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C. L. PETZE

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SHOE LAST

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Fig. 1.

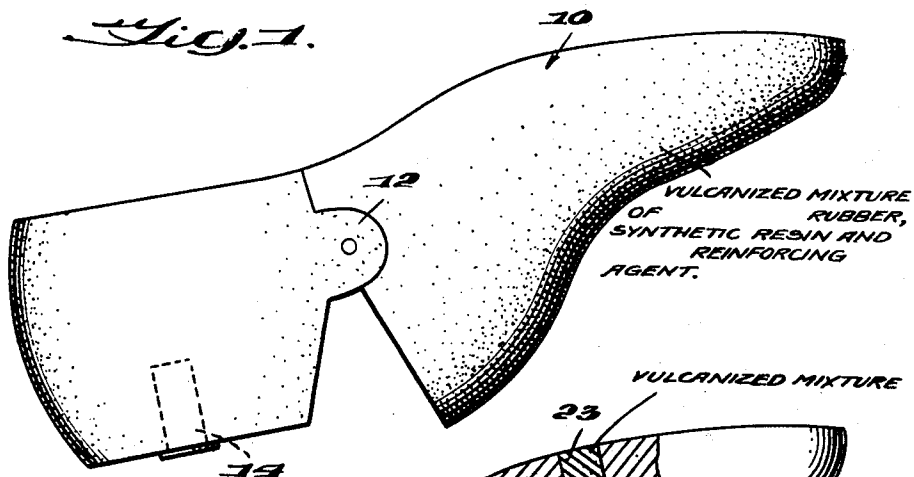


Fig. 2.

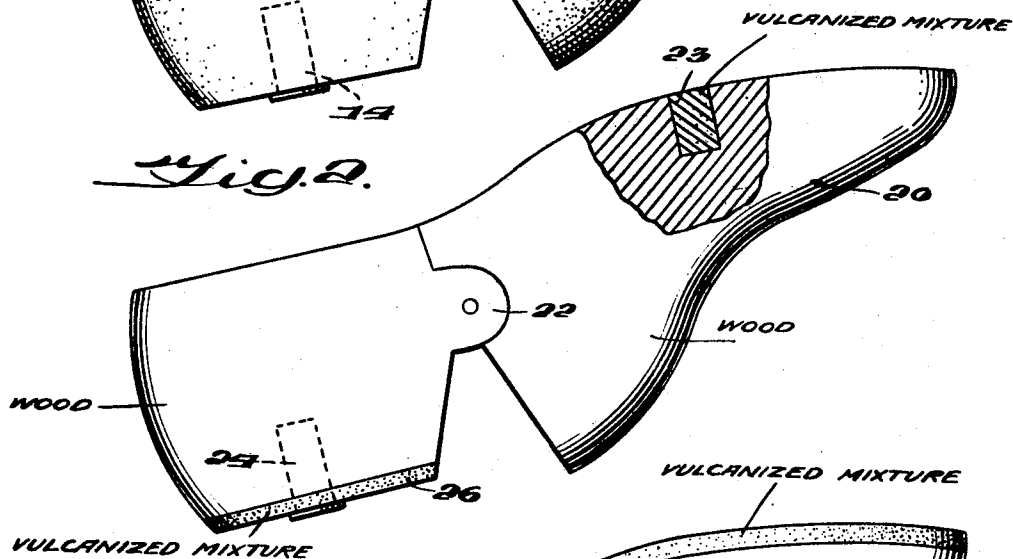
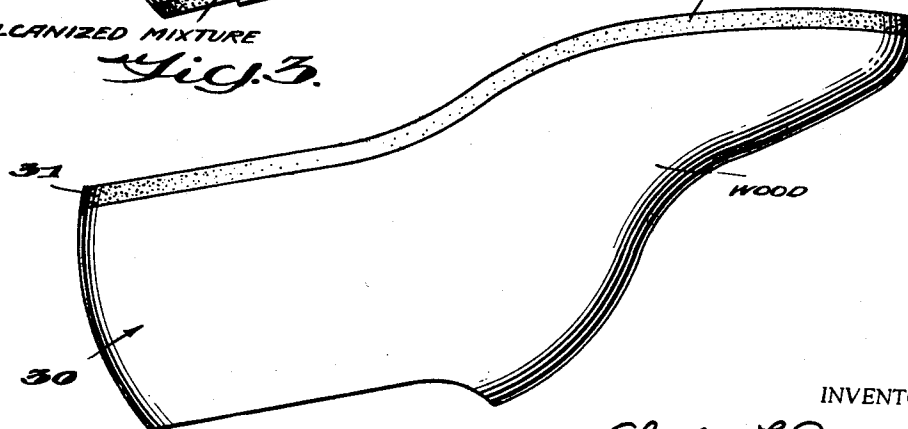


