

The ROMANCE *of* LEATHER AND ITS IMPORTANCE TO MANKIND

SOME of the most important dates in the history of mankind will never be known—the most anyone can do is to guess about them. When did people first use fire? When was salt first used? No one knows the answers. Nor does anyone know when mankind first began to make leather—undoubtedly one of the most important things of use in the prehistoric civilizations.

Shoes and clothing may seem commonplace to us today, for we take them as a matter of course, and have had no experience of life without them. But there was once upon a time a notable day when an inventor among a tribe of ancient men wrapped the skin of an animal around his sore bleeding foot bruised by stones or burned by the hot desert sands, and so wore the first shoe. The joy of that discovery was no doubt quickly communicated to his fellows. With the protection and comfort of this device, men could wander farther for their food, and no longer go hungry to bed so often as in the past; they could hunt more easily over a comparatively vast range of territory; they could move quickly—no longer bothered by sore feet, or having to proceed cautiously, picking their way over stones and thorns, which was a great advantage over their enemies, animal and human. It has been well said that civilization has advanced on foot, and that the well-shod have ever been the victors over the unshod. That is easy to believe.

Many centuries of leather-making for shoes and clothes passed before the days of written records came. We know that the ancients used leather for many purposes before history was recorded. The wandering tribes made tents of it and used it for beds, carpets, armor and harness. No one knows when they learned that leather “breathes” and water would keep fresh and cool in a leather bag—a discovery second only to the invention of the shoe in importance, for the tribes could now move away from the neighborhood of a spring or a river bank. They could take a water supply with them. Through many parts of Asia and Africa water is so kept today; waterbags are always made of leather as of old; and so are the “wineskins” or leather flagons of the desert peoples, just as they were in the Old Testament times and earlier. This “breathing” quality of leather is very valuable to us today, for it allows the gradual evaporation of moisture, an important reason for using it for shoes and other articles of clothing. The ancient pre-history people also found leather valuable for making bow strings and shields for warfare, and strips of it were used in fastening arrowheads to the shafts, and in making various implements and weapons and ornaments. At a somewhat later date, probably they made canoe-like boats of it, and crude drums, used in calling the tribe together, as a means of communication, and for primitive ceremonial

Centuries
of Use

music. Certain jungle tribes of Africa and South America have been found to have very complicated drum-tap codes of communication, and this leather-telegraph probably extends far back before written history, and may have been used by most of the primitive races from which modern man is descended.

In Genesis, iii, 21, we read: "Unto Adam and also unto his wife did the Lord God make clothes of skins and clothe them." And it is safe to say that leather for many centuries was the most usual material for clothing. Articles of leather more than thirty-three centuries old have been unearthed in Egyptian tombs and found to be still in a perfect state of preservation. The earliest records of human history all reveal that leather was richly prized—it was often classed with gold and silver, ivory and gems and was given to kings and gods as tribute. The ancient Arabs used leather extensively, and their recipe for making it has come down to us through the ages. "The skins are first put into flour and salt for three days, and are cleaned of all the fats and impurities of the inside. The stalks of the Chulga plant, be-

ing pounded between large stones, are then put into water; applied to the inner side of the skin for one day; and the hair having fallen off, the skin is left for two or three days and the process is completed." The Arabs, as one might imagine, were famous artisans in saddlery.

The Hebrews are said to have been the first to discover the value of oak-bark tanning, and this method was as good as any discovered until the introduction of modern tanning methods in America. Another ancient method was the "Shamoying" process—which is described in Homer's *Iliad*. In this process the pores of the hide are opened by repeated washings, with oil forced into the pores by beating and rubbing while the hide is stretched on a frame or staked out. The soft leather called shamoy or chamois is the result, and much of the leather clothing of the antique world was made of it.

From the Talmud we learn that the Jewish tanners of Babylon were not allowed to put hides into their vats on Fridays, as this would necessitate working on the Sabbath. Tanning was not highly regarded by them as an occupation, for Rabbi Judah wrote: "A man cannot get along without a perfumer (barber) and without a tanner. Happy is he whose art is of perfuming, and alas for him whose art is of tanning!"

A legend of the ancient Greeks describes Zeus, the great god, wearing the *aegis*, a covering supposed to have been the hide of the goat that suckled him. Other legends refer to the *aegis* as the shield Zeus carried, and Homer calls him the Aegis-bearer. The word *aegis* usually meant the leather coat or cuirass worn by the Greek soldiers. It is interesting to note that the horns of the goat that suckled Zeus were considered the magic horns of plenty. In the earliest legends and later history, the Greeks are described as wearing leather helmets and shields in battle. Ovid describes the warrior Ajax: "Ajax, to shield his ample breast, provides seven lusty bulls, and tans their sturdy hides." The famous legend of the founding of Carthage tells how Queen Dido, when promised only as much land as could be encompassed by the hide of a bull, cut the hide



LEATHER SANDALS FOUND IN EGYPTIAN TOMB
(Courtesy of The Metropolitan Museum of Art)

into a very thin continuous strip and was thus able to encircle land enough upon which to build a strong fort. Even at that, it must have been an extraordinarily large bull!

The Greeks placed their tanneries outside the city walls, and the wet skins were often spread out upon the ground for people to walk upon so as to soften them. Two classes of labor were employed, tanners and leather cutters, and the latter were considered artisans of the highest order. Roman, Greek, Pompeian and Egyptian tanners all used lime-water in dehairing the hides. They were familiar with the scraping-knife and the beam for completing the work, and oak-bark was most commonly preferred in the actual tanning. The hides were packed flat with powdered ground bark between the layers. Sometimes roots and berries of various kinds were added. The hides would be left in the "pickle" for months, then were hung on poles and later smoothed out with rolling pins.



ROMAN TANNERS

From the earliest dawn of history, leather was most important for clothing. The only costume of the ancient Aegeans was the loin-cloth, except for high boots, "probably made of leather," which were worn by the men. Sandals were worn by both sexes. In the very early days of Egypt a man of rank would be followed by a servant carrying a pair of sandals in case of need. This indicates how valued their shoes were, and probably how expensive and rare. In later days, sandals and other types of shoes were in common use, but their importance was signified in the court ceremonials when princes appeared before the Pharaoh barefoot, the monarch alone being entitled to wear shoes on those occasions. The simplest type of Egyptian footwear was a pad of sole of leather bound to the foot by two straps, one passing over the instep and the other between the toes. Sometimes a third strap was fastened behind the heel. And they quite early turned up the front to protect the toes. The ancients began to ornament leather with gold and silver thread, embroidery and jewels at quite an early period, and the shoes and girdles of the princely class are frequently mentioned. King Solomon's famous exclamation, "How beautiful are thy feet with shoes, O prince's daughter!" is paraphrased in the *Thousand and One Nights* in the descriptions of the splendid attire of princesses and sultans and heroes.

In ancient Rome shoes also marked the rank of the wearer. The Romans commonly wore sandals or light-weight shoes, but with full dress (the toga) the *calceus* had to be worn. This was a shoe with slits at the sides, and straps knotted in front. The senator's *calceus* had four such straps, which were wound around the ankle, with a tongue under the straps. The senator's *calceus* was made of black leather; while the patricians wore red. The Roman soldiers wore heavy hobnailed sandal-boots made with a number of straps wound around the lower part of the leg. A hunting boot that came up high was known as the *compagus*. A leather cap was also part of the Roman costume (particularly that of the soldier) from the earliest times.



AN ANCIENT SHOE SHOP

In the colder climates leather and furs were the first materials of which clothing was made, and in all ages both continued to play a most important part. Our modern leather coats, "windbreakers" and sheepskin jackets, are only new adaptations of types worn by the earliest human beings of the northern races. Furs were first worn, until tanning was discovered. Then leather came widely into use as it was more practical, less bulky, lighter, and more desirable for many reasons, and furs were used more for decoration, for luxurious ornamental dress, and ceremonial occasions. The average man wore a doublet of soft leather, a leather cap and leather buskins or boots, or sandals. If the man was a warrior, he carried a leather shield.

**Leather
Clothing**

From time immemorial leather was depended upon for armor. The ancient Greeks wore greaves or leg-guards, a cuirass or shirt, and helmet all of leather, as well as boots; the leather-covered wooden shield was used universally. Even in later days when shields of bronze and other metals were used, the leather-covered shields retained their popularity, for they were light and most serviceable.

The Anglo-Saxons made all their armor of leather or toughened hide, and wore leather pantaloons which were decorated with a network of steel lozenges called *mascles*. These metal pieces were probably designed to nick and dull the swords of their enemies. They also wore cone-shaped skullcaps of leather. The earliest coats of mail of the days of chivalry were leather doublets upon which rings of steel were sewn.

Marco Polo, the famous 13th Century Venetian traveller, who was almost the first European to penetrate Asia overland as far as China and Mongolia, tells us that the soldiers of Kublai Khan, the great monarch of the Tartars and Chinese, also wore leather armor. "They wear defensive armor made of the thick hides of buffaloes and other beasts, dried by the fire, and thus rendered extremely hard and strong." He writes a very interesting description of how the fierce Tartar soldiers prepared and kept their fighting rations—dried milk! After noting that the fresh milk was skimmed and boiled, he states that it was then "exposed in the sun until it dries. Upon going on service they (the soldiers) carry with them about ten pounds for each man, and of this half a pound is put, every morning, into a leathern bottle or small *outré*, with as much water as is thought necessary. By their motion in riding the contents are violently shaken, and a thin porridge is produced, upon which they make their dinner."

The war tents of Kublai Khan were also carefully described by Marco Polo. They were of leather made from the skins of lions "streaked white, black and red, and so well joined together that neither wind nor rain can penetrate. Withinside they are lined with the skins of ermines and

sables, which are the most costly of all furs." Probably no conqueror before or since has had such magnificent campaign tents. The palace of this Chinese emperor was of course even more splendid. Courtiers, Marco Polo records, were accustomed, upon going there, "to take with them handsome buskins of white leather, and when they reach the court, but before they enter the hall . . . they put on these white buskins, and give those in which they had walked to the care of the servants. This practice is observed that they may not soil the beautiful carpets, which are curiously wrought with silk and gold."

When Kublai Khan went into battle—which was quite often—he frequently "took his station in a large wooden castle, borne upon the backs of four elephants, whose bodies were protected with coverings of thick leather hardened by fire, over which were housings of cloth of gold."

Marco Polo visited India, and he thus describes the merchandise of Guzerat "by the Indian sea." "Coverlets for beds are made of red and blue leather, extremely delicate and soft, and stitched with silver and gold thread; upon these the Mahometans are accustomed to repose."

When the Arabs and Moors were in possession of Spain (from the 8th to the 15th century) they introduced to Europe the Arabian and oriental leather crafts, among them saddlery. The Moorish and Arabian saddles and harness were beautifully ornamented, some even jewelled—and in American colonial times, this taste and art was taken to the South American countries and Mexico by the Spanish *conquistadores*, and it enjoyed great favor.

Two hundred years after Marco Polo's time, Giles Fletcher, Queen Elizabeth's ambassador to Czar Feodor of Russia, in 1588, reported that leather was fifth in importance among the products of that unknown country. "An other principall commoditie is their Losh or Cow hide. Their Losh or Buffe (buffalo) hide is very faire and large. . . . There hath bene transported by merchants strangers some yeres 100,000 hides. . . . Besides great store of goates skinned, whereof great numbers are shipped out of the country."

