ON TANNING AND LEATHER-DRESSING.

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Every one knows that a skin, recently stripped from a sheep, an ox or any other quadruped, is tough, flexible and elastic; and, while in that state, may be fitted as a covering or article of dress to any part of the human body. As it dries, it shrinks, becomes hard like horn, and will no longer adapt itself to the free motion of the parts that it covers. There are various processes whereby the original flexibility or suppleness of the skin may be restored to it and even rendered permanent. Skin thus treated is converted into leather, a word obviously derived from the adjective *lithe*, supple. The primary idea, therefore, conveyed by the term leather, is that of flexibility; and when we speak of skin made into leather by tanning, tawing, or dressing in oil, we mean that it is rendered lithe by these processes, and consequently is fitted for use.

The English verb to tan and the French *tanner*, are plainly derived from the low Latin *tanare*, which has the same signification; but the origin of this latter word is not very clear: perhaps it is only the Greek word τανυειν in a Latin form; a word which occurs thrice in a remarkable passage in Homer, in which he describes a process of leather-dressing very analogous to currying, and seems

to apply the word almost as a technical expression. If so, the primary meaning of to tan is to stretch, and it alludes to the manual labour of pulling, stretching, or handling the skin, whereby the entry into its pores of those substances which render it supple, is facilitated, rather than to the nature or specific action of the substances themselves.

The skins of all quadrupeds are capable of being made into leather; but some are too small for use, and others are more valuable with the hair or fur remaining on them unaltered, than they would be in the state of leather. I shall, therefore, now proceed to enumerate the kinds of skins on which, in this country at least, the arts of the tanner and of the leather-dresser are employed.

Of our domestic cattle of the species ox, the bull-hide is thicker, stronger, and coarser in its grain, than that of the cow; the hide of the bullock, or castrated bull, is intermediate in quality between that of the male and female. Besides the skins of this species that are of home growth, large quantities of cow-hides are brought from South America, the produce of the half-wild cattle of European extraction which pasture on the extensive plains extending from Buenos Ayres towards the Andes.* The thickest and most substantial leather now in use is made from the hides of animals of this species, and is employed for shoe and boot soles, for most parts of harness and saddlery, for leathern trunks and buckets, hose for fire-engines, pump-valves, soldiers' belts, and gloves for cavalry.

* In the year 1829 there were imported 286,416 cwt. of hides, of which
166,400 were from South America,
24,000 ..... North America,
66,000 ..... Russia, Denmark, Germany, and the Netherlands.

Formerly, when metallic armour was going out of use, but while it was still considered advisable to cover the body in battle with a better protection than ordinary clothing, a species of very thick but pliant leather was made from the hide of the urus, or wild bull, at that time plentiful in the forests of Poland, Hungary, and the middle and southern provinces of Russia. The name by which this animal was commonly known was that of Buffe, whence is derived the term buff-leather as designating the hide of this animal prepared in a particular way. The Russia Company, which was chartered by Henry VIII., was obliged to import a certain number of "buffe-hides," which were manufactured into leather for military use. Real buff-leather would turn the edge of a sword and was pistol-proof. The time of its principal use in this country was during the great civil war in the reign of Charles I., after which it gradually declined and at length became obsolete. Besides the hides of the urus, I believe those of the real buffalo of Italy were employed for the same purpose. The buff-leather of modern times is prepared from cow-hide, and is used for little else than soldiers' belts.

The skins of calves are thinner than those of cows, but thicker than most others that are employed. When converted into leather by tawing, they are used by book-binders; but they are generally first tanned and then curried, and in this state form a very compact, soft and flexible leather, of which the upper parts of shoes and boots are made. In a lot of calf-skins several will be found defective, having been cut through in different places, owing to the carelessness of the butchers' boys while flaying the animal. A fine used to be levied on all such skins offered to sale by the butchers, and, being enforced with moderate strictness, either prevented the

skins from being injured, or at least excluded such from the market. A few years ago this fine was abolished, it appearing to the legislature that the interest of the butcher was of itself sufficient to prevent any unnecessary injury being done to the skins in the process of stripping them. The fact, however, has been, that, since the abolition of the fine, the proportion of defective skins, especially of calves, has very greatly increased, so as to amount, if I am rightly informed, to about one-fifth of the whole supply. Now, when we consider that the cost of the manufacture and the amount of the excise duty are precisely the same on defective as on perfect skins, and that the prime cost of the skin bears only a small proportion to the sale-price of the leather made from it, we shall probably be of opinion that the re-enactment of the old law would be of public advantage.