Fig. 3.



INVENTOR

Charles L. Petze

BY

Leech & Radue

ATTORNEYS

UNITED STATES PATENT OFFICE

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SHOE LAST

Charles L. Petze, New Castle, Del., assignor to Delaware Research & Development Corporation, New Castle, Del., a corporation of Delaware

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9 Claims. (Cl. 12—140)

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The present invention relates to shoe lasts or the like of novel composition.

This application is a continuation-in-part of application Serial No. 216,413, filed March 19, 1951, which has been abandoned.

It has been customary to make shoe lasts of wood, particularly rock maple and to this day, practically all lasts are of wood construction. In recent years, lasts of thermoplastic compositions have been proposed and patented. In addition to a thermoplastic substance, the lasts of such patents have included hemp fibres, ground cork, wood flour, and cotton flock as filling material that could be bound with the plastic. Besides strength and workability, these earlier patentees have been further interested in a thermoplastic last material capable of retaining tacks or nails driven repeatedly into the same location.

At present rock maple suitable for the turning of lasts is in short supply and is expensive. Its use also involves considerable unpreventable waste of material. Even the best rock maple is lacking in complete uniformity, and the lasts made from it are subject to cracking. Like other woods, but to a lesser extent, hard maple is subject to changes in moisture content and to warping and other deformation with age. Wood lasts have always presented the problem of wear after a moderate amount of use due to the continued insertion and withdrawal of nails and other metallic fastenings used in the lasting of shoes. Many expedients have been resorted to in order to keep lasts in service after a localized tacking area has been completely degraded or worn out. It has been the practice in such instances to drill out the worn part and to insert a lead filling, or a plug of wood, or the like. Such repairs by insertion have been found to be of short life, expensive, or much less than completely satisfactory from the standpoint of tack driving and retaining.

It is the general purpose of this invention to provide a shoe last with a body portion comprising synthetic material that will greatly outlast wood, have more nearly perfect tack receiving and retaining properties, be economical in composition and manufacture, and more than satisfy all the physical strength requirements for lasts or the like.

A further object resides in the provision of a last of synthetic composition that will be essentially chemically inert to the solvents used in shoemaking and have very little or no absorptive property.

It has been discovered that certain vulcanized compositions of synthetic resin and synthetic

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rubber combined with chemically inert reinforcing agents in determined proportions meet all these requirements to a high degree. It has also been found that lasts embodying the resin-rubber compositions to be disclosed have the outstanding characteristics of being capable of having nails or tacks inserted and removed a great many more times than was possible with the best grade of wood last. Lasts or lasts embodying such novel compositions are also distinguished by the satisfaction and uniformity with which nails can be driven and the resistance to undesired removal.

