UNITED STATES PATENT OFFICE.

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FLEXIBLE WATERPROOF LEATHER AND METHOD OF MAKING IT.

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To all whom it may concern:

Be it known that I, JOHN WESLEY BARBER, a citizen of the United States, of Newton, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Flexible Waterproof Leather and Methods of Making It, of which the following is a specification.

Many attempts have been made to furnish leather which is water-proof, and to furnish leather which is flexible or pliable, but all, so far as I am aware have either failed entirely, or have resulted in seriously affecting the quality or life of the leather, or in rendering it necessary to change from the usual processes in making up the leather into such articles as boots, and shoes, harness, etc. Those treatments which have seemed to attain the best results, have failed in respect to the duration of the effect; in other words, the effects of the treatments would be lost after some days, especially in the case of the soles of boots and shoes worn in melting snow.

After experiments and tests for some five years, I have succeeded in attaining the object of my present invention, which is to produce leather for various purposes, which leather shall be pliable and water-proof during practically its entire life of use and wear, may retain the usual odor of leather, shall retain its texture and natural wearing qualities, and which will require no special changes from the usual processes and steps of converting it into finished articles such as boots and shoes, straps, harness, saddlery, etc.

In the following description of one way of carrying out my invention, the term leather will be employed in its broad significance.

The leather is immersed successively in a plurality of baths, two in the present case, and preferably with an intervening and a following heating treatment. In each bath I employ petrolatum, with some paraffin, the proportions of the substances in one bath varying from the proportions in the other bath. The petrolatum is employed especially for the purpose of imparting pliability or flexibility to the leather. It possesses some water-proofing qualities, but the paraffin is relied upon mainly to impart water-proofing qualities.

Bath No. 1, preferably consists of approximately 75 parts of petrolatum to 25 parts of paraffin, while bath No. 2 preferably consists of approximately 45 parts of petrolatum to 55 parts of paraffin, but I do not limit myself to these proportions. Each bath is heated to keep it in a condition of sufficient fluidity so that it will penetrate the pores of the leather immersed therein. The temperature at which each bath will be kept, will depend somewhat upon the nature and thickness of the leather. The leather is first immersed in bath No. 1 for a sufficient length of time at a comparatively low heat, and is then, after removal from the bath subjected to a heat, preferably in an open oven of some nature, the temperature being sufficiently low, not to destroy the life of the leather, this subjection of the leather to an open heat permitting the leather to fully absorb the substances remaining in or on the leather. Then the leather is immersed in the second bath which contains a greater percentage of paraffin wax that will completely water-proof the leather. A preferable final treatment is to again subject the leather to an open heat treatment.

Neither the petrolatum nor the paraffin wax imparts any objectionable odor to the leather, nor does either substance detract from the natural leather odor, nor interfere with any of the usual manipulations or processes during manufacture of the leather into any articles of utility.

The entire process may be carried out by repair men, or small makers of custom shoes, for it is entirely a process that can be carried out by hand and by ordinary implements. On a large scale, however, machinery can be employed for the immersions, and to carry the leather through ovens or heating apparatus having means for ventilating the same by blast or suction devices.

Bath No. 1 may be heated to a temperature of 140° F. at which point I find the substances will readily assimilate. After starting at this heat, the degree may be lowered and the process of impregnation can then be carried on with perfect safety and economy. Sole leather of a thickness of from 10/64 to 16/64 of an inch can be treated at this temperature, while for extraordinarily thick leather, for men's heavy boots, the length of time of immersion at the heat mentioned may be increased. Experience has shown that a temperature of 160° F. is the extreme

limit of safety in order not to injure the leather by over-heating. And at such temperature, it is best to give very short immersions, say, one or two seconds. The lowest limit of heat at which the mixture will remain in condition to serve for impregnations, I have found by experience to be approximately 110° F. At such temperature, the immersion may be carried on with perfect safety for any length of time. For thicknesses of 10/64, 12/64, 13/64, and 16/64 of an inch in thickness, the following are approximate tables:—

160°	short immersions of 1 or 2 seconds.				
150°	immersions	from	3	to 5	seconds.
140°	"	"	6	" 10	"
130°	"	"	10	" 60	"
120°	"	"	10	" 70	"
110°	"	"	6	" 120	"

The reason why there may be such a great latitude at the lower temperatures as 110°, 120°, and 130°, is that leather will only absorb a certain amount, and any extra amount deposited as will be the case when the bath is not very fluid, will drip off during the next step of the process.

After withdrawal from bath No. 1, the leather is transferred to a heated receptacle or oven in which the heat should be kept practically uniform, at not over approximately 120° F. The temperature for this heat may, however, vary from 110° to 130°. During this heating treatment, the leather is preferably given some kind of turning over motion, to avoid discoloration of the leather by uneven absorption. After the complete absorption has taken place during this heating treatment, which may average 10 minutes in a ventilated oven the leather is placed in bath No. 2, which is preferably heated to a temperature somewhat higher than bath No. 1. For instance, at first the temperature of bath No. 2 might be as high as 160° F., or even somewhat higher. At a temperature of 160° F., the leather may be given only a series of brief immersions with intervening time, such as 2 seconds. At lower temperature, it may be left a longer time in the bath. When the process is being carried out in connection with large quantities of leather, and requiring large receptacles for the immersions, an even heat at from 130° to 140° is advisable, after which the leather is transferred to an open or ventilated heated oven or receptacle where it will remain long enough for complete absorption of the ingredients.