It used to be the custom in the south-west of Ireland to slaughter many cows while in calf. The skins of these unborn calves were of extraordinary fineness and delicacy, and from such was prepared the leather of which the celebrated Limerick gloves were made. This practice, however, is now almost discontinued, and whatever merit the Limerick gloves may still possess, is owing to the skill of the manufacturer and not to the superiority of his raw material.

Of sheep-skins, by far the greater number are of home growth; many thousands, however, are imported by a London house from the colony of the Cape of Good Hope. These latter are of the fat-tailed variety, and in quality are considerably superior to the English, being nearly equal to goat-skins. They are at once distinguishable from the common sort by the width of the skin that covered the tail being nearly equal to that which covered

the neck; whereas, in the common sheep-skin, the neck is two or three times as wide as the tail.

English sheep-skins vary much in quality. Hill sheep produce a finer and stronger skin than the lowland or marsh sheep; but the chief difference arises from the state of the wool at the time when the animal was slaughtered. A sheep whose skin is covered with a thick heavy fleece has to furnish a large quantity of matter for the growth of the wool, as well as a large quantity of oil or grease, technically called *yolk*, the effect of which is to render the wool supple and prevent it from being soaked by the rain. A long fleece, therefore, always indicates a thin skin; much of the jelly laid up in that organ being, perhaps, the material from which the oil is elaborated. As soon as a sheep has been sheared the air comes in contact with the cuticle, checks the perspiration and expenditure of the skin, and allows the jelly to accumulate; which it does so rapidly, that, if a parcel of sheep encumbered with long fleeces are driven up to London from a distance of a few days' journey, and if part of them are slaughtered immediately on their arrival and the remainder are sheared and slaughtered two days afterwards, the skin of the latter will be nearly twice as thick as that of the former.

Raw sheep-skins used to be liable to a duty when exported; the consequence of which was that scarcely any were sent out of the country except in the state of leather; but, of late, that duty has been taken off, and the exportation of raw sheep-skins has become considerable. They go chiefly to Flanders and to the United States of America, where they are manufactured; a considerable number of English artisans, in the various departments of leather-dressing, having recently established themselves in these countries.

Sheep-skin, simply tanned, is employed for leathering bellows, for common book-binding, and for various other purposes in which a thin cheap leather is wanted. All the whit-leather, as it is called, is of sheep-skin; and is employed for whip-lashes, for bags, for aprons, &c. The cheaper kinds of wash-leather, for breeches gloves under-waistcoats and other articles of dress, are of sheep-skin; of the same material are most of the coloured and dyed leathers and mock morocco, used for women's shoes, for covering writing-tables stools chairs and sofas, for lining carriages, &c.

Lamb-skins are chiefly of home growth, but are also brought in great numbers from Tuscany and other parts of the north of Italy, and from Sicily.* They are for the most part dressed white or coloured for gloves.

The skins of goats and kids are the material of the best kinds of light leather. [A few are procured from Wales, more from Scotland, and still more from Ireland. About 50,000 of these skins are prepared annually in Dublin, and perhaps as many, also of Irish growth, are sent to London.

But the great supply of kid-skins, and of the best quality, comes from Switzerland and Tuscany,† being shipped chiefly at Leghorn, as that of goat-skins is from

* Total number of lamb-skins imported in 1829, 1,888,000, of which 1,497,000 came from Italy and Sicily, and 239,000 from Spain.

