Complete Handbook for Hat Makers of All Kinds

Julia de Fontenelle

COMPLETE HANDBOOK FOR HATMAKERS OF ALL KINDS
Such as various felts, shakos, hats made of silk, cotton, and other filamentary fabrics, hats made of feathers, leather, straw, wood, wicker, etc., updated to reflect the progress of the chemical arts, and enriched with all patents for inventions relating to hatmaking.

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1830.

TO
MR. B. ANGLES,
MILITARY SUB-INTENDENT,

Knight of the Royal Order of Saint-Louis, and corresponding member of the Linnean Society of Paris.

MEMOIR OF LIVELY GRATITUDE,
AND TESTIMONY OF THE HIGHEST ESTEEM
AND SINCERE FRIENDSHIP.

JULIA DE FONTENELLE.

INTRODUCTION.

Hatmaking is one of the branches of industry that most requires the application of advances in chemistry. This manufacturing process encompasses a host of diverse operations, some of which require numerous improvements, both in terms of artistry and the health of the workers. We will limit ourselves to the process known as secretion, which is performed using mercury nitrate. This salt, as is well known, is a violent poison; thus, the vapors and particles released from the hair are very harmful to workers.

Dyeing processes are also far from meeting what one would expect from the great strides made in the chemical arts. It has been shown that blacks are often obtained which, over time, turn bronze, brown, and even reddish. This serious drawback is generally attributed to iron sulfate, for which it has been proposed to substitute the tartrate, or even better, the acetate, of this metal. The Society for the Encouragement of National Industry, whose watchful eye is directed towards all branches of the chemical, economic, mechanical and industrial arts, which require the benefits of science, has not failed to turn its attention to the various operations of hat making, several of which have already been the subject of the prizes it has proposed. If all have not yet been completely resolved, they have given rise to research and improvements marked by utility, and which will probably have opened the way to new discoveries.

We must add that several French and foreign manufacturers and various technologists have persevered in their own right to numerous projects to improve their craft; we will limit ourselves to mentioning Messrs. Guichardière, Morel de Beaujolin, Robiquet, Lenormand, Williams, Malartre, Malard and Desfossés, Collin, Borradaille, Chaming Moore, Ritchard and Franc, Trousier, Miraglio, Masniac, Vilcok, Mierque and Drulhon, Achard and Audet, Gury, Loustau, Perrin, Bercy jeune, Buffum, Pichard, Milcent, Reins, Blouet, de Bernardière, Weber, Wels, Cobbet, Michon; Mesdames Manceau, Reyne, Bernard, and Cavillon. We gratefully acknowledge that not only have we benefited from their work, but we have even copied verbatim their most useful documents, in order to preserve the technical and practical flavor that must be presented to workers. For greater clarity, we have divided our work into four parts.

The first contains a description of all the materials used for hat making.

The second part covers various felted hats and all the operations required for their creation.

The third covers hats made of silk, cotton, filamentary fabrics, etc.

The fourth covers all the various straw hats, wicker hats, wood hats, etc.

We have faithfully presented the best manufacturing methods used both in France and abroad for these various types of hats; and we have listed all the patents that have been obtained in the various branches of hat making. We believed this was the best way to make known a large part of the improvements that this art has undergone. Finally, we have combined the knowledge we have acquired through our practice with the best documents available from French and foreign technologists.

PART ONE:
DESCRIPTION OF THE MATERIALS USED FOR HAT MAKING.

WOOLS

From the very beginning, wools were the only raw materials used for hat making. Now they are only used for hats of inferior quality. Not all wools produce equally beautiful felting or the same quality of hats; it is therefore essential that we go into some detail about their knowledge and selection.

Knowledge and Selection of Wools for Hat Making.

There are two types of wool: dead wool, or wool from dead animals, cut or torn from the skin, and fleece wool, or wool shorn from living animals. The latter deserves preference for both hat making and drapery. Wools are also divided into surged or greased wool and washed wool. Greased wools have a longer shelf life. As for their color, they are generally white and sometimes black, reddish, etc.; only the first are subjected to dyeing. As for their length, the shortest are one inch long, and the longest (in England) are up to twenty or even twenty-two inches.[1]

Note 1: This length seems to us to have been exaggerated, unless the sheep are left for more than a year without being sheared. Indeed, Mr. Tessier reports that in an experiment he conducted and repeated at Rambouillet, the wool of Spanish animals, kept three years without being sheared, was eighteen inches long.

Wools differ from one another in their color, strength, fineness, length, and what is called their sinew or body; hence their division into:

- Superfine wools,
- Fine wools,
- Medium wools,
- Coarse wools,
- Coarse or super-coarse wools.

