

# UNITED STATES PATENT OFFICE.

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## PROCESS OF LEATHER MANUFACTURE.

SPECIFICATION forming part of Letters Patent No. 618,722, dated January 31, 1899.

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*To all whom it may concern:*

Be it known that we, ERNEST EDWARD MUNRO PAYNE, residing at Aylesbury, in the county of Buckingham, and JOHN PULLMAN and EDWARD ENGLAND PULLMAN, residing at London, in the county of Middlesex, England, all subjects of the British Queen, have invented certain new and useful Improvements in Processes of Leather Manufacture; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention consists in novel improvements in the process of forming leather from skins, furs, hides, pelts, or parts thereof, prepared in certain manners by the action of certain chemicals in various conditions of mixture or chemical combination, or both.

We are well aware that in certain processes of leather dressing or manufacture the action of one of the chemicals which we employ in the present invention is well known—that is to say, formic aldehyde, ( $\text{CH}_2\text{O}$ ), which it has been proposed to use in such processes; but the present invention consists, essentially, in using the said formic aldehyde, or in some cases other aldehydes, in combination with certain other substances, so as to effect the formation of leather by means of the action of certain compounds of formic aldehyde and of other aldehydes, together with other materials—such as alkaline carbonates, alkaline hydrates, alkaline earths, and other compounds of an alkaline reaction—singly or mixed, upon the fibrous tissue of skins, furs, hides, pelts, or parts thereof, which leather cannot be produced by the action of these aldehydes alone upon the said skins, furs, hides, pelts, or parts thereof. Moreover, certain aldehydes, other than formic aldehyde, in their pure state have not up to the present time been used in the preparation of leather on a commercial or manufacturing scale, and a part of the present invention relates to the use of these aldehydes, other than formic aldehyde, in conjunction

with each other or in combination or admixture with other chemical substances of alkaline reaction. For example, we make use of acetaldehyde, acrylic aldehyde, (acrolein,) and various other known aldehydes or their polymers of such a kind as will combine with the collagen contained in the hides or skins to form an insoluble compound, each one producing a different chemical combination, but at the same time of commercial value in the production of leather, some being white and others of other colors, used in substantially the same way as formic aldehyde—that is to say, a solution containing substantially the proportion of aldehyde mentioned below—and enough sodium carbonate or equivalent compound of alkaline reaction to keep the solution neutral is used.

In carrying out the invention there are many details to be observed in the preparation of the skins, furs, hides, pelts, or parts thereof which are capable of great variations in order to obtain those results which are required for commercial purposes; but we will now proceed to give some few examples in detail of the manner in which the invention may be carried out, adding an outline of its general application in the art of leather dressing or manufacture.

Our invention is also applicable to skins, furs, hides, pelts, or portions thereof which are already in certain states of combination as leather, either partly or completely, or which are intended to be treated by some other known process of leather dressing or dyeing, coloring, &c., such as are known in the art as “tanning,” “tawing,” “chroming,” “oil-dressing,” “dyeing,” and “coloring.”

We do not confine ourselves to any special kind of machinery or apparatus to be employed in carrying out the invention, but we find that the ordinary revolving drum of about three hundred gallons' capacity and the ordinary paddle of about the same capacity are suitable, and in them good commercial results may be obtained.

As an example of the manner in which we



employ the compound or mixture of formic aldehyde with other substances or their combined action we give the following: We take four hundredweight, or thereabout, of skin, 5 fur, hides, pelts, or portions thereof, prepared in the well-known ways by suitable washing, liming, bating, purging, or drenching, and we treat them in a closed revolving drum containing from one hundred to one hundred 10 and twenty gallons of water (preferably distilled, though ordinary water will suffice) at a temperature of about 100° Fahrenheit. In successive quantities we then add a mixture of formic aldehyde ( $\text{CH}_2\text{O}$ ) in aqueous solution, of thirty per cent. or stronger, and sodium 15 carbonate, ( $\text{Na}_2\text{CO}_3$ ), the mixture being made in about the following proportions and being termed by us "dressing liquor:" Formic aldehyde, (containing thirty-six per cent.  $\text{CH}_2\text{O}$ ), 20 about sixteen pounds; sodium carbonate, (eighty per cent.  $\text{Na}_2\text{CO}_3$ ), about thirty-two pounds, and water, (preferably distilled,) a sufficiency—that is to say, from ten to fifteen gallons or even less may be used, so long as 25 enough water to make a perfect solution is used. This solution or dressing liquor is added to the contents of the drum while still revolving in quantities varying from one or 30 or more gallons at a time at intervals of fifteen or more minutes, it being essential that the whole be not added at once, in which case the result produced would be not so good commercially. According to the thickness and receptive power of the material operated 35 upon the length of time varies which is required to produce the most perfect results. For light goods from three to six hours are sufficient and for heavy goods from twelve to forty-eight hours; but we do not confine 40 ourselves to any precise length of time. When the goods are showing leather to a sufficient extent, we find it advantageous to increase the temperature to about 118° Fahrenheit, a better loosening of the fatty matter 45 contained in the materials operated upon and a more even result being thus obtained. Having obtained the goods in this condition, we find that the sodium carbonate (or other alkali, alkaline carbonate, or alkaline earth) 50 is retained ultimately by the material and if allowed to remain therein would be detrimental to the strength of the finished product. In order to remove this alkali, alkaline carbonate, or alkaline earth, we submit the goods, 55 in a revolving drum or paddle, to the action of any solvent, preferably ammonium sulfate, ( $(\text{NH}_4)_2\text{SO}_4$ ), of ninety-five per cent., in the proportion of about sixteen pounds dissolved in about one hundred or one hundred and twenty 60 gallons of water, preferably distilled, at a temperature of about 100° to 120° Fahrenheit. The goods are then withdrawn and inserted, paddled, or drummed and nourished in a solution of soft soap, ten pounds, (commercial 65 soft soap, containing about sixty-six per cent. potassium soap, we find answers well,) and