† Total number of goat-skins and kid-skins imported in 1829:—

306,000 goat,
106,000 kid.

Of the former, 104,000 came from Barbary,
87,000 ... Cape of Good Hope,
36,000 ... France.

Of the latter, 82,000 came from the Italian ports,
16,000 ... Spain.

the Barbary coast and the Cape of Good Hope. The finest white and coloured leather, for gloves and ladies' shoes, is of kid-skin; and the best dyed morocco, of all colours, is goat-skin. When the walls of rooms were furnished with movable hangings, goat-leather, flowered or gilt in various patterns, was a fashionable and valuable material.

Deer-skins are partly furnished by our own parks; but the principal supply is from New York and New Orleans; a few come from Canada, and some from India; these latter are, on the whole, reckoned the best. Some antelope-skins of good quality are imported from the Cape of Good Hope.* All these are shamoyed or dressed in oil, and are used chiefly for riding-breeches.

Till a few years ago, there was an immense quantity of the skins of sheep goats and deer shamoyed in England. Breeches of this article, either white or dyed, were commonly worn by persons whose occupations or amusements led them to be much on horseback. They were worn by most of the cavalry of Europe, and the English shamoyed leather being of extraordinary good quality, was employed in clothing not only our troops, but the cavalry of Prussia, Austria, and most of the other German states.

In the campaigns in Spain during the last war, it was discovered by the British commander that the health of the horse-soldiers was seriously affected in wet weather by the leather that they wore, which, fitting close to the skin and being long in drying, chilled the men and rendered them liable to rheumatism and other diseases.

* In 1829, there were imported 123,000 deer-skins, of which
120,000 came from the United States,
1,780 ... Canada,
675 ... India.

Woollen cloth was accordingly substituted; and, the example having been followed by Austria and Prussia, this change has occasioned a great decline in that branch of the English leather-trade.

The hide of the horse is much thinner than would be expected from the size of the animal. It is prepared by tanning and currying; is used in harness-work for collars; and of late has been pared thin, and employed a good deal for ladies' walking-shoes.

The skin of the dog is thin but tough, and makes leather of excellent quality. The supply is entirely of home growth, and has fallen off so much of late years that at present it is in a manner extinct, and has been superseded, in part at least, as a material for thin dress-shoes, by horse-leather and by tanned rat-skins. Seal-skin is similar, but inferior, to dog-skin; it is employed for the same purposes, but its use has much declined of late years.*

Hog-skin affords a thin dense leather, employed entirely in covering the seats of saddles. It comes from Scotland and Yorkshire; for, though hogs are abundant in every part of the country, the general custom of cooking pork with the skin on greatly restricts the supply.

Having now gone through the list of those skins from which leather is made in this country, I proceed to consider the different modes or processes by which the several kinds of leather are prepared. In doing so I shall explain, as far as I am able, the chemical or mechanical changes produced in the skin, premising, however, that many important points have not as yet been investigated. These I

* The importation of seal-skins in 1829 amounted to 289,500, of which 227,000 came from Canada; but the greater part of these were employed as fur in covering caps, &c.

shall leave as I find them, being unwilling to supply by hypothesis what can only be really obtained from a careful comparison of well-observed facts.

I shall first describe in a few words the texture and composition of skin in general.

This organ consists of two parallel layers, the outer of which is called by anatomists *cuticle*, and the inner *cutis* or true skin. The cuticle is by far the thinner of the two; it is quite insensible, has somewhat the appearance of parchment, and, though closely adherent to the true skin, may be separated from it by various vital actions as well as by the combination of chemical and mechanical agents after death. The appearance of a blister is familiar to every one: it is occasioned by the effusion of a watery fluid between the cuticle and skin which thus separates the two; the skin of the blister, as it is called, being the insensible cuticle, and the highly sensitive red surface which forms the bottom of the blister, being the surface of the true skin. Chemically speaking, the cuticle is condensed albumen and differs in no material degree from horn or hair. It is not capable of combining with tan or of being converted into leather; and therefore one of the preparatory processes to which skin is subjected by the manufacturer is the separation of the cuticle. The true skin is of a semi-cartilaginous consistence when alive, becomes more or less horny and hard by drying, and by subsequent soaking in water it increases greatly in thickness, much in the same way as a cake of hard glue does in similar circumstances. If a piece of dried skin is bent repeatedly backwards and forwards in the same place, it will acquire an opaque whiteness in consequence of its separation into layers of irregular horizontal fibres. The same kind of structure may be developed by splitting the