Leather in
the Middle
Ages

Richard Hakluyt, in making up a list of things to be carried in the ships of British merchants going to Russia on a trading voyage (about the same time), included:

"Girdles of Buffe and all other leather, with gilt and ungilt buckles, especially waste (waist) girdles.

"Gloves of all sorts knit, and of leather.

"Shooes of Spanish leather of divers colours, of divers length, cut and uncut.

"Buttons greater and smaller, with moulds of leather and not of wood."

Hakluyt sent a dyer, one Morgan Hubblethorne, to Persia in 1579, to learn the arts of the Persians which would be useful to Englishmen; and among his instructions was Number 10: "They have a cunning in Persia to make in buskins of Spanish leather flowers of many kindes, in most lively colours, and these the Courtiers do weare there: to learn which arte would do no harme."

England had at that time many experienced leather workers and artisans, but Hakluyt, acting probably for the Government, was anxious that all trade secrets might be learned by the industrious and clever subjects of Queen Bess.

From the early Anglo-Saxon days, leather was a most important material to Englishmen for clothing and armor, and for shoes, saddles, and flagons and the other articles necessary to daily life.

Leather was hung over windows—which were commonly without glass in the early days—to keep out the cold and rain and snow. During the Middle Ages industry was organized into various trade guilds or fraternities, usually called companies and sometimes "misteries." These guilds were powerful and ruled apprentices and members with an iron hand to insure the quality of craftsmanship. The leather workers were among the first to form a guild or fraternity. In France the Fraternity of Leather Workers was established in 1397 by Charles the Sage, and was controlled by the Church. The right to become a tanner was bought from the king for sixteen sous, and every member swore to observe the customs and moral precepts of the trade.

The
Guilds or
"Misteries"

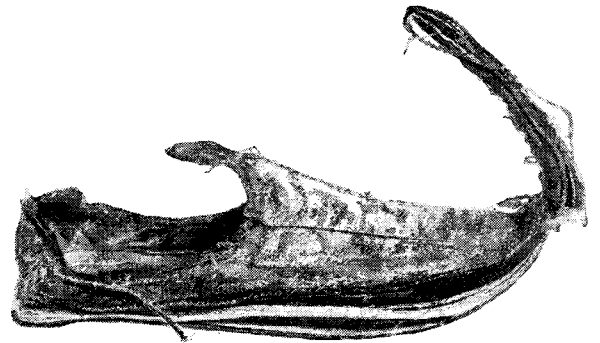
The guilds were powerful throughout the countries of Western Europe, but they reached their highest development and greatest power in London. Each guild enjoyed special rights and privileges, and created monopolies through their royal charters. Among the first five organized in London were the Saddlers and Skinners, which became one of the most influential; its guildhall was one of the first to be erected. Eleven of 111 different trades listed in London in 1422 were leather trades, and entire sections of the city were designated as cordwainers' or leather-workers' wards. The word cordwainer comes from the French word meaning Cordovan. Cordova was one of the great Spanish leather centers, and the name Cordovan is even today given to a leather made of horsehide that was often used by the Moors and Arabs, and continues to be popular.

During the Middle Ages, multitudes wore leather doublets and hose, and "upper stockes" as the short breeches or "shorts" of the time were called. Shoes often took notably fanciful shapes —with long points that at one period were fastened



MASTERS RULED THE GUILDS

up to the knees with tassels and bells. These were called *poleynes* or *Cracowes*, since the fashion was imported from Poland. The characteristic shoe of the Middle Ages, however, did not have such a ridiculously exaggerated toe, although it ended in a point; it was of soft leather fitting closely over the instep, with a high tab both at the front and above the heel. Later on, in the days of Henry VIII, the fashion went to another extreme —this time one of width. The shoe of Henry's era had a toe so wide that it left a "shovel" imprint, and the leather was slashed so that the gaily colored hose could show through.



MEDIEVAL SHOE—POLEYNES OR CRACOWES

It was during the Middle Ages that book-making reached perhaps its greatest flowering as an art, with the parchment-leather pages beautifully decorated or "illuminated" with silver, gold and every lovely color known to the artists, who were usually monks. All books were lettered and illustrated by hand, and almost all of the making of books was done in the numerous monasteries, where also the finest libraries were to be found—except those of the popes and kings.

This was before the invention of type. Making a book was a long process, and consequently only the choicest materials were used. Parchment of a sort had been used from the beginning of recorded history. Skins were employed as writing material by the ancient Egyptians; there exist skin-rolls which date back to some 1500 years before the birth of Christ. In western Asia the practice of writing on skins was widespread at a very early period. The Jews made use of skin-

Medieval
Clothing

History and
Literature
Recorded on
Parchment



MOORISH ARTISANS WERE FAMOUS FOR THEIR BOOKBINDINGS

rolls for their sacred books, and it may be presumed for other literature also; and this practice has been maintained by them to the present day, for synagogue rolls are still inscribed on this time-honored material. The Phoenicians and Persians also inscribed their records on skins, as did the Ionian Greeks, according to Herodotus.

The great libraries of Constantinople, Rome, Alexandria, and those of the emperors, monasteries, and wealthy nobles were full of these wonderful manuscript books. Many of them were destroyed in the wars of the later years of the Roman Empire, and in the early Middle Ages, when fanaticism was responsible for burning many collections of "pagan" books. The present great libraries of the world, both public and private, contain fine examples of illuminated Scriptures, Books of Hours, and Litanies, the parchment pages beautifully and intricately decorated in colors and gold-leaf and silver, and bound with handsomely tooled leathers, often studded with jewels. There is at least one example of the marvelous purple-dyed vellum, with all the text lettered in gold-leaf. It is a Bible that

was presented to Henry VIII of England as a coronation present by the Pope. During the later Renaissance that art of staining seems to have been lost or discontinued.

The early Christian era in France (while it was still a province of the Roman Empire, and called Gaul) gave us the patron saint of the shoemakers, St. Crispin. He is revered everywhere, but most particularly in Italy. Crispin was descended from a noble Roman family. He embraced Christianity, which was then against the law, and fled with his brother Crispinianus to Gaul. He worked as a shoemaker in the town that is now the city of Soissons, and distinguished himself by his work in helping to spread Christianity, and by his many deeds of charity. According to legend his benevolence was so great that he even stole leather to make shoes for the poor. From this, charities done at the expense of others have been called *Crispinades*. In the year 287 both he and his brother were martyred for their faith, and October 25th is called St. Crispin's day in their honor.

**Saint
Crispin**

The History of Leather in America

WHEN America was discovered, the settlers found the Indians well versed in the art of tanning. They used leather for many purposes, chiefly for clothing, tents and canoes (although they also made canoes of other materials).

All the leather made by the Indians was the famous "buckskin tan," a leather of exceeding softness and pliability, and remarkable for its ability to keep out water. The Navajos were especially skillful in dressing hides and ornamenting leather, but the Crow Indians were generally considered to have the best tanning method. The work of skin-dressing was largely, if not entirely, done by the Indian women. Skins were collected and heaped in piles, wetted, and allowed to decompose until the hair was loosened. Then

How Indians Made Leather

they were scraped with bone tools until both the hair and flesh sides were perfectly clean. After that the skin was rubbed with a mixture composed of the brain and liver of the animal, and later softened by thorough rubbing.

Among the Crows, however, the dehairing and scraping were preceded by the immersion of the skins in a lye solution made from the wood ashes of the campfires. As a final step in their process, the skins were placed in a tepee in which a smudge-fire had been built. The tepee was then closed as tightly as possible and the skins were left in this smoke-filled tent for several days until all had been thoroughly cured. The leather so made would withstand any amount of wetting and return when dry to its original soft and pliable condition.



WOMEN OF THE TRIBE DID THE WORK OF SKIN DRESSING



TANNING IN COLONIAL DAYS

Although the Indians made an excellent leather, they knew nothing of the types produced by the superior method of bark tanning, known to Europe for so many centuries, and introduced, naturally enough, by the new settlers. The first tanner to come to America of whom there is any record was Experience Miller, who came to Plymouth in the good ship *Ann* in 1623. He was followed, five years later, by two shoemakers, Thomas Beard and Isack Rickman, who were evidently sent over by the Plymouth Company, for they were to receive "their dyett and house room at the charge of the companie." It is also recorded that Beard had in the ship "divers hydes, both for sole and upp leathers, he intends to make upp in boots and shoes."

Leather, of course, played a large part in the life of the Colonists. The woodsmen and frontier settlers used leather clothing, very largely made by the Indian "buckskin tan," and often enough cut in the Indian patterns; the woodsmen themselves were commonly called "Leatherstockings" from this mode of dress. In the settlements, leather knee-breeches and jackets and coats were very popular. The high boots so necessary in days

when roads were muddy or were snow-filled trails, were of course made of leather, as were their square-toed shoes. Saddles were in great demand, and the first-rate saddlers were fine artisans. In the later colonial period the sedan chairs and coaches were upholstered in leather (and sometimes covered with leather, richly ornamented, on the outside). The early coaches were hung on wide, tough leather straps instead of springs. Post-riders carried leathern bags to protect letters and newspapers from the rain and snow, and every traveller had his saddle-bags of leather. The wide cordovan belts worn by pirates and sailors were probably worn for protection, as a sort of body armor, in hand to hand fighting with swords and rapiers, and their magnificent cavalier boots may have been designed to serve as similar protection.

Up to the latter part of the 18th Century, no one had made a scientific study of tanning processes. For many centuries leather was tanned by methods as old as the records of the Hebrews and Egyptians, each tanner following a rule-of-thumb process, and perhaps adding some slight variation of his own. Only one method was

**Early
Colonists**

**First
Scientific
Developments**

followed for practically all leathers. Hides were first put in a "soak" of lime and water. After the hair was scraped off, they were laid in crude boxes or vats made of rough-hewn planks. Ground oak-bark was sprinkled over each layer of hides, and when the vat was full, water was poured in to cover them. They were then left to soak for six months or more. Occasionally the hides were removed and freshly packed with ground oak-bark. Such was the method used nearly everywhere, tanners drawing on the resources of their immediate neighborhood for raw materials, and in turn supplying their neighbors with the finished leather. It was thus a small, almost entirely local business.

Towards the end of the 18th Century many changes were made in industry through scientific knowledge and experiment (a period usually referred to in history as the Industrial Revolution). Leather-making, like many other crafts, began to change from a small, local handicraft, dependent upon immemorial practice and limited to local resources, to a great industry, based upon scientific method, and highly organized, with machinery doing away with much of the slow, laborious hand labor. With the aid of new discoveries tanners began to produce a great variety of immensely improved leathers. Some of the steps in this change are as important as many of the more famous inventions and discoveries of the last two centuries.

Among the earliest contributions was the work of Sir Humphry Davy, the noted English scientist. Until he published the results of his experiments oak-bark was almost the only vegetable tanning agent known, although sumac leaves and nut galls as well as certain oriental trees, not readily available to tanners, had been occasionally used. Davy established that oak-bark was valuable for the tannin it contained. He discovered, also, that resources of tannin might be had from many other trees. Tannin was present in the bark of the hemlock and mimosa, the wood of the chestnut, the quebracho and oak trees, the fruit of the divi-divi, valonia and myrobalans. Sir Humphrey's work was of vast interest to American tanners, for our forests were full of hemlock and

chestnut, and the tanning industry could thus be sure of a large supply of tanning materials.

