Franz Hoffmann Company – Fine leather

A Brief Guide to Leather

J. J. Dargel

Rawhide

A difference is made between hides, skins and furs. Hides come from a large animal, e.g. a bullock or cow; skins come from smaller or young animals, e.g. calf, sheep, goat, lamb; fur comes from small animals e.g. hares, rabbits, foxes. The fur is removed by cutting at the rear legs and pulling it over the animal's head.

Rawhide is made up of three basic layers: the epidermis, the dermis and the subcutaneous tissues, which connect the dermis to the animal's body. Only the dermis is used for producing leather, with the exception of fur pelts. The epidermis and subcutaneous tissues need to be removed from the dermis before the tanning process can be started. The removal of the epidermis and subcutaneous layers takes place in the beamhouse.

Preserving the rawhide.

It is very unusual for the freshly-removed hide to be worked on immediately. As the hides are created, they are piled up and are later taken to auction.

The two principal preservation methods are **drying** and **salting**.

1) *Drying* is the most straightforward preservation method. The cleansed hide is stretched out to dry in the shade. It must not be allowed to dry out too quickly or too slowly. If a hide dries too quickly, the outer layers solidify and the middle layers can no longer evaporate. If the drying process is too slow, signs of decomposition can appear before the drying is complete. Hides

that have dried out too quickly take a long time to be softened again in the beamhouse.

The advantage of hides that have been dried is that they can be stored conveniently and securely.

Dangerous anthrax spores only arise in connection with hides that have been dried.

2) Salting has many advantages over drying. With salting, the fibres of the hide remain in a pure, natural, supple condition.

In the salting process the hides are piled up on a sloping surface so that any pools of salt which may form can drain away. The hides are kept like this for several days and are then individually rolled up.

Dry salted hides are hides that have been re-dried after salting.

Brine preservation involves leaving the hides dipped in a saturated saline solution for a few days. They are then taken out and allowed to dry well, before being re-salted with more salt.

The preserving effect of the saline solution is a result of its dehydrating effect and its minimal antiseptic properties.

Rawhide as a product

Rawhide is a by-product of the slaughtering of animals.

Different types of hide have different thicknesses, sizes and weights. Even hides of animals from the same species have differences which are determined by the animal's breed, origin, living conditions, nutrition, rearing, climate, age and sex.

Even individual parts of the same hide are not equal. The butt is the most valuable part of the hide. This is where the structure of the fibre is the toughest and the most consistent. The remaining parts, the belly and neck, have a looser fibre structure.

The pattern of the hide is a term which describes the relationship between a hide's thickness and its surface area. A hide with a regular pattern has the same thickness all over. A hide's pattern is dependent on the breed, sex, nutrition and age of the animal.

The different types of hide

Cattle hide is hide from cows, bulls and bullocks. Calfskins are not considered 'cattle hide' on the market.

The hide of younger animals has a finer grain and fibre structure. The most valuable hide comes from young cows that have not yet calved, and young bullocks. The hides of cows become less valuable with each calf born. They lose their elasticity and their strength becomes uneven. They tend to be made into sole leather or harness leather.

'Domestic hide' refers to European cattle hide whilst exotic hide comes from semi-domesticated animals from countries outside of Europe.

Calfskins are the skins of sucking calves, weaners and fattening calves.

The skins of sucking calves are characterised by a fibre structure that is particularly even and fine. They also have an especially tender grain.

Weaner skins have a courser fibre structure and tend to be wider.

The skins of fattening calves generally have neck creases. They are also noticeably larger than the other skins. Fatting calf skins are basically halfway between calf skins and cattle hides.

Sheepskin and lambskin: Sheepskin is only a by-product, as the main purpose of rearing sheep is wool. The higher the wool quality, the poorer the skin. Sheep skins contain a high level of fat and are degreased before tanning.
In Europe, Spanish and French skins are considered the best, while Dutch, German and Russian skins generally have a fibre structure that is too loose and tend to be dry and flaky.