edge of the skin when dry, and then tearing it up parallel to the surface. On examining it in this state it will appear to consist entirely of white glossy semi-transparent fibres, perfectly flexible, and somewhat elastic. In their chemical nature, they are considered as nearly identical with glue; for, by long boiling, skin may be almost entirely resolved into that substance. But, as the skin is an exceedingly sensitive organ, it is penetrated by an infinite number of nervous filaments: it also contains multitudes of minute veins and arteries, and of exhalant tubes through which the various perspirable fluids escape.

Skin is a substance not nearly so liable to spontaneous decomposition as muscular fibre; but when a number of damp hides are laid together, they will begin to heat in twenty-four hours, more or less according to the warmth of the air; a putrid odour is given out, and the result is, that the hides become tender and rotten and unfit for conversion into serviceable leather. This accident occasionally happens to imported hides in the hold of a ship, if they have not been previously well dried or if the air of the hold should be very damp and close.

As hides come into the hands of the tanner and leather-dresser with the hair or wool on them, the first process that they undergo (after washing in water to separate the blood and dirt) is that of taking off the hair. Now, the roots, as they are called, or the bulbous terminations of the hair, are inserted in the cellular membrane that lies at the bottom of the skin; and in order to get them out easily, it is necessary to weaken both the adhesion of the bulbs to the membrane as well as the close pressure which the skin exerts on that part of the hair with which it is in contact. This is done in two ways, either by the action of lime and water, the mode of operation of which is not very clear, or by such a degree of putrefaction as softens the

texture of the skin without weakening it in any injurious degree.

The same process that loosens the hair also loosens the cuticle, and likewise brings to the surface a quantity of slimy matter, the result probably of the decomposition of the nerves the capillary blood-vessels and other parts. The intention of the next series of operations is the farther cleansing of the skin from the impurities, and from the lime added in the previous process; the result of which, if properly performed, is a pure pelt, consisting merely of skin and having its pores sufficiently open to receive the materials by which it is to be converted into leather; for, up to this period, it is merely skin in a purer state than in the raw hide, but drying to a horny hardness and swelling considerably when afterwards steeped in water.

There are several ways of converting skin into leather; but they may ultimately be reduced to three, which may be applied either alone or in combination.

The simplest, most imperfect, and probably the earliest in use, is merely mechanical. It consists in first moistening the skin with water, and then, by dint of hard rubbing, forcing grease of any kind into the pores in proportion as the water evaporates. The oil is thus introduced among the fibres of the skin, rendering it supple, and, as long as it remains there, opposing the entrance of water and thus preventing it from swelling hardening or decomposing.

Thus Homer, in the passage that I have already alluded to (*Il.* xvii. 389*), describes "a man giving to his "servants to be tanned a great bull-hide drunken with

* Ὡς δ' ὁτ' ανηρ ταυροιο βοος μεγαλοιο βοειην
Λαοισιν δωη τανυειν, μεθυουσαν αλοιφη.
Δεξαμενοι δ' αρα τοιγε διασταντες τανυουσι
Κυκλοσ', αφαρ δε τε ικμας εζη, δυνει δε τ' αλοιφη,
Πολλων ἱλκοντων, τανυται δε τε πασα δια προ.

" grease. They surround the hide, and tug and strain it " this way and that in every direction; and as they pull, the " grease goes in and the water comes out." The native Indians in the country north-west of Canada practise a somewhat similar method, according to Hearne, of preparing their deer and buffalo-skins. They mix the brains and some of the softest part of the fat of the animal into a kind of lather, and soak the skin in it for some hours; they then take the skin out, rub it in their hands till nearly dry and afterwards hang it up in the smoke: after a few days it is taken down, well rinsed, and wrung out in water, and rubbed frequently while it is drying.