The most revolutionary discovery of the 19th Century as far as leather manufacture is concerned, was the development of chrome tanning. Tanning with alum had been one exception to the use of vegetable tanning agents, but the usefulness of that process was limited, and only small quantities of leather were tanned that way. An interesting problem was brought to an American chemist named Augustus Schultz. The white alum tanned leather used then to cover corset stays persisted in turning brown. Could any way be found to produce a leather that would remain permanently white? Schultz experimented, and in the course of his studies, he found that chromium salts produced an entirely new type of leather. The action of these salts on hides and skins had been studied a little in England some years earlier, but Schultz realized that chrome tanning could be made a commercial possibility. At first, however, even the tanners laughed when they saw the leather made by this process. It was stiff, hard and blue in color instead of mellow and russet, as the vegetable-tanned leather was. There were advantages to chrome tanning: the leather was more resistant to wetting, and the time in tanning was much reduced. These advantages stimulated further study in attempting to perfect the process.

A young Philadelphia tanner, Robert Foerderer, interested in the new ideas, patiently undertook a long series of experiments, and his work was rewarded with success. He learned how to treat chrome-tanned leather with soap and oil, a treatment now called "fat-liquoring," in order to give it softness and pliability. With this success a great field was opened to tanners for the production of light-weight and varied colored leather. Robert Foerderer himself became a very successful tanner. His leather took the place of the heavy bark-tanned leather previously used in shoe uppers. Through his enterprise in developing the discoveries of Schultz, chrome tanning was firmly established.

**Chrome
Tanning
Discovered**

Between the time of Davy's work and the development of the new chrome tanning, the production of leather—in common with other industries—was virtually revolutionized by the use of machinery. American inventive genius contributed mechanical developments of great importance. Not only did machinery save time and effort by doing away with slow hand labor, but it also opened processes to tanners which had previously been impossible. One of these inventions was so important that it deserves detailed comment.

Since no one can control the thickness of the hides obtained from animals, it was, throughout the ages, difficult to produce thin leather from a thick and heavy cattlehide. This was done only by a wasteful and laborious process. Hides were taken from the vats when about half tanned and carefully rubbed smooth and leveled, and then shaved down to the desired thickness. Obviously,

the shavings were wasted, and it was expensive in time, for one workman could shave only four hides a day.

In 1809 a patent was granted to Samuel Parker of Newburyport, Mass., for a machine that would split leather to any thickness. Hides could be fed into one end of his machine and emerge at the other end accurately cut into two splits, the "grain split" (the outer or hair side of the hide) and the "flesh split" (the inner side). This machine greatly increased the output of usable leather from heavy hides, and it was possible for one workman to split several hundred hides a day.

Other important parts of the tanning process—cleaning, fleshing and dehairing—continued to be done by hand for many years. Experiments with machines to do this work were first conducted with types that moved the skin against a fixed knife. Later attempts were made with machines that reversed the procedure—holding the skins fixed and moving the knife against them. But



A MODERN SPLITTING MACHINE

neither type was really successful. In 1840, Mellen Bray, a Maine tanner, solved the problem by inventing a machine that combined both of the earlier principles. His machine consisted of a table, on which the skin was held, moving against the knife, while the knife, fixed to a cylinder, moved against the skin.

Another improvement was in the method of using the vegetable-tanning agents. Instead of applying the ground-up oak-bark directly to the hides, it was found better to "leach" the tannin and other extracts from the bark, and to soak the hides in the resulting tanning liquor. It produced better leather, and shortened the tanning period considerably.

The vast changes made by machinery is America's great contribution to the leather industry, and it has revolutionized the methods and equipment of tanneries all over the world; since other nations have had to adopt our methods and install our machinery, or be outdistanced by our producers.

Changes in methods of shoe production were also highly important; they lowered the price of shoes, creating a larger demand, and making foot comfort more generally obtainable. Scientifically constructed and sturdy leather shoes were brought within the reach of all through modern methods and the increased output made possible by machinery.

The first shoe-pegging machine was operated by Charles D. Bigelow at his shop in Jacob Street, in "The Swamp" district of New York—that section of the city just south of Brooklyn Bridge. It is still the leather center of New York. From testimony in a law-suit against infringers, we know that his machine "would peg around a large size man's brogan in one minute, and the work was done much better than by hand, both as regards uniformity and firmness."

As the country expanded, and the use of machinery became general, it was more practical to build larger plants capable of greater individual production than to continue to operate the small plants. The rapid development of the railroads and other means of transportation

**Modern
Tanning
Industry**

(the earlier canals, and the present-day hard roads) made it no longer necessary to locate the tannery near a forest to obtain the tanning bark. In the early days it had been more economical to carry the lighter hides to the tannery, rather than the heavier bark, but it presently became more practical to transport the bark to more fully equipped tanneries. It was the very lack of transportation that had determined the location of almost all industries, in the early days of our history, and that is the reason so many were started, and long continued to remain, in the seaport or river towns, or at points near some necessary source of raw material. Looking back today, we can easily account for what sometimes seems the peculiar geographical distribution of tanneries. Those making hemlock leather, for example, established themselves along the line of growth of the hemlock tree through Pennsylvania, lower New York, Michigan and northern Wisconsin. Tanners requiring oak-bark followed a line through the mountains of Pennsylvania, Virginia, West Virginia, North Carolina and Tennessee. Many large tanneries still remain in these geographical areas. Improved transportation made it possible



A GREAT ADVANCE CAME IN SHOEMAKING WITH THE SHOE PEGGING MACHINE IN 1852

for them to stay, and to bring their raw materials for tanning, and the hides and skins, to their plants; they did not have to move on, following the forest, as they did in olden times.

Pennsylvania remains our largest tanning state, because its forest growth contains both oak and hemlock. Wisconsin, with large resources of hemlock bark, became another center of tanning. In the Southern states not only the oak abounds, but the chestnut tree as well, and tanning became, naturally, an important activity.

Another interesting impetus to tanning came at the time when gold was discovered in California. The historic rush of Forty-niners opened territory that in addition to its gold treasure provided a new source of tanning material. This was the California tan-bark oak.

These changes we have outlined may be summarized by giving a few figures that show how dramatic the difference is between the old handicraft industry and the modern way of manufacturing. In 1849 there were 6,686 tanneries in this country. During the eighty-odd years between then and now, the number of tanneries declined (after a slight increase) until in 1935 there were but 383 in operation. In 1849, the 6,686 plants employed only 25,000 people, while today only 383 tanneries employ more than twice that number, or 53,000. Wages paid to employees amounted to approximately 6½ million dollars in 1849; the present annual payroll is more than 58 million dollars. In 1849, the tanneries produced leather worth about 43 millions; today's output would exceed 300 million dollars in value.

The tanning industry today is a very important part of our industrial and economic life. The comfort and health of nearly everybody depends upon a uniform and constant production of carefully manufactured leather. About 400 million pairs of shoes are produced in the United States every year, and for the soles and uppers, and the inner parts of the shoes as well, enormous quantities of leather are necessary. In addition there

are numerous other leather articles upon which we depend for comfort and convenience—gloves, sports jackets, belts, purses, billfolds, handbags, luggage—to name but just a few. Farmers require leather for harness; leather belts are necessary to transmit power to machinery, and there are other strictly industrial uses. To supply leather for these and many other purposes, the tanneries of the nation must operate day after day.

Perhaps the most remarkable fact about the leather industry in its relation to the economic life of the country is its great stability. Year in and year out, through depression and prosperity, tanneries keep running. Their workers are always employed because leather is always needed. Nothing demonstrates more clearly how much a basic necessity shoes and leather are than this admirable soundness and stability of the industry that makes them.

Tanning is an old and honored occupation, full of romance. Into the making of leather comes its ancient history so intimately connected with the story of civilization itself. Represented in it are the active life of the Western: ranges with their cowboys, the pampas of South America with their *gauchos* of song and story, the workers of the northern hemlock forests and those of the oakwoods of the green Eastern mountains, the adventures of men in the *quebracho* forests of Paraguay and Argentina, and in many a tropical jungle. The far-away chromite mines of India contribute their stores, and the oceans of the world present the drama of the men who pursue the man-eating sharks. Men hunt out snakes and lizards and alligators to provide exotic leathers for a lady's shoe or handbag; designers trained in the art schools of the world use their genius to create improvements, beautiful ornamentation, and new designs. The research laboratories are constantly experimenting to add new scientific improvements in method, to discover new ways of improving the most historic of useful materials—leather.

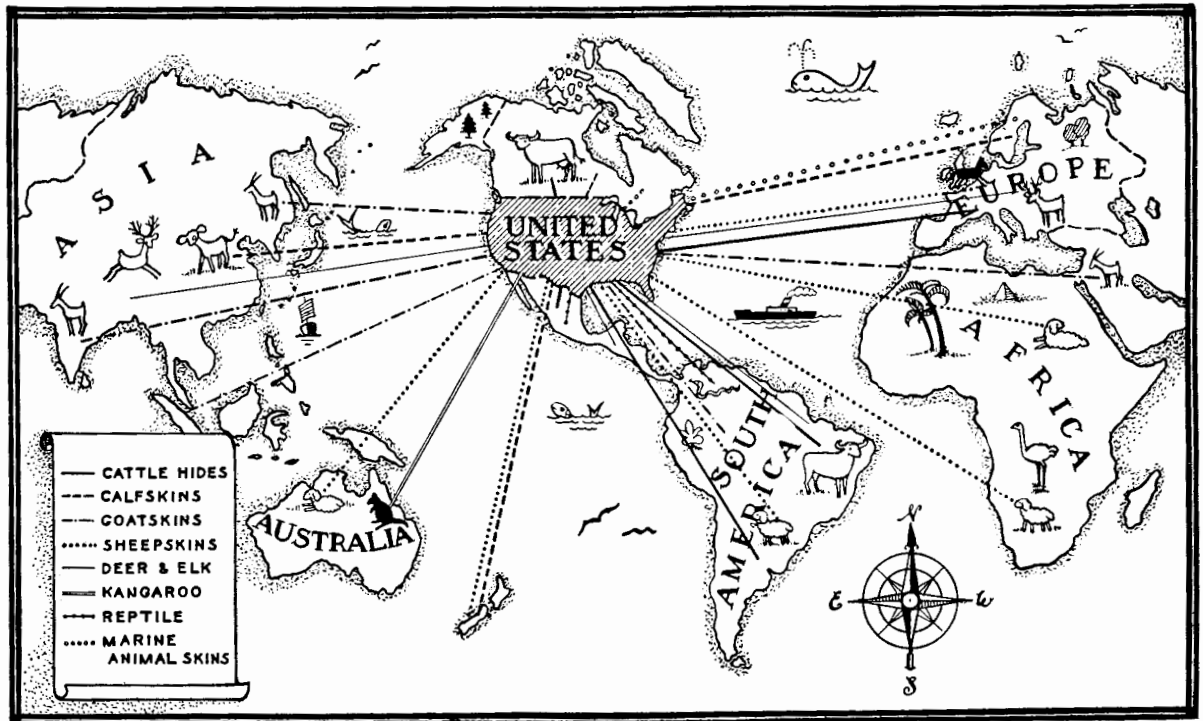
**There's
Romance
in Leather**

Raw Materials

WE HAVE briefly traced the history of leather through the ages and witnessed the transition of leather making from a handicraft into a great modern industry. Like other industries which supply the fundamental needs of civilization, tanneries require a constant flow of raw materials. In every industry, raw materials are indispensable; they are the foundation of the daily activity which keeps motors turning and wheels humming. Unless raw materials keep pouring into our factories, the flow of finished goods cannot be maintained, machines must be halted and production stops. Probably in no other industry do the facts of raw material supply present so fascinating a picture as in the tanning industry. For here the Romance of Leather spans all the continents and oceans from the equator to the Polar Regions, from the Far East to the modern West. Every country, with animals both familiar and strange, contributes to the raw materials of the leather industry.