common salt, or chloride of sodium, ten pounds, or in approximate proportion, dissolved in about eighty gallons of water, preferably distilled, for a longer or shorter time, 70 about three hours being found sufficient for light goods and about six hours for heavy goods. The goods may then be dried forthwith and finished.

Having now described the manner in which 75 the compound or mixture of  $\text{CH}_2\text{O}$  (formic aldehyde) with  $\text{Na}_2\text{CO}_3$  (sodium carbonate) may be used and a result produced totally different from that which can be obtained by the use of formic aldehyde alone, we will mention 80 some of the other aldehydes and other chemicals or substances which may be used to obtain other results in combination. In each case we take the molecular weight of the chemicals employed and keep the respective 85 amounts used about chemically proportionate to those already mentioned. Aldehydes: acrolein, (acrylic aldehyde,) ( $\text{C}_3\text{H}_4\text{O}$ ;) acetaldehyde, (ordinary aldehyde,) ( $\text{C}_2\text{H}_4\text{O}$ ;) propionic aldehydes and other aldehydes and their 90 polymers; fixed alkaline carbonates; fixed alkaline hydrates, and fixed weak alkaline compounds, such as saponaceous and other compounds of alkaline constitution. The alkaline 95 earths used are in the state of oxid or hydrate—for example,  $\text{CaO}$ , (oxid of calcium;)  $\text{Ca.2, (HO)}$ , (hydrate of calcium;)  $\text{MgO}$ , (oxid of magnesium;)  $\text{Mg.2, (HO)}$ , (hydrate of magnesium,) and other suitable salts, or these salts produced within the material itself by 100 metathesis, such as magnesium hydrate, ( $\text{Mg.2 (HO)}$ ) produced by the action of  $\text{NaNO}$  (caustic soda) upon  $\text{MgCl}_2$ , (magnesium chlorid.)

Having fully described our invention, what 105 we desire to claim and secure by Letters Patent is—

1. The process of manufacturing leather, which consists in subjecting hides or skins to the action of a solution containing formic 110 aldehyde or its equivalent, and a compound of an alkaline reaction, substantially as described.

2. The process of manufacturing leather, which consists in agitating hides or skins in 115 water and adding thereto successive portions of a solution containing formic aldehyde or its equivalent, and a compound of alkaline reaction, substantially as described.

3. The process of manufacturing leather, 120 which consists in agitating hides or skins in warm water, adding successive portions of a solution containing formic aldehyde and a compound of alkaline reaction and heating the liquid in which the hides or skins are im- 125 mersed at or near the close of the tanning operation, substantially as described.

4. The process of manufacturing leather, which consists in subjecting hides or skins to the action of a solution containing formic 130 aldehyde or its equivalent, and a compound of alkaline reaction, and at the close of the



tanning operation removing the excess of said solution from the hides or skins, substantially as described.

5 The process of manufacturing leather, which consists in subjecting hides or skins to the action of a solution containing formic aldehyde and a compound of alkaline reaction, heating the liquid to which the skins are subjected at or near the close of the tanning operation, and removing the excess of the tanning solution by agitating the hides or skins in a solution of ammonium sulfate, substantially as described.

15 6. The process of manufacturing leather, which consists in subjecting hides or skins to the action of a solution containing formic aldehyde and sodium carbonate, substantially as described.

20 7. The process of manufacturing leather, which consists in agitating hides or skins in warm water and adding thereto successive portions of a solution containing formic aldehyde and sodium carbonate and raising the

temperature at or near the close of the tanning operation, substantially as described. 25

8. The process of manufacturing leather, which consists in agitating the hides or skins in warm water, adding thereto successive portions of a solution containing formic aldehyde and sodium carbonate, raising the temperature at or near the close of the tanning operation and removing the excess of said solution by the action of ammonium sulfate, substantially as described. 30

In testimony whereof we have hereunto affixed our signatures in presence of two witnesses. 35

ERNEST EDWARD MUNRO PAYNE.  
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Witnesses:

L. WENGER,  
WALTER ERNEST SYKES.