Another method of making skin into leather is by the action of vegetable astringents. The bark, the roots, and occasionally the leaves, of a multitude of plants, chiefly trees and shrubs, are astringent. By soaking them in hot or cold water an infusion is obtained, usually of a yellowish brown colour, which, when taken into the mouth, corrugates puckers or constringes the lips and every other soft part that it touches. It also has the property of hardening and thickening dead skin which has been exposed to its action. For a long time this was considered as a mere mechanical effect; but, about the beginning of the present century, M. Seguin, a French tanner and man of science, discovered that if a solution of glue or jelly is dropped into an infusion of oak-bark of gall-nut or of any other vegetable astringent, a brown insoluble precipitate falls down, which is a combination of the jelly with a peculiar substance contained in the infusion, and to which, on account of this property, he gave the name of *tannin*, or tan. But, besides tan, there are two other substances contained in astringent infusions; one of these is called gallic acid and, as well as tan, has the property

of giving a blue black colour with salts of iron; the other is extract, a substance common to all vegetable infusions. Skin that has been tanned, although by no means impenetrable to water, swells scarcely at all by imbibing it, and appears to be insoluble in that fluid either cold or hot. These properties are owing to the combination of tan with the jelly of the skin. It also becomes black when rubbed over with a solution of green vitriol or of any other salt of iron, which property it owes partly to the tan and partly to the gallic acid. The flexibility which the tanned leather retains is no doubt owing, in a considerable degree, to its fibrous texture, and perhaps in part to its combination with some of the extract; at least, we are certain that the compound of glue and tan when dry is perfectly brittle, and that leather made in a strong infusion of tan with but little extract is harder than common, and very liable to crack on the surface.

If a piece of prepared skin be immersed for some days in a moderately strong infusion of oak-bark, and then be taken out, washed, and dried, it will be found, on cutting a piece off, that the surface only has been tanned, the inside being still in the state of skin. Another piece being then put into the same infusion for the same time as the first, will be found to be still less tanned than that. Hence the necessity of refreshing the tan liquor from time to time by additions of bark, or of removing the hides from an exhausted infusion to a stronger one, in order to complete the tanning. As the process goes on, the change of skin into leather penetrates deeper into the hide, the interior layer of skin becomes narrower and narrower and at length, when the process is completed, entirely disappears; I say at length, because the operation of tanning is a very slow one. The heavy bullock-hides cannot be

converted into good leather in less than fifteen months, and other skins in proportion. Many attempts have been made to shorten the time, but on the whole without much success. On trying the very obvious method of increasing the strength of the infusion of bark, the leather, though finished in a shorter time, was found to be proportionally harder and liable to crack. By employing the infusion warm, a similar gain in time, but deterioration in quality, has been the result. Even Mr. Spyllsbury's very ingenious plan of employing weak infusions, and forcing them by artificial pressure through the pores of the skin, failed of success.

Tanned leather is sold by weight, and this is a strong inducement to the manufacturer to make his hides gain as much weight as possible in the tan-pit, even at the expense of the toughness or compactness of the leather. Weak infusions not only take longer time to produce their effect but also give a leather of less weight. It is true that the quality of such leather is excellent, but it will rarely command a price in the market to compensate the greater expense of its preparation.

The third method of converting skin into leather is by the use of alum. I am not aware that any experiments have been made in order to shew precisely the action of this salt on skin. We know, however, from the employment of alum in dying, that it is capable of combining both with animal and vegetable fibre, and may conclude that it acts a similar part towards the fibre of skin. But alum is never used alone for this purpose; and whatever more may remain to be said concerning this substance will come more conveniently hereafter.