Because the tanning industry has grown to such importance, not only in this country, but almost everywhere, hides and skins have become a valuable world commodity. In the United States alone, the hides and skins tanned annually represent an almost incredible number of animals. Imagine, if you can, a procession of 20 million cattle, 14 million calves, 50 million goats, 35 million sheep, almost 2 million horses and various numbers of such animals as deer and elk, kangaroos, alligators, lizards, snakes, ostriches, seals and even sharks. The collection of all these hides and skins for our tanneries is an absorbing study in geography.

Most of the hides and skins are not produced with the tanners' needs in mind. The animals are raised for their meat, and the hides and skins are largely a by-product. In the case of sheep, wool and meat are the principal products, but the skin remains important to commerce. Similarly, goats are raised in many countries for their value



AMERICAN TANNERS USE HIDES AND SKINS FROM ALL THE WORLD

as milk-givers. Cattle are not slaughtered for their hides, but because man requires beef for food. There are a few exceptions—kangaroos, lizards, snakes and seals are hunted for their value to the tanner.

It is obvious that the hides and skins of different animals have marked differences and are suitable for different uses. The skin from a calf, for instance, is quite unlike the hide of a grown cow or steer. Leather made from calfskins, therefore, is very different from the tanned cowhide, and each leather is used for different purposes. Cattle hides are used for a multitude of products. The soles of shoes are made from thick, unsplit hides; harness leather, machinery belting or similar heavy leathers must also be made of unsplit hides. When the hides are split the leather is used for making shoe uppers, bag, case, strap, automobile and upholstery leather. Calfskins, goat or kid skins, sheepskins, and various other types cannot, of course, be used for sole or machine-belting leather. They are used principally in the uppers of shoes, in clothing, handbags, gloves and various miscellaneous articles requiring light leather.

In considering the nature and sources of supply of the most important kinds of hides and skins, it is natural to speak first of cattle hides. The tanning of these is, in point of volume and value, the largest branch of the industry. Each year cattle-hide tanners in America use approximately twenty million hides, and since this country normally produces about fifteen million, that leaves about five million to be imported from Canada, South America and elsewhere.

Cattle hides and calfskins are produced wherever cattle are raised for beef or dairy purposes. Our own supply of hides is furnished to a great extent by the huge livestock industry of this country. At the end of 1935 there were almost 68 million cattle and calves in the United States. In Canada and Mexico cattle-raising is also an important industry, stretches of land similar to our Western prairies affording pasture and grazing lands for large herds. Several South American countries—with Argentina most important—support a very large livestock industry. Much of

the meat supply of England and other European countries comes from the Argentine, where the colorful *vaqueros* ride among the herds as do our western cowboys. Elsewhere in the world there are also great numbers of cattle raised to supply mankind with food. Hides are therefore produced, not only in the Americas, but in Europe, Asia, Africa and Australia, and as each country varies in its needs for hides, there has grown a world trade in them which follows many trails across the earth.

Since hides are an animal product, they may suffer damage from decay between the time they are removed from the animal and the time they enter the tanning process. During this period they must be preserved in some way so that their full value may be realized by the tanner. There are several ways of doing so, and each of these brings the hide to the tanner in a different condition. A green-salted hide is one which has been kept from decaying by an application of salt. In the large slaughter houses the fresh hides, as removed from the animals, are washed with water and then spread out flat in beds or packs, one on top of another, with layers of salt between, where they remain thirty days or more to cure. In this way the hides are kept moist and sound until they are shipped to the tanner. Dry hides, as the name implies, are those which have been exposed to sun and air until they have become bone-dry. They usually are stretched out flat during the drying time. Dry-salted hides are similarly treated, but salt is applied to them before they dry. Because dry or dry-salted hides are liable to be damaged during the drying, the green-salted hides are usually much superior, and they constitute by far the largest number of the hides used.

Most cattle are slaughtered in the packing plants to which animals are shipped every day in the year. Because of the highly specialized workmanship that large-scale production affords, the quality of hides produced in the large packing plants is usually quite superior to that of hides produced by small plants, butchers or farmers. This difference is evident in the skinning, curing and grading of the hides. Ordinarily about 60%

Classification of Hides



BRANDS FREQUENTLY DAMAGE THE BEST PART OF THE HIDE

of those produced in the United States are packer hides, and the remainder constitute the small-plant or country production.

As we have observed, several million hides must be imported every year from "hide surplus countries." Argentina is the most important of these. Very large packing plants have been established in South America to slaughter and dress cattle and chill the meat for shipment abroad. The hides produced in these plants are called *frigorificos* (from the Spanish word for "chilled") and the frigorifico hide is regarded as the equal of the best hides produced in this country. For sole-leather many tanners regard them as the best in the world. We also import the *saladeros*, another type produced at South American abattoirs, *mataderos*, their country hides, and many other types too numerous for specific mention.

When very large or heavy hides are required, American tanners must import them from certain parts of Europe. Strangely enough, this is because huge oxen are used as draft animals in many parts of the Old World, and their hides which are much larger than those from the ordinary beef animal are in demand for upholstery material.

All hides, however, may at times have a lower value through damage from ticks or grubs or branding. Ticks attach themselves to the skin of cattle, causing a slight wound, which when healed by nature leaves a scar. Tick damage leaves the finished leather spotty and pitted in appearance, and its value is necessarily lower. A grub is a worm which grows from an egg laid on the hair of the animal by certain flies. These worms bore into the flesh and then emerge from the hide, leaving small holes about an eighth of an inch in diameter.

Another kind of serious damage to hides results from the practice of branding. Cattle raisers, in order to identify their calves, apply a hot iron to the skin of the animal, sometimes on its rump, and often on its sides. These brands may range from a small letter or numeral several inches long to a design or series of initials two feet square. Wherever the brand is applied the hide is scarred so deeply that its fibrous structure is partially destroyed. Leather made from the branded part is not so strong or as serviceable as that made from the unbranded portion, and

**Ticks and
Grubs**

**Branding
Damages
Hides**

the practice causes the loss of many thousands of dollars worth of leather yearly.

Years ago, when herds of cattle roamed the plains as a common range, branding was necessary in order that cattlemen could identify their own animals. The custom is slowly decreasing now. As the Western ranges are taken over for cultivation the herds are becoming more nearly domestic farm stock, confined by fences and no longer free to run and mix with other cattle. In addition, more humane and less wasteful means of marking animals have been developed—such as the much less harmful chemical brand. But there still are too many cattlemen who hold to the old and wasteful idea of branding with the hot iron, creating large waste to themselves.

Although our search for cattle hides takes us far from our own shores, we must literally comb the world to find the habitat of animals, reptiles and birds that supply us with much other important leather. There is no more striking example of the importance of international trade than the traffic in calf, sheep, goat, pig, deer, ostrich, snake, lizard, kangaroo, shark, seal and walrus skins, horse and buffalo hides. There are trade lanes in these covering thousands of miles across land and ocean; trade lanes that are almost as clearly marked as the traffic lanes through a city.

The skins of very young cattle are a highly important material for the leather industry.

Calf Skins About fourteen million calfskins are tanned each year in this country. Much that has been said above concerning the supply of cattle hides applies to calfskins as well. Normally our domestic supply of skins is only two-thirds of the quantity needed by tanners. The remainder must be imported.

Most calfskins come from dairy or veal-producing regions; only a relatively small number is available from beef areas. Dairy herds in this country, for example, furnish practically all of our domestic calfskins. Our imported skins come chiefly from Canada, France, England, New Zealand, Scandinavia, Australia and Argentina. Those imported from veal-producing countries are superior to those from countries where stock

is raised principally for dairy purposes, since veal calves are milk-fed much longer and have finer skins. It is an odd scientific fact that as soon as calves begin to eat grass a definite change occurs in the hair and the skin.

Sheep and lambskins of many varieties are used in making leather, the total number averaging thirty-five million or more annually. The gloves you wear, or the leather jacket that protects you from a chill wind, may be made from a sheepskin brought halfway around the world.

Of all the domesticated animals, the sheep has perhaps the widest range on earth, for it is raised in every important country except Japan. From the far North, the Faroe Islands off the coast of Scotland; from the far South, the Falkland Islands and the bleak territory neighboring the Straits of Magellan at the far tip of South America; from the Levant or Near East; from nearly all parts of North America; from every continent (except the damp tropical areas) sheepskins are brought to the tanneries of the world. Our tanners obtain from the packing plants of the United States about 17,000,000 sheep and lambskins, and about as many more must be imported to satisfy the demand.

A strange member of the sheep family provides the cabretta skins—they are animals called "haired sheep" and resemble sheep in most respects, but differ from them in having hair like that of a goat instead of wool. Slightly more than 3,000,000 cabretta skins are imported each year from Brazil and Africa.

One of the most important of the tanners' raw materials is the goat, or kid, skin. Numerically, the goatskins tanned in the United States reach the huge quantity of almost 50,000,000, probably exceeding the number tanned throughout the rest of the world. Per unit of weight, goatskins are the most expensive of the major types of hides and skins: only kangaroo skins or a few minor specialties cost more. It may seem strange that although the United States is the greatest consumer of goatskins, practically all of them must be imported from abroad. There is very good

reason for this. Practically all goatskins must be chrome tanned and this process, it will be remembered, was developed by American tanners. To this day the superiority of domestic leathers has been maintained by the skill, experience and constant research of American tanners.

Since almost all of the 50,000,000 goatskins annually required here must be imported, there must be great numbers of goats throughout the world. Europe, Central Africa, South America, India and China are the chief producing areas. In many of these countries the goat is as important to the natives for milk and meat as cattle are to us.

While cattle hides, calfskins, sheepskins and goat and kidskins are the most important raw materials of the leather industry, there are numerous other types. Included with these are the hides and skins of such familiar and strange animals as pigs, deer, kangaroos, ostriches, snakes and lizards, alligators, horses, seals, walrus, sharks and water buffaloes. Many of the facts regarding these are quite interesting, and illustrate the world-wide sources of the industry's supplies. In the next section the characteristics of leathers made from these various raw materials are discussed.

A survey of the raw materials essential to the production of leather would be incomplete without mention of the products which enable the tanner to convert perishable hides and skins into enduring leather. A description of this class of raw materials, known as tanning agents, and the sources of their supply, is an interesting and fascinating study in commercial geography.

There is a great variety of vegetable material, growing throughout the world, which may be used in tanning hides and skins. All of these have one essential characteristic in common; they contain certain quantities of tannin which is the substance actually needed in vegetable tanning.

The barks, woods, nuts and leaves that contain the valuable vegetable tannin are selected

either for the quantity of tannin they contain or because of their commercial availability, or for the type of leather they will produce. The raw materials themselves are no longer used directly, as we have noted. It is more efficient and economical to extract the active tanning agent through leaching, which is a process similar to the brewing of tea or coffee.

The raw material is taken to large mills where it is finely ground or cut up. It is then placed in large tubs resembling a coffee percolator, through which hot water is continuously circulated. The tannin is thus dissolved from the ground wood or bark, and the solution produced is the tanning liquor. This must be purified and refined. The water is often evaporated to produce a dry extract which can be easily shipped over long distances.