Cabretta leather is the skin of the Persian hair sheep (Hair sheep are **not** a cross between sheep and goats!). This leather is high-quality and tight.

Goat and kid leather: Goat leather is tougher and firmer than sheepskin and has a thicker fibre structure. It is made into glazed kid leather, as well as leather for bags and book binding. Young goats are referred to as kids and their skins are kid skins; they are used to manufacture top-quality glove leather.

Goatskin is imported pre-tanned from India. Morocco leather is manufactured from this.

Pigskin is made into leather for saddlery, bag-making and book binding. Pigskins contain a high level of fat. One of pigskin's defining characteristics is its hair-holes, which go all the way through to the flesh side. Pigskin is the most durable book-binding leather, with no reddening over time.

The beamhouse

In the beamhouse all parts of the hides and skins are removed that are not suited to the manufacture of leather. After this the fibre structure is prepared for the tanning process.

All processes are carried out with large amounts of water and the quality of the water is of great importance. Many of the processes are significantly influenced by the properties of the water used. Numerous methods have been developed for making the water less hard.

All parts which are not needed for leather manufacture need to be removed, e.g. hair, hair roots, subcutaneous tissues, epidermis, scraps of flesh and dirt.
Once this is completed, the hide is prepared to absorb the tanning agents. A hide which has been prepared for tanning is called a 'pelt'.

Soaking

Soaking is the first process that takes place in the beamhouse. The hides are hanged in pits of cold water to clean them of blood and dirt, remove the preservation agents and to dissolve soluble protein matter away from the hide. The aim is for the hide to regain its natural suppleness.

The water must not be too cold or too warm. If the temperature is too low, the soaking would take too long and if it is too high, the danger of decomposition would be too great.

Soaking is easiest with fresh hides, as these hides have not yet lost their natural suppleness.

If hides and skins have been salted they need to be soaked for a long period. If they have been dried then soaking is particularly difficult.

To speed up the soaking, the water is 'sharpened' , i.e. alkalis or acids are added to it.

The hides can be protected from bacterial damage by using the correct soaking temperature, by changing the water regularly and by soaking the hides for only as long as is necessary. If bacteria damage the hide this is not always visible immediately. It is often only the brittleness and loose grain of the finished leather that signals that the hide has been damaged during soaking. The soaking process is also often accelerated in mechanical agitation appliances or in rotating drums. The hides must no longer be too hard at this stage, however, or else the movement could damage the fibre structure.

Hair loosening, hair and epidermis removal methods.

In the manufacturing processes which follow soaking, the first step is to remove the hair and epidermis from the hides and skins. The removal of the epidermis is achieved by dissolving a layer of mucous that connects the epidermis to the dermis. This layer is as keratinised as the epidermis and is less resistant to chemical agents and bacterial fermentation. This dissolving process also loosens the hairs.

The most important methods are **liming**, **painting** and **sweating**.

Liming

The oldest liming method is the done using lime water. There are three or more pits full of a lime solutions, each one more recently prepared than the next. The hide is first submerged in the oldest solution and then makes its way through the whole range, each time being submerged in a stronger solution. As the hides constantly absorb lime from the water, the lime needs to be topped up from time to time.

Along with lime water liming there are other liming methods.

Pure lime water 'sharpened' with sodium sulphide is the most commonly used liming agent in tanneries.

This liming agent has a stronger hair-loosening effect due to the addition of sodium sulphide which means the time needed for liming is considerably shorter. This agent is also less aggressive towards the hide's fibre structure than pure lime water. With more strongly sharpened versions of this agent, the loosening of the hairs starts more quickly, or the hairs can even dissolve.

There are mechanical agitation devices which prevent the lime from settling during pit-liming. Hides are also often limed in drums or wheels that slowly rotate.

Painting

Painting differs from liming only in the application method, not in the effect. A lime and sodium sulphide paste is applied to the flesh side of the skins. The strong solution penetrates the hide through to the hair roots. In this way it loosens the hairs without coming into contact with them, except at the root. This kind of hair loosening is mostly only used for sheep skins or other skins where the wool or hair is to be used later.