The last compositions that have been found to have the desired properties are vulcanizates comprising a rubbery copolymer and a resinous copolymer that is compatible with the rubbery copolymer and will react therewith. A preferred vulcanizable elastic rubber is the butadiene-styrene rubbery copolymer commonly known as "GRS" synthetic rubber, and a preferred compatible, reactive resin is a resinous copolymer of styrene and butadiene-1,3, with the styrene predominant, of which "Pliolite S-6" is an example. Commercially available GRS rubber, or "Buna-S" rubber is a copolymer of butadiene-1,3, with a lesser amount of an unsaturated compound of styrene, e. g., about three parts of butadiene and one part of styrene.

Although a generally satisfactory vulcanizate can be produced with the use of only the GRS rubber and the S-6 resin, it is preferred for economical reasons and improvement of physical properties to incorporate in the vulcanized compound a substantial proportion of a reinforcement agent inert to the solvents used in shoemaking. Nylon flock, asbestos fibre, carbon black, calcium silicate, and calcium carbonate are examples of reinforcing agents having the desired chemical resistance for use in lasts.

The following are proportions by weight of preferred compositions that have been found to be fully satisfactory in all respects:

Example I

	Percent
GRS rubber	24.78
Styrene-butadiene resin ("Pliolite S-6")	37.18
Asbestos fibre	34.08
Color	.62
"Altax" (accelerator)	0.37
Stearic acid	0.50
Zinc oxide	1.25
Sulfur	0.98
"Tuads" (accelerator)	0.25

Example II

	Percent
GRS -----	29.1
Styrene-butadiene resin ("Pliolite S-6") ---	43.1
Nylon flock -----	20.0
Color -----	0.3
Stearic acid -----	0.7
Zinc oxide -----	2.9
Altax -----	1.2
Tuads -----	0.8
Sulfur -----	1.8

In the above compositions, all the minor constituents are perfecting ingredients that are known to the prior art. The accelerator "Altax" is benzothiazyl disulfide, and the agent "Tuads" is a tetramethyl thiuram disulfide accelerator.

Nitrile rubber, which may be substituted in the foregoing examples for the GRS rubber, is a rubbery copolymer of butadiene and a lesser amount of acrylonitrile. A commercial source sold under the trade-mark "Paracril" is understood to comprise about three parts of butadiene and one part of acrylonitrile. Other commercial rubbery copolymers of this kind are known as "Chemigum" and "Hycar OR." "Captax," also a rubber accelerator, is mercapto-benzo thiazole. Natural rubbers may also be substituted.

The above compounds may be prepared by conventional procedure in which the rubber is slowly worked into the resin with the curing ingredients being subsequently added. In using a two-roll mill, the resin is first banded on the mill and then the rubber is slowly worked into the resin, with the curing ingredients being finally added. In Banbury mixing all the ingredients except the curing agents are added initially. The curing agents may then be added to the batch later on a two-roll mill. The compound thus produced may be extruded, calendered or molded, and is then vulcanized.

In the vulcanized compound, the combination of a vulcanizable rubbery copolymer, or natural rubber with a compatible, reactive resin gives the principally desired results. The resin is hard and provides the necessary stiffness and firmness for a mass into which tacks can be driven readily and accurately. The rubbery component is equally essential because it provides a recovery effect which prevents the material from taking a permanent deformation, thus permitting repeated use with uniform effectiveness over a long life. This long life tacking acceptance and the resistance to absorption and chemicals represent a unique and highly useful combination of last properties.

Although specific examples have been given using as the rubbery copolymers of butadiene and styrene or acrylonitrile, compositions can be based on other elastic, vulcanizable rubber such as chloroprene, isoprene-isobutylene copolymers, and organic polysulfides. Other reactive resins may be used with these elastic rubbers in addition to those given in the examples. Among these other reactive resins are phenol formaldehyde, resorcinol formaldehyde, butadiene acrylonitrile copolymers with a high proportion of acrylonitrile, acrylic acid copolymers, and the like.