There is still a large supply of tannin-producing woods and bark in the United States, and the peeling of oak and hemlock bark for use in tanning and the collection of chestnut wood is an important industry. The timber is cut down in the mountain forests, sawed into logs and split much like cordwood, and then brought to the tannery or extract plants. There it is first ground into little chips resembling coffee beans. These chips are put through the leaching process.

With all of our vast areas of chestnut, oak and hemlock, tanners must still import great

Tanning Materials enable the tanner to convert perishable hides and skins into enduring leather. A description of this class of raw materials, known as tanning agents, and the sources of their supply, is an interesting and fascinating study in commercial geography.

Vegetable Tanning Materials used in tanning hides and skins. All of these have one essential characteristic in common; they contain certain quantities of tannin which is the substance actually needed in vegetable tanning.



GRINDING BARK IN AN EXTRACT PLANT

**The Axe
Breaker**

quantities of tanning agents, some of which come from the most remote parts of the world. Of all such imports the most important is quebracho extract, produced from a remarkable tree that grows in Argentina and Paraguay. Its name is derived from the Spanish words *quebrar* (to break) and *hacha* (ax), meaning, therefore, ax-breaker. This name was given to it by the early Spanish explorers, and it is no misnomer.

Quebracho wood is shipped hundreds of miles by rail or barge from the great forests of South America to the grinding stations and extract plants near the seaboard, and the extract is there made ready for export in concentrated form. We import some quebracho logs to do the extracting here, but this is not the prevailing custom, by any means. Obviously it is more economical to ship the extract than to transport the heavy, untreated wood. As a tanning agent, quebracho is seldom used alone, but generally in combination with oak or hemlock.

Other tanning agents must also be brought long distances. Valonia, which is the acorn cup of the

**Other
Tanning
Agents**

Turkish oak, grows generally throughout Asia Minor and is shipped from the city of Smyrna. Mangrove bark is stripped from the mangrove tree which grows in many tropic island regions. Both Africa and Asia supply mangrove, which is used, with other extracts, in tanning sole leathers. Difficulties in collecting the bark have retarded its greater use.

The tanning material known in the United States as Cutch is an extract made from the bark of two species of the mangrove that grow in the great tidal swamp areas of the Philippines and Borneo. Because the fresh bark deteriorates rapidly, most of it is used for making extract immediately after it is stripped from the trees.

Nut galls on the leaves of oak trees are a very strange tanning agent. These are caused by insects laying their eggs on the leaf or bud, and producing an abnormal growth, which when dried yields a high percentage of tannic acid. These nut galls are collected for the most part in Asia Minor.

Certain varieties of sumac are quite valuable for making light-colored, soft leather. The best type is the imported Sicilian sumac, although usable grades are found in some South American countries and in Virginia.

Gambier is derived from a climbing shrub of the Dutch East Indies. It is also grown in China to some extent. Only the leaves of the plant are used. These are chopped and boiled, and the heavy extract is then drawn off in an almost pasty condition. It is allowed to cool, and then is cut into cubes for shipment. Gambier produces a soft leather much used in the making of gloves. Myrobalans are the unripe, prune-like fruit of a tree growing in India. They contain a high percentage of tannin which is invariably used with other extracts in making sole leather or leather for machinery belting.

The dried pods of a tree found in Central America yield divi-divi. This extract is very desirable also for making sole leather, when used with other extracts.

Wattle bark is the source of an excellent tanning agent, the use of which has grown in recent years. It is derived from several species of the acacia, which grow principally in South Africa, where the Dominion government has promoted the cultivation of wattle trees in order to insure the future supply.

In chrome tanning certain chemicals must be employed which are prepared from chromite, which is, incidentally, the same mineral that has become so useful in the development of chromium plating. There are chrome mines in some of our Western states, but most chrome ore must be imported from out-of-the-way corners of the earth. British and Portuguese Africa, Greece, Brazil and French Oceania provide the world's major supply.

Naturally, the chrome ores cannot be used in the rough state in which they are brought out of the mines, but must be chemically treated and refined. Tanners rely on the chemical industry to furnish the chrome salts for tanning—sodium or potassium bichromate.

**Chrome
Tanning
Agents**



MINING CHROME ORE IN NEW CALEDONIA (Courtesy of the Mutual Chemical Co.)

There are numerous other raw materials of considerable importance to tanners, in addition to those we have mentioned. At almost every step in the tanning process, from the time tanners receive the hides and skins to the shipment of finished leather, a great variety of raw materials are necessary. These are far too numerous to describe singly, but two broad groups are particularly noteworthy.

Modern tanning depends greatly upon the chemical industry for a large variety of products essential to leather-production:

Chemicals and Dyes Lime for dehairing purposes, "syntans" or synthetic tanning materials, acids, such as lactic and sulphuric, and a long list of other chemicals. Perhaps one of the most important chemical groups comprises the dyes. Certain of them are derived from plants and trees, but most are products of coal-tar chem-

istry. The brilliant colors produced from coal-tar rival the hues of Nature and enable the tanners to dye leather any color dictated by fashion.

Many kinds of oils and greases, suitably treated, are practically indispensable in the making of different types of leather, for during the process of tanning much of the natural oil in the hides and skins is removed. This must be replaced in order to give long wear and beauty to the finished leather, and properly treated oils provide a lubricant for the millions of tiny fibres of which leather is composed. Many tons of cod and other fish oils, neatsfoot, linseed, petroleum, tallow, wool grease and other oils and greases contribute to the strength and beauty of leather. They are, in fact, one of the most essential raw materials.

How Leather Is Made

ALL the great variety of leathers we have discussed have been converted from perishable hides and skins. How is this transformation accomplished?

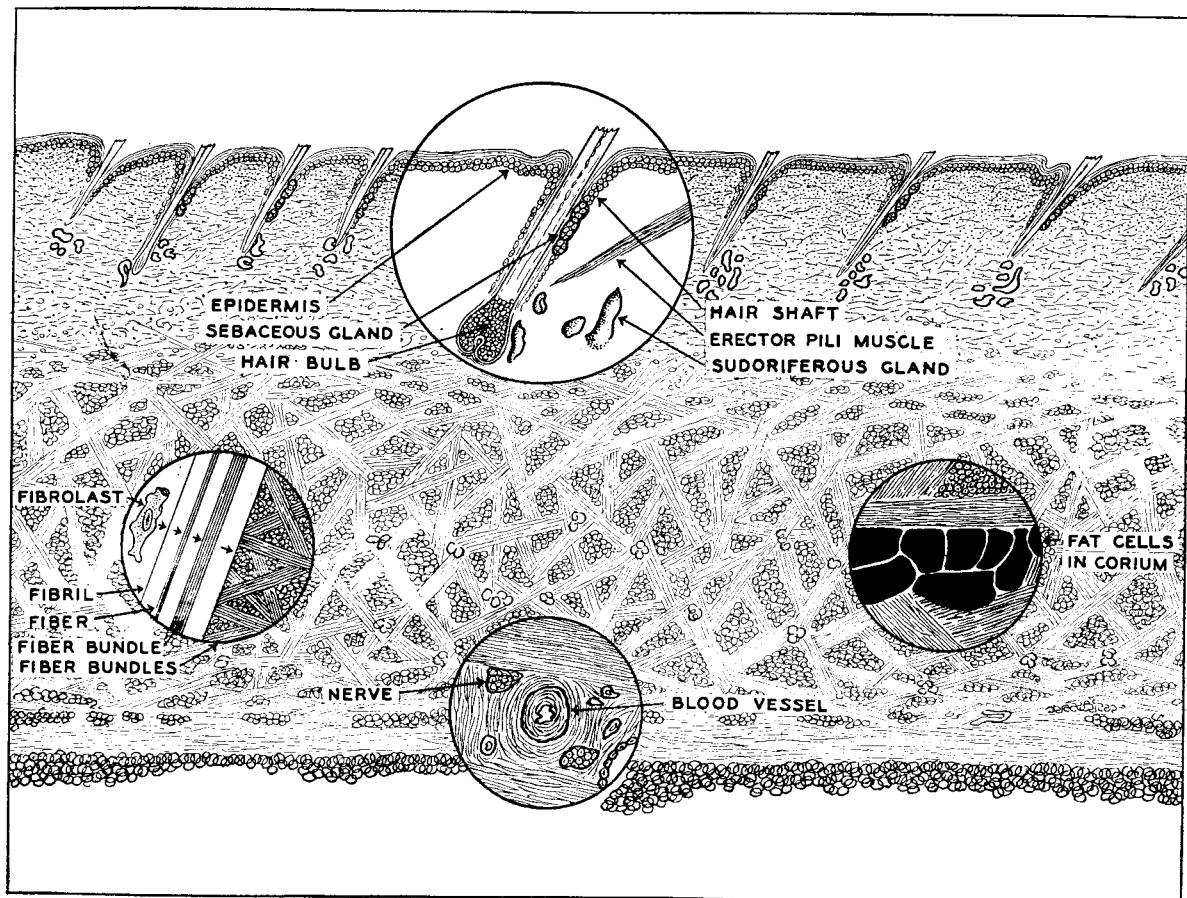
The covering with which nature has endowed animals is, chemically, a very complex substance. According to chemists, hides and skins are made up to a large extent of proteins, about the ultimate nature of which too little is known. The most notable characteristic of hides and skins, the quality which has made them so valuable since the earliest days of the most ancient peoples, is not their chemical composition but their physical structure. All hides and skins are composed of a

vast number of minute fibres intricately interlaced. This structure gives the skin its wonderful flexibility and strength, while leaving it sufficiently porous to admit the passage of air.

In both of the principal processes employed by tanners in converting the raw hides and skins into leather—vegetable and chrome tanning—the preparation and initial steps are the same.

In the first stage of preparation, hides and skins must be restored to their original soft and flexible condition so that they may be easily handled. This is done in that part of the tannery known as the "beam house," so called because generally hair

Preparation for Tanning



DIAGRAMMATIC DRAWING OF A TYPICAL CROSS SECTION OF FRESH STEER HIDE. THE WHOLE SECTION REPRESENTS LOW MAGNIFICATION WHILE THE INSERTED CIRCLES REPRESENT STRUCTURES UNDER HIGHER MAGNIFICATION TO GIVE MORE DETAIL

and flesh used to be, and in some tanneries still are, removed from the hides and skins when spread out on a rounded support similar to the trunk of a tree and known as a "beam." First the hides and skins are soaked in rectangular "soaking vats" containing water, or in pits having rounded bottoms in which a paddle stirs the hides in the water. This soaking has a twofold purpose; washing all foreign material out of the hides, and restoring them to a soft, flexible condition. From one to seven days are required to soak them properly, depending on the condition and thickness of the hides.

After they are softened, the hides or skins are ready for the next preparatory step, which is the removal of the hair. An older method of doing this consisted of sweating the hides, setting up a slow decomposition on the surface and thus loosening the hair, which could then be removed with a blunt knife. The modern and more effective way is liming, followed by dehairing in a special machine. There are several variations in liming, to suit different kinds of hides and skins. Sometimes pits containing the lime solution are employed, but frequently lighter skins are put into huge rotating drums filled with the solution. Many chemical substances, such as sulphides of sodium and arsenic, are added to the limewater to accelerate the loosening of the hair. In general, the purpose of liming is to loosen the epidermis or outer layer of skin in which the hair is embedded, so that the latter may be easily removed. Liming also tends to swell and plump the hide and makes it more susceptible to the action of the tanning liquors and chemicals. After three to nine days, depending on the thickness and texture of the raw hides, as well as the type of leather to be made, the batch is removed, washed, and brought to the dehairing machine, which resembles a clothes wringer. The raw stock rolls through it much as clothes do through the wringer. Cleverly shaped knives in the machine remove without damage the hair from all kinds of hides and skins.