Sweating

Sweating is the oldest process used to remove hair. This involves dissolving the mucous layer using a simple decomposition process. This simple process can easily destroy the entire hide, however. This is because it is very hard to tell when decomposition has started to attack the dermis.

In earlier times the hides were simply piled up for sweating. Today, sweating takes place in a small room where the hides are hanged up very close together, but without touching.

Another method is cold sweating, where the walls are sprinkled with cold water. After 1-2 weeks the hair has been sufficiently loosened. In warm sweating, the water is converted to steam. This results in the hair been loosened within 1-2 days.

Unhairing and fleshing

All skins and hides that have been limed (or painted or sweated) in pits need to be unhaired by hand or with an unhairing machine. Hair from hides limed in drums or wheels is pulled out mechanically as it is loosened. As part of this process, the hide is cleaned by the liming fluid or by the rinsing which follows.

Unhairing by hand is carried out on the beam with a unhairing knife. In most large tanneries a range of different unhairing machines are used. However they all work on the same basic principle. The hide is placed on a surface and a rotating cylinder equipped with blunt knives strips away the hair.

For hides that have been limed in a drum, any epidermis remaining along with the hair roots, still loosely fixed in the pores, are stripped away with a scudding knife on the beam.

The subcutaneous tissues on the flesh side of the hides, as well as any pieces of flesh still attached to them, are removed in the flesh removal, or 'fleshing', process. This can take place before or after liming. The advantage of fleshing before liming is that the liming agents can act on the hide more evenly and quickly.

Fleshing can, like unhairing, be done by hand or with machines. Hand fleshing is done using a fleshing knife, a long, sharp knife with a handle on both ends. Fleshing by hand requires experience and skill, as fleshing cuts greatly reduce the value of the hide.

The subcutaneous tissue can be removed more evenly and cleanly by hand fleshing than by fleshing with a machine. On the other hand, machines work much faster and are cheaper than hand fleshing. Once the hand fleshing is done, the hides are once again submerged in water.

Deliming

The liming agent leaves deposits of lime in the hide. The deliming process should remove more or less all of the lime compounds. Washing the hides and skins only results in a partial removal of the lime compounds. A proper deliming is achieved using acids and ammonium salts. Using mineral acids can easily result in an undesirable acid swelling in the hides and skins. This can

also occur if organic acids are used, even though this is less likely. Boric acid and sodium bisulphite, on the other hand, cannot cause swelling.

Deliming is mostly carried out in wheels or drums, but also occasionally in pits. Different processes are used depending on which kind of leather is being produced. For softer leathers, a more thorough deliming is necessary.

Bating

In earlier times the leather was bated with dung. Nowadays, this form of bating has been replaced with artificial methods. Bating is carried out in drums or wheels. A more intensive the bating process produces a leather which is softer and more supple. If the bating process is overdone, this results in an empty leather. An expert can recognise bated leather by how it feels, its 'body'.

Bating has the following effects on the pelt:

1. The pelt is cleaned of remaining epidermis and hair roots.
2. The fibre structure of the hide is loosened. The intensity of this depends on the amount of bating agent used.
3. Certain subcutaneous tissue cells, located between the fibres of the leather hide, are removed.
4. Bating removes all remaining traces of the liming process.

If pelts that are due to be made into soft leather have not been sufficiently bated, they will have a deficient body. On the other hand, bating for too long can lead to the grain becoming blind or too loose, the hide being too soft and even to the hide being destroyed.

After bating, the hides and skins are rinsed in order to remove the substances which have been dissolved out and to halt the bating effect.

Scudding

Scudding is mostly done with a scudding knife on the beam, or by machine. Its purpose is to press parts of the epidermis, hair roots and fats out of the skin. These parts remain stuck in the hair sheaths or other depressions, as they cannot be removed by rinsing alone. The tanner refers to these remnants as 'scud' or 'scurf'.