Bath No. 2 is intended to make the water-proofing more perfect. The first bath chiefly imparts flexibility or pliability to the leather while the second bath adds more of a substance which renders the leather durably water-proof.

Owing to the fact that the leather is actually immersed and not simply allowed to rest with one surface in a bath, both the top and the bottom surfaces of the sole leather will absorb an equal amount of the water-proofing material. Then, when the boot or shoe is being worn, any moisture which might be taken up in any degree, will not be communicated through the sole, even if the middle portion of the leather should not be thoroughly impregnated. This is because the thorough impregnation of the upper surface of the sole leather will prevent transmission of moisture to the inside of the shoe. This advantage is still true after the shoe has been worn so long that the under thoroughly impregnated surface has been worn away. The upper surface still remains in condition to prevent the transmission of moisture to the inside of the shoe, because none of the substances applied are volatile.

When the leather being treated is to be used not for boot and shoe soles, but articles where there is little or no surface wear, I have found that one treatment in the first bath at a low heat, for a long immersion, followed by the treatment described in an open low-heated oven or receptacle will give permanent pliability to the leather and prolong its life.

I have found it very essential to employ only the very best quality of petrolatum, and that perfect absorption can only be obtained by this refined article. Even of this grade, I find that only the "short," as it is technically called, can be used successfully. Grades that are at all stringy will not answer. The grade of paraffin wax employed, is that referred to as "test 128–140." These two substances effect a perfect union with each other, and cause no possible harm to the leather. The leather absorbs them perfectly, without parting with its characteristic odor, and it will always remain flexible or pliable, and capable of being worked up into manufactured articles, by the usual manipulations or treatments or processes of manufacture.

I find an essential advantage is shown when the leather treated as described is being stitched by machinery with a waxed thread. The waxed thread is used while warm. The warmth of the waxed thread serves to act upon the substances in the leather so as to seal each stitch and make the sewing water-proof.

The ordinary heating used in burnishing, after the edges of the sole have been inked, seals the coloring matter and by the same operation brings the water-proofing substances to the edge surfaces of the sole.

As has been stated, the two compositions effect a perfect union with each other although they are successively applied to the leather. The first composition contains an excess of petrolatum and imparts pliability

or flexibility to the leather, as has been stated. The nature of petrolatum, however, is such that it is liable to exude or be worked out from the leather in use. The composition in which the leather is next immersed contains paraffin in considerably greater proportion than the composition in which the leather was first immersed and said paraffin, owing to its crystalline nature, remains in the surface portions of the leather, and confines in the body of the leather all the composition material previously applied, and hence the capability of the leather to retain its moisture-proof quality is insured.

While I have referred particularly to the waterproofing material or composition consisting of petrolatum and paraffin, I do not limit myself strictly thereto, as other equivalent waterproofing materials or compositions capable of attaining the objects stated, may be substituted therefor.

Owing to the fact that the leather is impregnated with water-proofing material, the stitches and stitch holes are rendered impervious to moisture, this resulting from the action upon the waterproofing material of the warmed or heated sewing strands.

I claim:—

1. The method of rendering leather pliable and waterproof, consisting in immersing it successively in dissimilarly proportioned compositions of petrolatum and paraffin, the proportion of petrolatum in one composition being in excess, to impart flexibility to the leather, and the proportion of paraffin in the succeeding composition being considerably in excess of that in the preceding composition, to increase the durability of the resistance to moisture and to confine the before-applied composition.

2. The method of rendering leather pliable and waterproof, consisting in immersing it successively in dissimilarly proportioned compositions of petrolatum and paraffin, the proportion of paraffin in the composition used for the second immersion being greatly in excess of that in the first used composition, to increase the durability of the resistance to moisture.

3. The method of rendering leather pliable and waterproof, consisting in impregnating substantially the entire body of the leather by a composition consisting of petrolatum and paraffin in substantially the proportions of three parts of the former to one of the latter, and then impregnating the surface portions of the leather by a composition consisting also of petrolatum and paraffin in substantially or nearly equal parts.

4. As an article of manufacture, leather impregnated with petrolatum and paraffin, the proportion of the paraffin relatively to the petrolatum being greater in the surface portions of the leather than in the intermediate or body portion.

5. The method of rendering leather pliable and waterproof, consisting in impregnating it successively with dissimilarly proportioned compositions of hydrocarbons possessing respectively the qualities of imparting flexibility to the leather and waterproofing it, the proportion of the hydrocarbon which possesses waterproofing qualities being in excess in the later used composition over that in the previously applied composition.

6. As an article of manufacture, leather impregnated with successive compositions, each composition being composed of different hydrocarbons possessing respectively the qualities of imparting flexibility to the leather and waterproofing it, and the composition used for the later impregnation having a larger proportion of the waterproofing composition than the previously applied composition.

In testimony whereof I have affixed my signature, in presence of two witnesses.

JOHN WESLEY BARBER.

Witnesses:

A. W. HARRISON,

P. W. PEZZETTI.