After dehairing, it is important to clean the flesh side so that it will be almost as smooth and free of foreign matter as the "grain" side. It

might be useful to note here that the term "grain" side is applied to the hair side of leather, since removal of the hair always leaves a distinctive surface pattern on the hide or skin. The cleaning of the flesh side is performed either by a fleshing machine, or by hand. If the fleshing is done by machine, it is usually necessary to supplement this by some hand work on parts of the hide which the machine does not properly clean. The hand-fleshing is done with the hides laid over beams and by the use of special, curved two-handled knives.



REMOVAL OF FLESH BY BEAMING

After the hides have been unhaired and fleshed they are washed and then some of the lime remaining in them is removed either by drenching or bating them. The extent to which the tanner removes the lime depends upon the kind of leather that he intends to make. Hides that are drenched are put into a weak solution of acid which neutralizes and dissolves the lime out of them. Those that are bated are put into a solution containing enzymes which act not only on the lime but on the hide itself. Bating helps to produce a leather with a particularly fine and tough grain.

When the hides have been drenched or bated, or both, they are again washed thoroughly, and are then ready for the actual tanning operation.

However, hides or skins to be tanned by the chrome process usually are pickled after having been bated. Pickling consists of placing the hide in a solution of acid and salt and allowing it to remain there until it has been thoroughly penetrated by the chemicals.

Before continuing with the description of tanning methods, it will be interesting to mention two by-products of the preceding steps. The hair obtained is quite valuable—it is used for an amazing variety of purposes. Coarse hair is used as a binding material in plaster or wallboard, and as an insulating material. The finer types of hair go into the making of hair felts, carpets, blankets and other kinds of textiles.

The fleshings, removed either by hand or machine, and those parts of the hide unsuitable for tanning, which are trimmed off before the hides enter the tanning process—such as ears and snouts—are also valuable and utilized to good advantage. The poorest grade of this material is used in the manufacture of fertilizer, a better grade is used to make glue, and the best grade makes one of our purest and most digestible foods—gelatine.

For the manufacture of either glue or gelatine the fleshings and trimmings are thoroughly washed, limed and dehaired, then again washed and sterilized. This purified material is then cooked in steam and water which convert the substance into gelatine.

Immaculate cleanliness exists throughout the gelatine plant; the final product is not touched by hand from the beginning of the process until it reaches the consumer. Gelatine, therefore, is as pure as any food can be.

After the hides and skins have been brought through the initial stages, they go through the processes which will convert them to leather. Up to this point all hides and skins, whether they are to be tanned by vegetable or chrome agents, have been given basically similar treatment. Vegetable tanning, the most ancient method, remains very important today, because it is essential for the production of the heavy leathers,

such as sole-leather, belting leather, harness and upholstery leathers and most of that used for luggage. While some shoe-upper leather is vegetable tanned, the proportion is quite small. Likewise, vegetable tanning is used for certain kinds of glove and garment leather, but not to a great extent. Most of the heavy leathers are made from cattle hides, and consequently vegetable tanning may be considered as mainly applying to the tanning of hides, as distinct from skins. Vegetable tanning still requires a period running into months, despite the many improvements made in modern times.

Almost all the upper leather produced in this country, whether made of cattle hides, calfskins, goatskins or any of the other raw materials is chrome tanned. This modern process which has virtually supplanted vegetable tanning in the making of upper leathers, glove and garment leathers, and most fancy and miscellaneous types, yields a leather of more compact fibrous structure, and requires only days as against months for the older method. Sometimes it is desired to combine the qualities of both methods, and a process known as combination tanning is employed, for producing a certain kind of sole and upper leather. A very small percentage of skins is tanned by methods other than the basic ones mentioned above. Such methods as alum, formaldehyde or chamois tanning have advantages for special leathers of limited quantity.

The following table shows the various leathers produced by the basic tanning methods:

<i>Process</i>	<i>Leathers Produced</i>
Vegetable	Mainly sole, harness and belting leathers; luggage and upholstery leathers; some upper leather
Chrome	Mainly upper leather; glove and garment leather
Combination	Some sole and upper leather
Alum or Alum-Chrome	Pure white upper leather and furs
Oil	Chamois

By-Products:
Hair

Edible
Gelatine

Tanning
Processes

Vegetable tanned leathers are produced by the action of certain tannin liquors or extracts upon the fibres of hides and skins. By a suitable choice of tanning agents leather can be made which will vary in hardness, strength or flexibility. The principle of vegetable tanning consists in placing the hides or skins in tanning liquors of progressively increasing strength until every fibre in the raw material becomes permeated and tanned. In the case of heavy cattle hides, this process normally requires from two to six months even today, and not so long ago it required from one to two years. Hides are usually cut down the backbone, and tanned as two "sides"—only those being tanned for upholstery and belting leathers are ordinarily carried through the process as whole hides.

The first contact of the hides with tanning liquors occurs in the rocker section. This is merely a series of vats containing relatively weak liquor. Across each rocker vat frames are strung, and the hides are suspended on these and are moved slowly up and down to agitate the liquor and produce an even absorption in the hide. This is essential if a uniform color is to be produced over the entire side of leather. Much care is necessary in this operation, as the quality of the leather is largely determined by the attention given the hides in the rockers. Usually, two to three weeks in the rockers are needed to swell the hides properly and tan them sufficiently to withstand the stronger liquors in the next series of vats.



ROCKER VATS IN A TANNERY

After leaving the rockers the hides are placed in lay-away vats which are much larger than the rockers, and in these, instead of hanging suspended, each hide is laid out flat and sprinkled over with ground bark. The liquor solution is then pumped in until the vat is full and the hides are allowed to remain undisturbed for a period that varies with the kind of hides and the nature of the leather being produced. The hides are generally changed in these lay-away vats from four to seven times, and each time they are placed in a new solution. From the time the hides enter the rockers until they leave the lay-away vats there may elapse a minimum of two months, and possibly as much as six. When the completely tanned leather is taken from the last lay-away vat, it is put into a vat filled with hot water. This dissolves any excess tanning liquor out of the leather, and removes some of the sediment and bark that may be on the surface. A thorough cleansing is then given the leather in a scrubbing machine, which removes the last traces of sediment or bark.

Various finishing operations must then be performed, and these depend upon the use for which the finished product is intended. Usually, it is necessary in completing almost all kinds of leather to restore the natural oils and greases which have been removed from the hides by the tanning process. Replacing the oils gives flexibility and life to the leather, and provides a lubricant for the fibres which results in long wear. Cod oil, or a mixture of cod and other oils, is added to the newly tanned leather while it is still in a moist condition. The leather is then hung up to dry in the drying loft, generally a darkened room where precautions are taken to insure a good circulation of air with a certain amount of moisture, in order that the drying shall not be too slow or too rapid. The subsequent treatment will be touched on when the various types of leather, their qualities and uses are described.

Chrome tanning differs completely from the process just described. After the preparatory steps, an entirely new technique is employed which bears little resemblance to the methods or chemistry of vegetable tanning. Being suitably

**Chrome
Tanning**

prepared, the hides or skins are placed in large tanning drums or rolls containing the chrome chemicals, which are to do the tanning. In these



REMOVING CHROME TANNED SKINS FROM DRUMS

drums they are tumbled about so that each fibre is brought in contact with the chemicals which convert it into leather. The result is that within five or six hours light weight skins have become—leather.

With a knowledge of these basic tanning processes in mind, we can consider in some detail the principal kinds of leather, which have such an important role in the daily life of mankind. Again we begin with cattlehide leather, for this is one of the oldest and most important branches of the tanning industry. Among cattlehide leathers we find first the heavy leathers, such as sole, belting, or harness leather, and the lighter types embracing upper leathers, upholstery, luggage and miscellaneous leathers. The distinction between heavy and light in this instance is between leather having the full thickness of the hide and thin leather obtained by splitting a hide into several thicknesses. In general, however, the term "light leather" is applied to that made from thin hides or skins such as calf, goat and sheep.

Few materials are as important as sole leather, which is the basis of our durable and sturdy shoes.

Sole Leather

Sole leather is strong enough to support the weight of the body yet flexible enough to bend with the foot. It resists abrasion so that it wears slowly and cannot be easily penetrated by nails, broken glass or any dangerously sharp substance, yet its invisible pores permit the passage of air and moisture and allow the feet to "breathe." Sole leather may be of many types. Work shoes require a particularly solid and rigid sole; men's street shoes may require a sturdy piece of leather which will give long wear and yet be light and somewhat flexible. For the very finest of women's turn shoes the sole must be so pliable that the shoe can be turned inside out in its making. Some of these varying characteristics are given the leather by the kind of raw hides used, some by the methods used in tanning or by the method of finishing. For example, to produce the leather required for heavy shoes, slightly damp leather is rolled under heavy rollers which compress it, making it firm and solid.

The whole finished "side" of sole leather may be sold as such to the shoe manufacturer, or it may be sold with some part such as the head, the shoulder or the belly removed. Again, the tanner may cut his leather into strips or blocks and sell these to shoe repair men or leather mer-



ROLLING SOLE LEATHER

chants, but many sole-leather sides are bought by sole-cutters, who make a business of expertly cutting the sides into outsoles, insoles and heels, which they grade uniformly for quality and thickness. The sole-cutters then sell the graded cut leather to shoe manufacturers or repair men.

Leather excels all other soling material in promoting foot comfort and health. Not only does sole leather permit the feet to "breathe" but it adjusts foot temperature more comfortably and permits perspiration to evaporate more perfectly than any other material. Many doctors and experts in foot health believe that non-porous sole materials are injurious to health, and for this reason they agree that leather is the ideal material for soles and shoes.

Leather for machine belting is another member of the heavy leather group. Rough leather which is to be finished for this purpose is carefully selected to have as few imperfections as possible, such as brands, or grub or tick marks. These would lower the tensile strength or flexibility of the leather. A process known as currying is employed in converting the rough leather into belting. In currying, the rough leather is treated with quantities of grease, smoothed out so that it is flat and free of wrinkles, and most of the stretchiness is removed. One of the most common practices is to put the damp leather into a revolving drum with the proper amount and type of grease and then tumble them together until the grease has been absorbed by the leather. This currying operation often increases by as much as fifty per cent the tensile strength, toughness and flexibility of the leather, all of which are desirable qualities in machine belting.

Leather belting is invaluable in many factories or machine shops where it is used to transmit power from a large engine or motor to individual machines. Certain qualities are deemed highly desirable in such belting. It should have a good driving surface so that it will not slip on the pulleys. Pliability in the leather will enable the belt to hug the pulley, and high tensile strength will permit heavy loads to be borne without breakage. Belts should possess enough elasticity

to take up the load without strain, but should have very little stretch in order that they need not be shortened too often. Finally, resistance to external conditions such as chemicals, heat and moisture, give the leather endurance and long life.