Splitting

With modern splitting machines the hide can be put to especially good use. This is because the hide can be split across its whole surface into two or more layers, as a pelt or after the tanning process. Splitting is mostly done before tanning, as this means the grain split and flesh split can be tanned using different methods, depending on what they are due to be used for. Additionally, tanning agents can penetrate a hide which has been split more effectively.

A split hide is naturally not as tough as a hide which has not been split, as splitting involves cutting through the fibre structure of the dermis.

In the splitting process the hide is pressed against a knife, which is either still or attached to moving disks.

The pelt

Once the processes described above have been carried out, the hide has been adequately prepared for tanning. The hide leaves the beamhouse as a pelt. The pelt is a hide that has been cleaned of all components that cannot be processed into leather.

Tanning

The tanning process alters the pelt in such a way that it can no longer become keratinized and dry, decompose or be dissolved by hot water.

There are no standard procedures for tanning. Each tanner has his own technique. No two methods are exactly the same. The important thing is that the beamhouse, tanning and finishing processes are all coordinated for the creation of a specific type of leather.

Tanning involves treating the pelts with tannins, which are contained in the tanning agents. The actual tanning process involves the fibres of the hide absorbing the tannin from the tanning agent extracts to such an extent that they become difficult to separate.

Tanning agents

There are three main groups of tanning agent: **vegetable, mineral** and **artificial tanning agents**.

They precipitate lime and gelatine solutions and with iron salts they cause a blue-grey to bluish-black colouring.

There are a large number of vegetable tanning agents. The most important are:

Oak bark, quebracho wood, sumac leaves

Oak bark is one of the oldest and most valued vegetable tanning agents. It was used even in early pre-Christian times. Oak trees were cultivated for their bark, as a tanning agent, as far back as 1450 in Germany.

Before 1940, one third of the world's demand for tannins was met by **quebracho** extract manufactured from **quebracho wood**. The **quebracho** tree grows only in South America.

The leaves and new shoots of the **sumac** bush are one of the finest tanning agents. Different species of **sumac** bush can be found in southern Europe, especially in Mediterranean countries.
Leather tanned with sumac is especially well-suited for book-binding. Just like pigskin, it does not degenerate over time and it is also more colour-fast than bark-tanned, aniline-coloured leather. This is not the case for leather that has been tanned with extracts.

Extraction of vegetable tanning agents

As the tannin in the tanning agents can only tan the hide once it has been diluted with water, the tanning agents need to be leached. The solution resulting from this is then concentrated by the extract manufacturers, until it turns into a thick or solid extract.

Vegetable tanning

Pit-tanning is the oldest form of tanning with vegetable tanning agents.

Colour tanning generally takes place in eight or more pits, connected to each other via an overflow system. In each pit there is a stronger solution (dye) - in the last pit the solution is the strongest. The hide, having arrived from the beamhouse, is first submerged in the weakest solution, and then moved to the next strength in the series, until it reaches the strongest solution

(concentration gradient). This means the tannin colours or completely penetrates the pelt slowly but evenly. If the hide is placed immediately into a strong solution, the outer layers are coloured very rapidly, which brings the tanning process to a halt. A fatty layer is left and the grain becomes raw and contracted. This kind of hide is referred to as 'case-hardened'.

The tanning process is managed in such a way that the pelts are first coloured with old, depleted solutions, and are then gradually introduced to fresh extracts, rich in tannins.

The skins and hides remain in the colour pits until they are completed 'coloured through', i.e. the tannin has completely penetrated them. Tanning in rotating drums considerably reduces the amount of time needed.

Mineral tanning

There are many mineral compounds that have a tanning effect. The only ones that are actually used are potash alum salts and chromium salts.

In chrome tanning, the colouring begins with weak basic chromic acids and the tanning is completed with strong basic solutions.

There are a variety of chrome tanning extracts and tanning methods. Chrome leather has the advantage of remaining supple, but it cannot be processed into book-binding leather as easily as vegetable tanned leather.