For wool to be considered of very good quality, it must be fine, soft, fluffy, elastic, and strong at the same time.

To determine their degree of strength, which, along with their fineness, is their primary merit, filaments are pulled from both ends and their strength or weakness is judged by their resistance to breaking. To judge them comparatively, a more rational process is used. Threads of equal thickness and length are made, attached to a fixed point, and small weights are placed at the other end, which are multiplied until the thread breaks. The degree of strength is estimated by the number of weights each thread requires to break. In addition to the wool, the animal bears on some parts a type of hair mixed with wool, called awn, dead hair, or dog hair, which is used only for making very coarse fabrics. The wool from the legs and underbelly, burned, so to speak, by the manure, is also of lesser value.

The wool from the north of France is longer and coarser than that from the south; thus, that from the departments of Hérault, Aude, and especially from all of Roussillon, far outweighs that from Flanders, Picardy, Île-de-France, and Champagne. The wool from the south, particularly that from Narbonne and Salanque, is short, curly, and very fine. The latter is similar to that from Spain.

We must, however, agree that the wool of Spanish merinos surpasses the best in France in every way. Also, in the southern departments and in some in the north, owners have not hesitated to crossbreed their flocks with Spanish rams raised in royal sheepfolds. Most wools from Italy are also very fine.

Those from England and North Holland are long and finer than common wools, without, however, having the fineness of those from merinos. Among those from Spain, those from Leon and Segovia hold the first rank: even then, the Spanish classify them into four qualities.

- The first quality is that which extends from the neck to five to six inches from the tail, encompassing a third of the body; that of the shoulders and underside of the belly, preserved from the action of manure, is also included in this class. This quality is called *floreta*, or flower of the wool.
- The second quality is that which covers the flanks and extends from the shoulders to the thighs.
- The third is that of the neck and rump.
- The fourth is that which extends from the front of the neck to the bottom of the feet, including part of the shoulders and both buttocks, down to the tips of the feet. This is the wool that the Spanish call *cayda*.

People familiar with the trade or use of wools can tell their degree of fineness by eye. Some verify this by spreading the filaments on a black cloth and examining them with a magnifying glass. But Daubenton, who, as we know, took special care in the training of wool-producing animals, advised manufacturers to subject these wool filaments to a micrometer placed in a microscope. This micrometer, says Mr. Tessier, represented a small network or a compound of meshes. There was only one tenth of a line between the two parallel sides of the squares of the micrometer used by Mr. Daubenton, and his lens magnified fourteen times. Having recognized, by carefully made observations, that the large filaments[2] of twenty-nine samples of superfine wool, brought from various manufactures, rarely occupied more than two squares of the micrometer, he fixed the last term of superfine wools to those whose largest filaments fill by their width a square of the micrometer, and whose diameter is the 70th part of a line. The width of the largest filaments of the coarsest wool occupied up to six squares of the micrometer, which is equivalent to the 23rd part of a line. The largest filaments of the jar filled up to eleven squares of the micrometer, which make 17th part of a line. Such an examination is almost impractical for shepherds, whose eye and experience are sufficient for this operation. We will add that without resorting to Daubenton's micrometer, one can very easily ascertain the degree of fineness of wool using the Amici or Euler microscope, perfected by Messrs. Vincent Chevalier and sons.

Note 2: All wool is composed of very fine threads, of varying thickness. The latter, according to Daubenton's observation, are found at the ends of the strands.

The animal's state of health and the time of shearing significantly influence the quality and beauty of wool. Thus, sick animals not only lose part of their wool, but the other part, lacking nourishment, is dry and easily detaches from the skin. The same is true of the wool extracted from animals that have succumbed. As for the wool from the skins of sheep killed for slaughter, the more the animals were slaughtered close to their shearing time, the more distant they are from their point of maturity. These wools lack the softness imparted by grease, which nourishes them; if we add to this the lime or ashes used to detach them from the skin, we will realize their roughness. As for long-wool skins, butchers have them sheared into fleece.

It is therefore quite obvious that the best time to shear wool is when it is fully mature. This point should not be exceeded because in France, animals, especially weak ones, lose some of their fibers.[3] If, on the other hand, they are sheared before this maturity, the filaments seem to adhere to each other at their base, and the wool is, as they say, soft, that is, it lacks sinew or strength.

Note 3: It is not the same with merinos; these, except in cases of illness, can keep their wool for up to three years, almost without losing any. Tessier, New Complete Course in Agriculture.