The various reinforced agents recited vary widely in density. The substitution of some will increase the total weight of the last body, but the addition of others will not. The relative expense of the rubbery and resinous materials, individually and as a group, is great as compared with that of the reinforcing agent. It is there-

fore highly desirable to use as large a proportion as possible of reinforcing agent without material sacrifice of the necessary last properties. It has been found that some reinforcing agents may be used up to nearly one-half part (50%) by weight of the complete compound, but in no event is it desirable to use a reinforcing agent which will amount to more than 75% by weight.

It is preferred that the weight ratio of rubbery copolymer to resinous copolymer be of the order of 3 to 5, and that a minimum of approximately 30% by weight of reinforcing agent be used in the compound.

The accompanying drawings illustrate the manner in which the vulcanized compound can be embodied in lasts or the like.

Fig. 1 shows a conventional hinged last that is formed of vulcanized mixture as disclosed herein.

Fig. 2 is a side elevation, partly sectioned, of a similar conventional hinged last in which the vulcanized mixture provides only an inserted body portion, and an attached heel cone part.

Fig. 3 is a side elevation of a one-piece last or shoe formed of wood and having a built up portion formed of the vulcanized mixture.

Referring to these embodiments in more detail, a last 10 as shown in Fig. 1 is composed entirely of the vulcanized mixture of this invention, except for the necessary metal link for a hinge connection 12, and a metal last thimble 14 in the heel part. In the construction of such a last, the parts will be molded to approximate shape in lefts and rights and then reduced to the desired size and final configuration by ordinarily used profiling equipment. The amount of working and the loss of material is thus kept at a minimum.

Fig. 2 illustrates the manner in which the large number of wood lasts now in use can have their lives extended for a very considerable period. A wood last 20 having hinged toe and heel parts, a hinge connection being indicated at 22, has had a central portion of its forepart sole area renewed by insertion of a rod member 23 of the vulcanized mixture of this invention. This is accomplished by boring out a suitable zone and inserting a closely fitting length of rod, which is then trimmed off to the general level of the sole surface, and securely and integrally anchored in place by a strong adhesive previously applied to the rod member or plug. The central forepart area, to which the insert member 23 of $\frac{1}{8}$ inch to $\frac{3}{4}$ inch in diameter has been added, is one which receives maximum tacking wear in shoe manufacture. It will be understood, however, that corresponding inserts in the form of strips or other elongated shapes may be made in whatever other part of the last has been subjected to wear, through repeated driving and pulling of nails or tacks, to such an extent that it is no longer fit for service. The wood last 20 includes also a metal last thimble 24 and a wear plate 26 of the vulcanized compound of this invention positioned over the cone of the last and adhesively bonded thereto with the last thimble inserted therethrough. While there is no tacking in this area, the vulcanized compound of this invention provides an excellent wear plate for prevention of damage to the last by repeated insertion of the last pin in the thimble.

An additional and very useful form of composite last embodying the metallic fastener receiving composition of this invention is illustrated in Fig. 3. In this instance, a wood last 30

has had its entire sole area built up by the application thereto of a layer 31 of substantial thickness composed of the vulcanized mixture herein disclosed. A sheet of suitable thickness for the intended purpose is heated sufficiently to be conformable and applied to the bottom of the last to which it is securely bonded by any one of a number of suitable commercial adhesives, the natural or synthetic rubber cements being particularly satisfactory. After this has been done, it can be worked to the desired shape and profile in the same manner as was the original wood last blank. It will of course be understood that such building up of wood lasts is not limited to the particular part shown, but can be accomplished at any place desired through addition of a body of the vulcanizate with suitable adhesion bonding and final working to finished shape.

The term "last" as used herein is intended to include last blanks and any similar forms or patterns employed in the shoemaking art.