I now proceed to detail, as far as my plan and the time will allow, the methods practised in this country of

preparing the different kinds of leather. It is hardly necessary to remark, that in so doing it is not my intention to teach the arts of tanning and leather-dressing, but to confine myself to such particulars as are of most importance and best worthy of being made the objects of a liberal curiosity.

The heavy hides, that is, ox cow and calf-skins, and some sheep-skins, are made into leather by tanning; and there are two preparatory processes, to one or other of which they are submitted, before they are placed in the tan-pit. One way is to mix together quick-lime and water to the consistence of cream, and to put the hides into this mixture after they have been washed in water and pared on the flesh side with a two-handled drawing-knife, in order to separate the bits of fat, flesh, or membrane that adhere to it. The hides remain in the lime-pit for several days, being stirred about from time to time, and are then taken out and placed, one by one, on a semi-cylindrical block of wood or stone, called the beam, where they are scraped on both sides with a blunt draw-knife: the hair is removed by this operation, and the hide is well washed in order to get out as much as possible of the lime. For hard shoe-soles and for pump-valves it is advisable to leave some of the lime in the skin; such, therefore, are less accurately washed than the others: the skin comes out of the lime much thickened and very hard. It is next put into the mastering-pit, which contains a mixture of water and dogs' dung; and if enough of this latter article cannot be had, its place is supplied by the dung of pigeons or domestic poultry, or, still better, of sea-birds. In the mastering-pit the skin becomes thinner soft and supple; and if kept here too long, its texture is irrecoverably destroyed, it being reduced to a tender gela-

tinous mass that may be pulled to pieces with great ease. The effect produced on the skin in the mastering-pit has been attributed, perhaps without sufficient examination, to the putrefactive effect of the dung. The hide is then washed, well cleaned on the beam, and is thus brought to the state of pelt.

The thickest skins, and those intended for the toughest leather, in which lime, from its hardening quality, would be injurious, are prepared in another way. After being well washed, they are folded up lengthwise and placed in a close chamber. Here they soon begin to heat and exhale a somewhat putrid ammoniacal vapour, the evidence of spontaneous decomposition having begun. When this has proceeded a certain way, the hides are laid on the beam and the hair is readily detached with a blunt knife, its adhesion having been loosened by the foregoing process. They are then immersed for several days in sours, that is, in a mixture of rye or barley flour and water fermented till it has become sour. The hide comes out of this bath considerably swelled and softened; and if kept too long in it the texture of the skin is much injured. As a cheaper and less hazardous sour liquor, sulphuric acid and water, in the proportion of a pint of the former to fifty gallons of the latter, is often employed. In this the hide may be kept a long time without injury, and it comes out thicker and harder than when it was put in. By the methods that I have now described, the skin is brought to the state of pelt; that is, it has been cleared of the hair and of all impurities, and its texture is more or less opened to facilitate the penetration of the tan, which is the next process. The hide is first put into a pit containing nearly-spent ooze, that is, an infusion of oak or chestnut bark, in which hides have already lain, and which

therefore has lost more or less of its tan. In this pit they are frequently stirred or handled, to equalize the infusion in every part of the pit and to facilitate its penetration into the pores of the skin. From weak infusions they pass successively into others that are stronger, finishing with the strongest of all. When the whole interior line of unaltered skin has entirely disappeared, the hides are thoroughly tanned: they are then taken out of the ooze, rinsed in water, are partly dried, and then are laid on a wooden beam, called a horse, where they are beaten in order to render the leather compact, or are passed between rollers which answers nearly the same purpose; lastly, they are dried in an airy loft, and are then fit for market.