Harness leather is also finished by a somewhat similar currying process. A much larger quantity, and a different kind of grease is employed in currying harness leather, in order to protect it against the extreme weather conditions to which it is often exposed. Although there was a time when the use of draft animals was declining rapidly, both on farms and in cities, it has been found that for many purposes horses are more economical. Consequently there has been an increase in their number and use in recent years. Harness leather, therefore, is in quite considerable demand, and hundreds of thousands of cattle hides are tanned annually to make it.

From the heavy cattlehide leathers we have been discussing, we come to an entirely different group. These, too, are tanned from cattle hides, but the hides are almost always split in two or more thicknesses, and the surface or finish becomes exceedingly important. First in importance in this group are the leathers for shoe uppers. Since much of the procedure in the tanning of chrome upper leather, whether it be cattlehide, calf, kid or any other type, is basically the same, the following statements about cattlehide leather may be generally applied to other chrome tanned upper leathers.

Upper leather made from cattle hides is called "side upper" leather because the whole hides are cut into two halves or sides before or during the tanning process. At some point, either after liming or following the actual chrome tanning, the sides are fed into the splitting machine and two layers of leather are produced.

From the grain side, which, as we have seen is the top or hair side, the finest cattlehide upper leather is made. The split is sometimes used for other grades, or it may be finished into leather for gloves, innersoles for shoes, shoe tongues, or luggage leather of medium quality.

Some of the most important steps in the preparation of upper leather follow the splitting and actual chrome tanning. The grain side, to which we shall limit our description, is at that point merely rough tanned; it has none of the lustre or gleam of finished leather. It is now necessary to put life-sustaining oils and fats back into it in order to replace the natural oils that may have been removed in the course of tanning. Again huge revolving drums are used, where the sides are whipped about in a mixture of water, soap and oils, known as fat-liquor. Neat's-foot and cod oils, plain or sulphated, egg yolk and soap are used. These materials lubricate the hide substance, and the leather becomes mellow and pliable. Often by altering the lubricant the entire character of the leather may be changed.

Dyes are sometimes added at the same time, or in a subsequent drumming operation, in order to give leather the beautiful colors found in modern shoes, particularly shoes for women. Some important dyes for the tanners' use are made from the wood of certain trees. Most of them, however, are aniline colors which the magic of chemistry creates from ordinary coal-tar. Very careful and clever manipulation of the dyestuffs is necessary if a desired color is to be uniformly reproduced on many pieces. While experience and skill are essential, the formulas and judgment of scientists are even more important. On certain grades of leather, a coating of dry-paint colors or pigments is often applied to the surface, instead of the aniline or other dyestuffs.

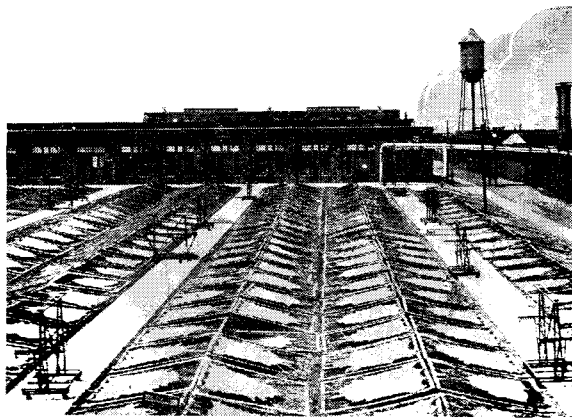
After the coloring, leather is ready to be stretched and smoothed. Laid flat upon smooth tables, it is pressed with blunt knives, until it lies flat and most of the water absorbed in the coloring drums has been squeezed out. Before the last finishing touches can be given, the leather must stand for a few days to permit the full penetration of the fat liquor. Each side may then be moistened with water or with dampened sawdust and given a mechanical softening and stretching, after which it is tacked, or nailed, by the edges to the boards. Dried in this fashion the leather is kept taut, thereby removing the wrinkles and most of the stretch. Since the dried

leather is dull and without lustre, a final operation must be performed, known as finishing, or glazing.

In glazing, the leather is subjected to friction by being rubbed with a glass cylinder. This gives to the surface of the leather a lustre which may be intensified to a gloss by repeating the glazing after applying a seasoning or "dressing" to the leather. For dull finishes a revolving brush is used instead of the glass cylinder.

The bright surface of patent leather requires an entirely different kind of finishing. Most patent leather is made of cattle hides, although kid, calf or colt skins are sometimes employed.

To make patent leather the side or skin must be coated with a bright, hard material which after drying will remain flexible enough to bend with the leather. In order for this coat to adhere, the leather is taken, after coloring, through a "degreasing" operation in which naphtha removes the surface grease left by the fat-liquoring stage. Then it is stretched taut on frames by tacking or clamping the edges and is coated by hand with special paints or colors. Several such coats, composed of linseed oil and other materials, are usually needed, with alternate baking and rubbing with pumice. Strangely enough, nothing has been found to replace exposure to sunlight, following each coat, to make the finish hard, bright and firm.



SUNNING PATENT LEATHER TO HARDEN ITS SHINY FINISH

Due to the high level of scientific technique reached by American tanners in making patent leather, their product is in great demand all over the world. Millions of square feet of this leather are exported every year, going to almost every country of the world.

The beauty of a good piece of leather luggage, and its durability, are qualities that have been admired for centuries. An intricately ornamented Florentine case or jewel box, the sturdy scrip of the medieval traveler, or distinguished modern leather luggage, all carry the same appeal of good leather.

**Bag, Case
and Strap
Leather**

In the trade usage, luggage leathers are called bag, case and strap leather. These are for the most part made of cattle hides, although, largely because of their distinctive appearance, other types of hides and skins may be tanned for this purpose. Toughness to withstand wear, as well as fine appearance, are sought as the essential qualities in leather made for bags and cases.

Luggage leather is bark or vegetable tanned, the process being similar to that followed in sole leather tanning, except that different tannins make softer leather. Various desired thicknesses of leather are obtained by splitting. The outer layer, or grain side, is the most desirable, since it has a closely knit texture, rendering it tough and very resistant to wear. As used in bags and cases, leather is usually from one-twentieth to one-tenth of an inch thick.

Because it is so widely available and highly suitable for luggage, cattlehide leather is frequently embossed to resemble the rarer leathers that are either too expensive, too often unobtainable in quantity, or not durable. Metal plates which bear the wanted design are applied under great pressure to the leather, and this leaves the design on its surface. In this way added beauty is obtained without sacrifice of the strength of cowhide, which is greater than that of many rarer leathers. Embossing is a useful process for many other types of leather as well as luggage. It is used to give upholstery leather, for example, a distinctive finish.



EMBOSSING GRAIN DESIGN ON UPHOLSTERY LEATHER

Upholstery is the last of the important cattlehide leathers to be considered. Although upholstery and decorative leathers of rare beauty were made by the Moors and others hundreds of years ago, it was only with the development of the modern splitting machine that the leather upholstery we know today became possible.

**Upholstery
Leather**

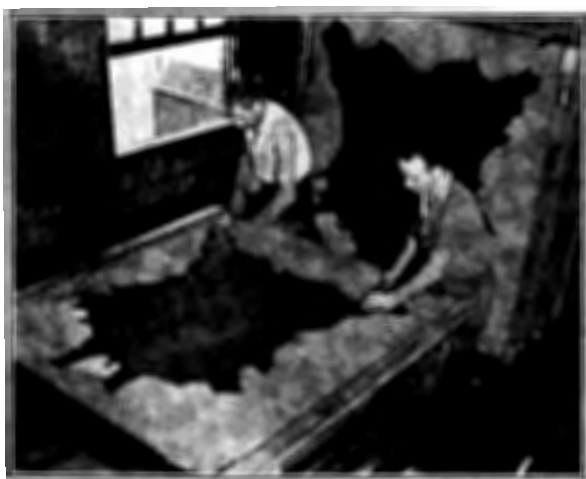
In obtaining cattle hides for upholstery leather, the markets of the world are combed to select large and perfect hides. Some of these may be eighty square feet in area. After being vegetable tanned the whole hide must be split into the required thicknesses. In doing this, two practices are generally followed. One of these requires the removal of a thin cut, one sixty-fourth of an inch in thickness, from the grain surface, which is called a "buffing." The rest of the hide is then split into three equal thicknesses. The first cut underneath the buffing is called the machine buff, the second the deep buff, and the remainder is termed the split. In the other practice, the first thin cut is not taken; the entire hide is split into three equal thicknesses. The first, or top, cut is called the top or full grain leather. The second is the deep buff, and the third, the split. Top grain and machine buffs are used for higher priced

automobiles and fine furniture; deep buffs and splits are used for medium priced automobiles and the less expensive furniture. Splits are also used for insoles and luggage.

Having been split, the rough tanned leather must be finished to give the beautiful surfaces we are accustomed to expect in upholstery. Several processes are employed in doing this, and essentially they consist in applying a durable and smoothly colored coat to the leather. Brushes are sometimes used to apply the color and finishing material, or it may be sprayed on with a powerful airbrush. The surface texture or design may be changed by embossing, and sometimes the leather is softened and crushed by hand.

There are other uses of cattlehide leather. Garment, bookbinding, lace, and numerous miscellaneous leathers are often made from cattle hides, but the processes employed resemble one or another of those already reviewed and do not require detailed mention. We come, therefore, to the other important kinds of leathers.

Calf leather has a finer grain than leather made from hides, and with its tough texture, it is particularly desirable for all grades of shoes because it can withstand scuffs, knocks and hard wear and still retain its attractive appearance for a long time. Calf leather is produced in a variety of weights suitable for men's shoes as well as lighter



TACKING CALFSKINS TO FRAMES

footwear for women and children. Besides its value in shoe uppers, calf leather is used in the manufacture of handbags, purses, gloves and garments, bookbinding and some kinds of luggage.

The tanning of calf leather follows the general chrome tanning procedure, except that an appreciable quantity is still tanned by the vegetable process for shoe leather and other purposes. There are many variations in the finishing of calf leather in order to obtain the variety of colors and surfaces used for the uppers of shoes and for handbags. Besides the smooth or polished leathers which are made by dressing or glazing the grain side, a great quantity of suede leather is manufactured from calfskins. Other leathers, such as kid, sheep and side upper, are also finished with suede surfaces, and the following brief description, therefore, applies to all suede leather.

In producing suede, the tanner must raise a soft, even nap on the surface of the skin. This is done by buffing the leather against a large, rounded emery wheel, which creates the characteristic nap and silky texture of suede. None of the strength of the leather is impaired by this buffing, because it is the flesh side and not the grain side that is surfaced. Consequently all the strong tight texture of the grain surface is left. Until recently suede was a fashionable leather chiefly for women's shoes and handbags, but new varieties of it have extended its popularity. It is greatly used for garment leathers, and some with rougher naps than fine suede have won favor for use in men's shoes as well as women's.

