to outsoles for attachment to shoe bottoms, which comprises preparing a mixture of water and cement solvent, vaporizing the mixture by means including aeration, and subjecting such cemented outsoles to the action of such vapor until the cement thereon is activated.

9. A method of activating waterproof, solvent-activatable cement applied to outsoles for attachment to shoe bottoms, which comprises preparing a mixture of water and cement solvent, vaporizing the mixture by means including heat and aeration, and subjecting such cemented outsoles to the action of such vapor until the cement thereon is activated.

10. A method of activating waterproof, thermoplastic and solvent-activatable cement applied to outsoles for attachment to shoe bottoms, which comprises preparing a mixture of water and cement solvent, vaporizing the mixture by means including heat, and subjecting such cemented outsoles to the action of such vapor until the cement thereon is activated.

11. A method of activating waterproof, thermoplastic and solvent-activatable cement applied to outsoles for attachment to shoe bottoms, which comprises preparing a mixture of water and cement solvent, vaporizing the mixture by means including heat and aeration, and subjecting such cemented outsoles to the action of such vapor mixture until the cement thereon is activated.

12. A method of activating waterproof, thermoplastic and solvent-activatable cement applied to outsoles for attachment to shoe bottoms and simultaneously tempering such outsoles, which comprises preparing a mixture of water and cement solvent vaporizing the mixture by means including heat and aeration, and subjecting such cemented outsoles to the action of such vapor mixture until the cement thereon is activated and the sole is tempered.

13. A method of activating waterproof, thermoplastic and solvent-activatable cement applied to outsoles for attachment to shoe bottoms, and simultaneously tempering such outsoles, which comprises preparing a mixture of water and cement solvent, vaporizing the mixture by means including heat, and subjecting such cemented outsoles to the action of such vapor mixture until the cement thereon is activated and the sole is tempered.

14. That improvement in cement attaching outsoles to lasted shoe bottoms, which comprises providing a lasted shoe having the sole attaching face thereof coated with a heat and solvent activatable cement, providing an outsole having its attaching face coated with a heat and solvent activatable cement, subjecting at least one of said cemented parts to a heated mixture of water vapor and cement solvent vapor to activate the cement thereon, and quickly bringing said outsole and shoe bottom together under pressure until the cements thereon have merged.

15. That method of cement attaching soles to shoes, which comprises providing a lasted shoe having on its sole attaching face a substantially dry coating of a butadiene acrylonitrile base cement, providing an outsole having on its attaching face a substantially dry coating of a butadiene acrylonitrile base cement, subjecting at least one of said cemented parts to the action of a heated mixture of water vapor and a solvent vapor until the cement thereon is activated, and thereafter quickly bringing said parts together under pressure until the cements thereon have merged.

16. That method of cement attaching soles to shoes, which comprises providing a lasted shoe having on its sole attaching face a substantially dry coating of a polymerized chloroprene base cement, providing an outsole having on its attaching face a substantially dry coating of a polymerized chloroprene base cement, subjecting at least one of said cemented parts to the action of a heated mixture of water vapor and a solvent

vapor until the cement thereon is activated, and thereafter quickly bringing said parts together under pressure until the cements thereon have merged.

17. That method of cement attaching soles to shoes, which comprises providing a lasted shoe having on its sole attaching face a substantially dry coating of a vinyl resin base cement, providing an outsole having on its attaching face a substantially dry coating of a vinyl resin base cement, subjecting at least one of said cemented parts to the action of a heated mixture of water vapor and a solvent vapor until the cement thereon is activated, and thereafter quickly bringing said parts together under pressure until the cements thereon have merged.

18. That method of cement attaching soles to shoes, which comprises providing a lasted shoe having on its sole attaching face a substantially dry coating of waterproof cement, providing an outsole having on its attaching face a substantially dry coating of waterproof cement, subjecting at least one of said cemented parts to the action of a heated mixture of water vapor and vapors of a high boiling solvent and a low boiling solvent, until the cement thereon is activated, and thereafter bringing said parts together under pressure until the cements thereon have merged.

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