The most well-known chrome leathers are boxcalf, velvet leather, chrome-tanned kid, chrome-tanned horse leather and chrome-tanned side leather.

White tanning

Tanning with alum is now only used for kid or lamb skins and high-quality book-binding leather. Leather tanned with alum is especially resistant to ageing. A modified version of this method is used for the tanning of fur skins.

Fat tanning

Most fats, for example those of land mammals, have no tanning qualities. If pelts are treated this way, the fat can be removed again afterwards. Cod oil,

egg yolk, linseed oil, rapeseed oil and other oils have a tanning effect. They combine with the fibres of the hide to form a proper leather.

'Fat-tanned leather', which is very tough and is used for harness leather, threading lace and belt lace, is treated with non-tanning fats such as tallow and beef fats. Strictly speaking, it is not actually leather, as there is no tanning involved, just preservation.

Chamois leather is manufactured for many different purposes. It is generally the skins of red deer, roe deer and other large game that are used to manufacture this, as well as the skins of sheep and goats.

The grain splits are separated off and then taken to the beamhouse, where they undergo the usual treatment.
Following this, the pelts are submerged in cod oil and drummed several times and then piled on top of each other. Within the pile, they become warm, which gives them a yellow colouring. Chemical processes take place that transform the pelts into leather.

The correct heat is of great importance, as the skins can deteriorate if the temperature is too high. Once the tanning is done, the excess cod oil is removed by draining and scouring.

Finishing

To soften the leather mechanically, it is moved or raked. If it is to be hardened, it is rolled or hammered.

Most dressery processes can be performed with machines.

Coated leather

This is leather which has been sprayed or coated with a coating colour. Coated leather is waterproof, but cannot be gold blocked by hand (or only with difficulty) and cannot be blind tooled, i.e. the imprint only becomes shiny and not darker.

Coated leather is mostly pre-coloured with aniline, i.e. it is coloured through (Although not always – 'aniline leather' is coloured with aniline alone.). The

coating colour conceals any marks and other unwanted discolourations caused by the aniline colouring.

Aniline leather

Leather coloured with aniline tends to discolour slightly, but is very well-suited to being gold blocked and blind tooled by hand. Leather which has been vegetable tanned is also very well-suited to this.

The leather can be coloured by spraying, brushing, or in a drum or a tray.

Aniline leather is more sensitive to fading, depending on the colour and the kind of tannin used.

Some leather is offered on the market as aniline leather, although it is not purely aniline-coloured but has a slight colour-coating. Aniline leathers can be recognised by their ability to absorb moisture ***immediately*** and the fact that they do not all look boringly identical. Aniline leather is the most valuable and the finest quality leather. Semi-aniline leather has a colour-coating finish similar to aniline.

For lightly-coated leather that is difficult to blind tool, a raw product can be used of significantly lower quality, as smaller defects can later be concealed. Offering this kind of leather as 'aniline leather' is misleading.

Different grains

All types of leather can be decorated with embossed grains, for example Morocco leather, goatskin or crocodile skin grains. The metal plates used are based on real original skins, so that leather that it often takes an expert to be able to tell leather that has been embossed in this way apart from the original skin type.
Many natural grains also occur through shrinkage.

Measuring leather

Light leather (skin) is still measured in imperial square feet (sqft), and leather with a large surface area (hide) is measured in square metres (m^2). An electronic measuring machine is normally used for measuring nowadays. Heavy leathers are traded according to their weight.

Parchment and transparent leather

The pelts are treated with glycerine, stretched and dried. The more glycerine that is used, the smoother and softer the skin becomes. This is how parchment and transparent leather is made, which can be converted back to its pelt state, i.e. it is not tanned.

Author:

Johann-Joachim Dargel, nephew of the company founder, former owner of the Franz Hoffmann Company - Fine Leather, Bookbinding Leather, Restoration Leather and natural skin parchments.

founded in the year 1925 in Stuttgart- Germany

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