Another leather highly important for the manufacture of shoes is goat, or kid, leather. In fact, the uppers of more women's shoes are made of this in the United States than of any other material. While all goat skins are commercially known as kid skins, there are dozen of varieties, and in general they are divided into three types—fine, medium and coarse grained. This differentiation is based on the spacing of the pores; in the fine skins they are small and close together, and in coarse skins they are larger and more widely spaced. The flexibility, porous characteristics,

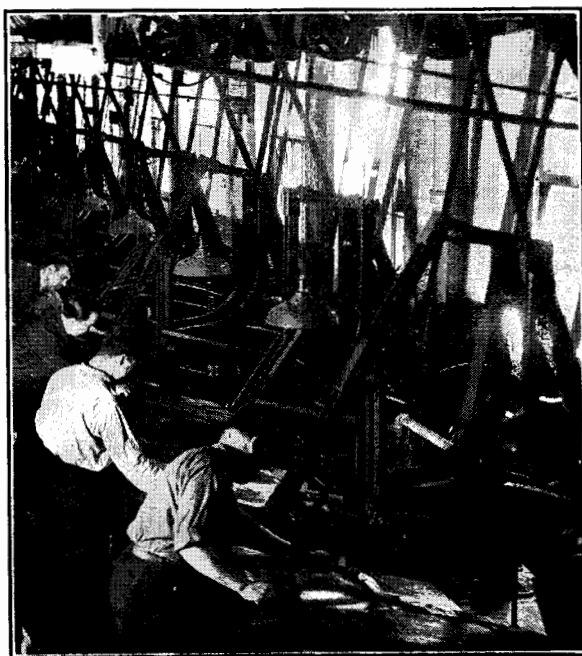
Suede
Leather

Goat and
Kid Leather

Calf
Leather

and the perfection of color obtainable in kid leathers are features that have promoted their world-wide use in footwear. On a weight basis kid leather is one of the strongest of the tanners' products; its fibres are tight and compactly interlaced, yet it is soft and pliable. These qualities were well appreciated in antiquity, for goatskins were a regular source of leather-making material thousands of years ago.

Chrome tanning is also employed for most kid leathers. The bulk of this is finished as "glazed kid" and more of it is produced in this country than in all the other nations put together. Goatskins, because of their fine surface texture, are well adapted to glazing and may be finished to a high gloss. Much suede and dull finished kid



GLAZING MACHINES PRODUCE A HIGH GLOSS ON KID LEATHER

leather is also made today, but glazed kid remains the outstanding kid leather.

In addition to its importance as a standard upper leather, kid is frequently used for the linings of well-made shoes. Still another important purpose to which kid is put is the manufacture of

gloves. Several methods are employed for producing and finishing glove leather, and the product is usually accepted as one of the very finest materials for gloves.

Fancy leather for many miscellaneous articles is also made from goatskins. The term Morocco is applied to one type of fancy leather tanned from goatskins because the Moors were the first to make this leather. They discovered that the fine grain of tanned skins could be brought out into bolder relief by boarding. This is a manual process in which the leather is folded over itself, grain surface to grain surface, and the fold pressed back and forth with a cork board. Morocco is one of the classic bindings of fine books.

Sheep leather is put to a greater number of uses than any other type of leather. Among the standard leathers made from sheep and lamb are the two important groups of shoe leathers and glove or garment leathers. The type of tannage depends on the breed of sheep from which the skins came, or the use for which the leather is designed. Chrome or vegetable tanning may be used, or, in some cases, a combination of the two.

Glove and garment leathers are produced from sheep- and lambskins in a wide variety of finishes. Lambskins are the most important raw material for glove leathers, which are made with smooth surfaces, or with suede and mocha finishes. The tannage of lambskins depends primarily on the desired finish of the leather. It may be chrome, oil or a special process involving the use of other chemicals.

Leathers for clothing, handbags, for rollers in textile mills, for sweatbands in hats, for parchment used in making such documents as diplomas, for piano parts, for pouches in gas-meters, are numbered among the fifty-odd special leathers made from sheep- and lambskins.

Many lambskins are tanned with a uniformly clipped short length of wool still adhering to the skins. This product is called shearling leather, and it is deservedly popular for lining men's and boy's work coats, warm slippers, and other articles of clothing. Very often such skins are colored and finished to resemble fur such as seal.

Much of the leather from miscellaneous and exotic skins, as well as from more important types, is termed fancy leather.

**Fancy
Leathers**

This is a general classification covering leather for articles ranging from pocketbooks to shoes, scissor-cases to collar bags. Nearly every color is shown in such articles, and the surface texture varies from hard, smooth finishes to unusual grain designs. Calf-skin is an important fancy leather material, but a great deal is made from the skins of sheep, goats, ostriches, snakes, lizards, alligators, seals and sharks. Sheep and lamb are of considerable importance for fancy leather, because, while relatively inexpensive, they have a texture well adapted to embossing with the grains of rarer leathers.

We have now discussed the qualities and the tanning of the major leathers. There are many other kinds; not all of these are available in great or constant quantities, and their uses are often quite specialized.

As everyone knows, pigskins are distinguished by the peculiar markings on the surface, which are really the pores left by the removal of bristles. Although many pigskins are tanned here, the bulk of the raw skins must be imported because only a small percentage of the pigs slaughtered in this country are skinned. The smoothest and best skins come from Europe where the animals are as carefully tended as pure bred cattle in this country. A small number are imported from Mexico and from the River Plate region in South America. Many "pigskins" used for gloves really are the skins of the peccary, a species of wild hog, or those of the carpincho or capivari. Both the latter belong to the rodent, rather than to the pig family.

Pigskin leather might be classified as a fancy leather, a luggage leather or as a glove leather. It excels in one quality particularly, that is, its resistance to wear and its durability. For that reason, together with its handsome appearance, it is found serviceable in the manufacture of novelties, saddle seats, wallets, sport shoes, luggage, gloves, bookbinding, upholstery, innersoles for shoes and razor strops.

Skins from the animals of the deer family are almost entirely imported. Latin America and

Deerskins Canada are the chief sources of supply, although a number of countries, including regions of northeastern Africa, southern and eastern Asia, and the East Indies, furnish us with some.

Deerskin, or, as it is more generally known, buckskin, makes a leather of some importance for gloves and for shoe uppers. The buckskin leather of which gloves are made is usually tanned with oil or with a chemical called formaldehyde. A different tannage is employed when the leather is to be used for shoe uppers. The quantity so used, however, is limited to the high grade and usually expensive sport shoes. A considerable amount of side upper leather is tanned with a suede or "ooze" finish to resemble genuine buckskin. In volume side upper "buck" far exceeds the use of genuine buckskin.

The kangaroo and wallaby, a species of kangaroo, have skins which make one of the most perfect upper leathers. Until about fifty years ago these skins were thought valueless, until an American tanner discovered their usefulness. Since then the production of kangaroo leather has been a comparatively small, but stable, branch of the industry. American tanners import approximately 1,000,000 kangaroo and wallaby skins a year, chiefly from Australia. Kangaroo leather differs from other types in having a particularly tightly-woven skin structure, the closely intertwined fibres running in all directions. Because of this peculiar structure the leather is the strongest known for a given weight and thickness. In service it does not readily scuff or crack, and makes shoes both attractive in appearance and extremely serviceable. Many athletic shoes, where both strength and comfort are extremely desirable, are made of kangaroo leather.

The tiny rosette that marks ostrich skins makes this leather distinctive and much in demand.

**Ostrich
Skins** This leather is also unique in that it is the only one that comes from birds. Ostriches are raised principally for their plumes, and the skins are only



OSTRICH SKINS COME MAINLY FROM AFRICA

taken from birds that die or are past their period of usefulness to the South African farmers. The number tanned is thus very small, and perfect skins are rare.

Ostrich skins are tanned by the vegetable process, and the leather has so distinctive a surface and is so strong in substance that it is highly valued for all types of fancy leather merchandise, as well as some women's shoes.

Tanning serves to stress the original markings of reptile skins, which vary a great deal in design and coloring, so each variety of these leathers is peculiarly distinctive. They are used chiefly in some shoe uppers and specialties. The pythons, boas and anacondas are of the greatest value for leather because of their size, but the skins of the smaller poisonous and water snakes have the most beautiful colors and designs, and are therefore widely sought in dangerous jungles and waste places throughout the world. Shoes, pocketbooks, and similar articles are frequently made with reptile leather.

Alligators and crocodiles are valuable only for their skins, which in recent years have become greatly appreciated because of the beauty and durability of the leather they yield. While some skins are available from animals hunted in Florida and the Louisiana bayous, the greater part must be imported. Mexico, Central and South America are sources of many skins, and the Philippines and Africa supply the remainder.

Not only women's but men's shoes as well are made of alligator leather and there is a constant demand for handbags and luggage fashioned of alligator leather. It is also used as a fancy leather for ornamental belts, billfolds and other articles.

The hair seal, walrus and shark are the principal marine sources of material for leather. Of course the quantity is not great, but each of these types of skins yields a leather of appealing surface and other valuable qualities. Seal and walrus skins are brought in by ships that set out from Newfoundland and Norway once a year and go to the subarctic regions where the seal and walrus are plentiful.

Sealskins make a soft, quite strong and durable leather of unquestioned beauty. The finest seal leather is the "pin grain" made from the tanned skins of young seals. In glazed black or in colors, this leather is extensively used in handbags and novelties. It is also available in quantities sufficient for a limited amount of footwear. Heavier sealskins provide a grade of vegetable-tanned leather that is used for covering travelling bags and cases, but the bulk of sealskins is employed in the production of fancy leather.

Though the natural grain of seal is often simulated on calf or sheep skins, the surface of genuine pin seal is distinguished by its softness, while the simulated leather has a slightly hardened surface.

Another leather of marine origin is tanned from the skins of sharks. This is a relatively recent member of the leather family, and is interesting in many respects. Its pleasing and original surface has given it considerable value as a fancy leather, particularly for women's handbags. Because it is quite an expensive leather its use in shoes has remained limited, although it possesses a high tensile strength and great resistance to scuffing or tearing. It is often used to cover the toe-caps of children's shoes because of its ability to withstand scuffing. Shark skins come from tropical waters, particularly off the coast of Australia. A smaller supply is obtained in the Pacific off the lower California coast.

Walrus leather is chiefly important because it is both very thick and tough. Its coarse texture

**Leather of
Marine Origin:
Seal, Walrus
and Shark**

**Snake and
Lizard Skins**

**Alligator
Skins**

makes it highly suitable for buffing wheels used by jewelers and silversmiths for polishing their wares. No other leather has been found to take the place of walrus for this work. It is also used to a minor extent in the manufacture of luggage.

Very few horses are slaughtered in the United States for human consumption, although the practice is more common in other countries. Horse meat, however, is extensively used in the manufacture of dog food. Consequently, a number of horsehides are obtained in this country from horses that have outlived their usefulness. Some horsehides and coltskins are imported from France and other countries, but not in large quantities. Although this raw material is relatively a small part of the vast number of hides and skins used by tanners, several leathers useful for shoes, gloves and garments are made of it. Cordovan leather comes from the butt of the horsehide, a section cut off from the hind quarters. It differs in a singular way from all other leather in that the flesh side becomes the surface of the

**Horsehides
and
Coltskins**

tanned leather. Cordovan is extremely hard and fine-grained, and is less porous than other shoe leathers.

A very fine grained leather for shoe uppers, work gloves and rugged garments is made from selected horsehides. Horsehide leather is also used quite extensively in the manufacture of sporting goods such as baseballs, catcher's mitts and similar articles.

Another raw material is the hide of the true water buffalo, an animal common to Southern Asia and some parts of Europe east of Italy. This animal is not to be confused with the American bison which once roamed the great plains. The true buffalo bears a resemblance to our short-horn cattle, and is a beast of burden, particularly in the rice fields of semi-tropical countries. Buffalo hides are coarser than those of cattle, and while once imported in some quantity, are now used to a very limited extent, chiefly in making luggage and mechanical rawhide leathers.

**Water
Buffalo
Leather**



KANGAROO AND WALLABY SKINS ARE IMPORTED FROM AUSTRALIA