Of this leather, that which is employed for the soles of shoes and boots, and for some other purposes, undergoes no farther preparation; but that which is required to be supple and soft is afterwards dressed in oil, or, in other words, is curried. The process of currying consists, in few words, of steeping the leather in water, of covering one surface with a mixture of oil tallow and grease, and then stoving it. As the water evaporates, the oil takes its place in the pores of the leather; the grain side is then rubbed with a solution of sulphate of iron in order to blacken it, and the leather is completed by beating and passing between rollers to smooth its surface, and to render it at the same time compact and flexible. Many sheep-skins, for gloves and other purposes, are prepared by a combination of tanning and aluming, forming tawed leather, which is generally done in the following manner, as I am informed by Mr. Savage, of Chiswell Street, who is largely concerned in this branch of the trade: —

The skins, after being soaked in water, are painted over on the flesh side with a batter of lime and water, are

then rolled up and kept so for twenty-four hours; the wool is thereby loosened, and is easily stripped off. The skin is next drenched in bran and water, in order to soften it by getting out the lime; after which it is put into a weak ooze, and then into two others, each stronger than the preceding, till it is stained of a good brown colour and is half tanned. It is then soaked for some days in a strong solution of alum and common salt; is afterwards washed in water, and then dried. The common white, or whit-leather, is also prepared in the same way, but omitting the tanning.

For the finer kinds of tawed and dyed leather, more care and a somewhat more elaborate process are required. Messrs. Bevingtons, of Bermondsey, stand, I believe, the highest, or at least among the highest, in this department of leather-dressing; and to their liberality I am indebted for the following particulars, obtained on a visit to their manufactory. The skins employed by them are those of sheep, goats, lambs, and kids. The essential foundation of success in the finer kinds of leather-dressing is the perfect purity of the pelt; for, wherever a particle of dirt or lime is allowed to remain, there will be a speck or flaw. The purity of the water employed in rinsing the skins is also a matter of considerable importance. The manufacturers whom I have just named have derived great advantage from a boiler larger than what is absolutely required for their steam-engine, as, by means of it, they get a sufficient supply of warm distilled water.

The skins are first steeped in cold water, and are then fleshed on the beam in order to separate the dirt and grosser impurities. The sheep and lamb skins are then hung up in a close chamber till they heat and their texture is sufficiently loosened to allow the wool to be

stripped off. The sheep-skins are then put under an hydraulic press, by the action of which a considerable quantity of tallow is squeezed out. The next process is liming. In this the skins are first put into a nearly exhausted lime-pit and then transferred to a stronger one; here they are frequently worked about with poles, to expose every part of the surface to the action of the lime, and remain here for a fortnight or six weeks, according to the nature of the skin.

The goat and kid skins are put into the lime after being simply washed, their hair being of little value and not liable to be injured by the lime as wool is. From the lime-pit the skins are transferred to the beam, where they are scraped with a draw-knife and soaked at intervals in warm water, in order to get out the whole of the slime. They are then transferred to a bath of bran and water in a state of gentle fermentation, where they remain for some weeks, being from time to time dressed on the beam, and washed out in warm distilled water. By this means they are brought to the state of pure pelt, delicately white, semi-transparent, and without a spot.

Those pelts that are intended to be tawed are then put into a solution of alum and salt, in the proportion of three parts of alum to four of salt. The solution is employed blood warm, and the skins remain in it till they are saturated: they are then taken out, washed in cold water, and again put into a bath of fermenting bran, where they remain till they become soft and pliable. After this they are washed and stoved till quite dry, and some sheep-skins are used in this state. The lamb and kid skins undergo a farther process, which commences by soaking them in warm water, wringing them out, and then putting them in a wash-wheel, into which is poured a mixture

of the consistence of batter, composed of meal eggs salt and alum: a gentle motion is given to the wheel, and by degrees the whole of these ingredients are absorbed by the skins, nothing but a watery fluid remaining: the substance of the skins and the softness of their feel are increased by this. They are then hung up in a loft, and when about half dry are put into a stock-mill with a quantity of dry bran: here they are beaten for some hours, after which they are finished by working them on a blunt semicircular knife set upright in a post. The eggs are brought from France, and are preserved for use in lime-water. More than a million eggs are imported weekly into London from France and Flanders for domestic use, and for the manufactures in which they are employed: they are absolutely indispensable in the preparation of white lamb and kid leather; and one reason why the English leather of this description is at present fully equal to the French, is the abundance and consequent cheapness of an article, the demand for which can never be adequately supplied from our own sources.