By means of the synthetic compositions that have been disclosed, there has been produced a last or form that is the equivalent of wood lasts in all respects, and superior to them in many others. The materials of which this novel last are formed are readily available and at reasonable cost. The lasts formed of this material are uniform in their properties and not subject to deformation by reason of moisture absorption or solvent attack. In the latter connection, it is to be noted that they require no separate and special protective coating for those areas that are exposed most to the solvent action, because lasts formed of the material disclosed are not affected by moisture, steam or the organic solvents used. In the completed vulcanized compositions, asbestos and nylon fibers have the requisite chemical resistance. Asbestos fibers are recognized as chemically inert to the solvents used in shoemaking. While nylon fibers will swell moderately on long immersion in a strong solvent, their susceptibility to chemical attack in the lasts of this invention is practically negligible because the surrounding vulcanized composition greatly reduces sensitivity. Therefore, nylon fibers can be regarded as essentially chemically inert to the solvents used in shoemaking.

There is a minimum waste of material because last blanks made of this composition may be molded to approximate size, and reduced to final last contour by simple operations in a lathe in the same manner as hitherto.

The physical properties of a last of this new composition are such that it has all the durability and resistance to destruction of the ordinary wood last. The compositions after vulcanization are substantially homogeneous, appreciably more dense than maple, and capable of taking a smooth finish. Their inherent resilience combined with firmness is detectable by hand pressure.

Comparative tests have been made using the material of wood lasts, namely the best available grade of seasoned maple, inserts of ordinary rubber compressed as highly as practicable, and inserts and blocks of the vulcanized compounds of this invention, with the following results.

A limited area of a maple wood block was rendered unfit for further tacking after 75 tacks has been driven and withdrawn over the area.

An equal area of material embodying the vulcanized mixture disclosed herein and firmly supported was subjected to equivalent tacking. After several times the maximum limit of tacking for the wood, there was no indication of objectionable degradation of the area or unsuitability for further continued use.

The tests on an equivalent body of natural rubber of soft composition highly compressed bandwise was given up before any limit was reached, because the rubber was so yielding to tacking that tacks could not be driven in a satisfactory and accurate manner, and the tack retention of those driven was so poor as to be considered unsuitable as a substitute for wood.

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

1. A shoe last embodying a hard, non-absorbent body portion adapted to repeatedly receive and retain tacks or the like and comprising essentially a vulcanizate of a vulcanizable elastic rubber; a resinous copolymer of butadiene with a larger amount of styrene, the weight ratio of said vulcanizable elastic rubber to said resinous copolymer being approximately 3 to 5; and fibrous reinforcing material that in the vulcanizate is essentially chemically inert to the solvents used in shoemaking.

2. The combination of claim 1 in which the vulcanizable elastic rubber is a rubbery copolymer of butadiene with a lesser amount of styrene.

3. The combination of claim 1 in which the vulcanizable elastic rubber is a rubbery copolymer of butadiene with a lesser amount of acrylonitrile.

4. The combination of claim 1 in which the fibrous reinforcing material is asbestos.

5. The combination of claim 1 in which the fibrous reinforcing material is nylon flock.

6. The combination of claim 1 in which the fibrous reinforcing material is about 20% to about 30% by weight.

7. A shoe last of hard, non-absorbent material adapted to repeatedly receive and retain tacks or the like and comprising essentially a vulcanizate of a vulcanizable elastic rubber; a resinous copolymer of butadiene with a larger amount of styrene, the weight ratio of said vulcanizable elastic rubber to said resinous copolymer being approximately 3 to 5; and fibrous reinforcing material that in the vulcanizate is essentially chemically inert to the solvents used in shoemaking.

8. A shoe last of wood having a hard, non-absorbent tack receiving and retaining insert adapted to repeatedly receive and retain tacks or the like and comprising essentially a vulcanizate of a vulcanizable elastic rubber; a resinous copolymer of butadiene with a larger amount of styrene, the weight ratio of said vulcanizable elastic rubber to said resinous copolymer being approximately 3 to 5; and fibrous reinforcing material that in the vulcanizate is essentially chemically inert to the solvents used in shoemaking.

9. The combination of claim 1 in which the fibrous reinforcing material is nylon flock and comprises approximately 20% by weight.

CHARLES L. PETZE.

No references cited.