The dyed leathers are of sheep or goat skin. The former, technically called roan, is far inferior in strength and softness to the latter, which bears the name of morocco, because it was at first offered in the market as a substitute for, or imitation of, the dyed goat-skins prepared in Morocco and other parts of the north of Africa.

The skins worked and limed, as already described, are then put not into fermenting bran, but into a bath of dogs' dung; after which they are worked on the beam, and washed, and thus brought to the state of pelt. Next, they are sewn into bags, the grain side outwards, and are put into a warm-bath of colouring matter; for the red, cochineal is employed, indigo for the blue, archil for the

purple, &c. In this bath the bags remain till the colour has struck. Into the bags dyed red a handful of sumach is put; the opening is again sewed up, and the bags are floated in a warm-bath of sumach till they are thoroughly tanned. For the other colours the pelt is first tanned with sumach, and afterwards dyed. Lastly, the skins are dried in an airy loft, and are finished by spreading them on an inclined board; then rubbing them slightly with oil, and afterwards giving the grain by rubbing them hard by hand with a ball of box, on the surface of which are a few raised lines or ribs.

Another kind called wash-leather or Shamoy, remains to be described. The subjects of this operation are deer and sheep skins, and they are essentially distinguished from other kinds of leather in being dressed in oil without salt or alum, and without tanning, and in the grain of the skin being taken off. Of such leather, the best kinds are used for riding-breeches, the inferior kinds for under-waistcoats, for straps pads and similar articles sold by the surgeons' instrument-makers, and a variety of other purposes.

The skins are brought to the state of pelt by liming, washing, and working on the beam, as already described; after which those skins that are intended to be buff colour are steeped in spent ooze, not to tan, but merely to dye them. They are next *frized,* which is done by wrapping one end of the skin over a pole, the grain side being uppermost; then scraping away the whole surface by the application of a round knife, or a rubber of pumice-stone; the former is chiefly used to sheep-skins, the latter to deer-skins. The removal of the grain not only affords a much softer surface but greatly increases the extensibility of the leather, which still remains sufficiently strong and

elastic for the uses to which it is put. The skins, after being frized, are wrung out in water, and are then put into a mill where they are beaten by the stocks till most of the water has come away, and oil is then poured in, and the milling is continued till the oil has been totally absorbed by the leather and all appearance of greasiness on the surface has vanished. The skin is then stoved in order to dry it and to promote a more intimate combination of the oil; after which it is scoured in a weak solution of potash in water, by which whatever excess of oil may have remained in the leather is extracted. Finally, it is washed in water, dried gently, and smoothed and suppled by passing it between rollers.

I shall conclude the subject by a short description of the method by which that singular and valuable substance called Shagreen is prepared. It can hardly be called leather, for it is in the state of skin, and is used, or rather was used, for covers of watch-cases and other similar purposes. Astrakan is the seat of this manufacture. The material is the strong skin that covers the crupper of the ass or the horse. The skin is first soaked in water for some days till the hair is loose enough to be scraped off; after which it is cut and scraped till it becomes scarcely thicker than a hog's bladder. It is then, while wet and soft, fastened to a frame, the flesh side undermost, and the upper or grain side is strewed over with the hard round seeds of a species of chenopodium; a felt is then laid over it, and the seeds are trodden deeply into the soft yielding skin. The frames are then placed in the shade till the skin becomes dry and the seeds will shake out of their holes. Next, the skin is rasped till the sides of the holes are worn down almost to a level with their bottoms: it is then soaked, first in water, and afterwards

in an alkaline lie; and, as it becomes soft, those parts of the skin which were merely depressed by the seeds being forced down upon them, rise above the parts which had been rasped, presenting a granular pustular surface. The skin is then stained superficially of a green colour by copper filings and sal ammoniac, and is afterwards allowed to dry: lastly, the grains or warts are rubbed down to a level with the rest of the surface, which thus presents the appearance of white dots on a green ground; and when polished is very beautiful as well as durable.