In the south of France, wool is sheared from mid-May to June 15th; in the other departments, throughout the latter month. There is one reason that should encourage owners not to shear beyond this time: when the heat arrives, the fleeces, in addition to their weight, trap perspiration, heat the animal, and allow vermin to settle in them, etc.
The volume and weight of fleeces are relative to the size of the animal, its species, and the climate in which it lives, regardless of the care and the more or less abundant food it is given. We will briefly describe the weight of most known wools, as given by Mr. Tessier.

1. The fleece of Alençon, Ardennes, and Sologne sheep weighs from two to four pounds. This latter wool is intermixed with red hairs and is unsuitable for hat making. It is used to make blankets.
2. That of Briard, Bourbonnais, Champagne, and Langres sheep also weighs two to four pounds; it is used for hosiery and is not very suitable for hat making.
3. That of Bar sheep weighs three pounds. The best quality is used for hosiery and to make terry cloth.
4. That of Faux, Valières, or Bocagers sheep weighs three to four pounds. Most of this wool is mixed with white, black, and red, which in hosiery terms is called beige. It is used to make thick fabrics without the need for dyeing.
5. That of Cotentin sheep weighs three pounds.
6. That of Cauchois sheep weighs five pounds. It is combined with a few red hairs. It is used to make blankets and sheets known as Châteauroux.
7. That of Cholet sheep weighs four pounds. They are used to make blankets.
8. That of Vexin or Santerre sheep weighs six to eight pounds. The wool is beautiful and is used for warp knitting.
9. That of Artois and Gravelines sheep weighs nine to ten pounds. It is used for warp knitting.
10. That of Dutch or Liège sheep weighs nine to ten pounds. This wool is only used for clothing troops.
11. That of Flemish sheep weighs ten to twelve pounds. It is strong and is used for warp knitting.
12. That of German sheep weighs six to seven pounds. It is often beige.
13. That of Alsatian, Lorraine, and Swiss sheep is strong and suitable for combing.
14. The weight of merinos varies depending on the location, and whether the animal grazes on the plains or in the mountains. In the former case, it is eight to ten pounds; in the latter, seven to nine.
15. The wool from the district of Narbonne is, after that of Roussillon, the most highly valued in the south of France, especially that of the wool-bearing animals that graze in the Corbières and La Clape mountains, in the communes of Fitou, Lapalme, Sigean, Leucate, Portel, Armissan, Saint-Laurent, Thézan, Bize, Treilles, etc.
According to a survey I made of the approximate product from shearing wool in the district of Narbonne, in 1822 it amounted to:

Merino wool at	*3,000 kg*
Mixed wool at	*40,000 kg*
Native wool at	*365,500 kg*
	408,500 kg

The fleeces of all the animals having been calculated, on average, two kilos each.
According to a letter addressed to the Minister of the Interior, on December 23, 1813, there would be in the district of Narbonne, in woolen animals, merino, mixed race or native, 2,042,500; in addition to the 65,187 which perished in 1813, as a result of the drought and the poor quality of the grass.

In this district of Narbonne, the fleeces weigh from four to ten pounds, depending on whether the woolen animals graze in the mountains or certain plains like those of Coursan. There are certain herds which are almost all mixed race, and which are remarkable for their beauty and the fineness of their wool. We will limit ourselves to mentioning that of my honorable friend Mr. Chevalier Angles, at Sigean; of MM. Caunes, at Ginestas; Tapie Mengaud, at Celeyran; Caumettes, in Vires; Fournier, in Moujean, etc.

16. The wools of the Carcassonne district are similar to those of Narbonne; but in general, they are inferior in quality. They are used for casimirs, superfine cloth, common cloth, cordelats, and fleece. [4]

17. The wools of the Castelnaudary district are much less fine than those of Carcassonne; they are used for the manufacture of common cloth, cordelats, and blankets. [5]

18. The wools of the Limoux district are very similar to those of Carcassonne; they are used to make fine and common cloth, as well as blankets. [6]

Note 4: There are twenty-three factories in this district.
Note 5: This district has thirteen factories.
Note 6: This district, which includes Chalabre, Limoux, and Quillan, has sixty-nine mills.

We should add to this that most of the wool qualities from the Narbonne district are highly sought after by all the mills in the departments of Aude and Hérault, primarily those of Bédarieux, Saint-Chinian, Saint-Pons, etc., and even by a large number of other localities.

In this department, as in those of Hérault, Pyrénées-Orientales, etc., it is not customary to wash wool on the animals; far from it, shepherds have the bad habit of constantly making them lie on manure without bedding, of piling them up in barely ventilated sheepfolds, so that the wool, by absorbing the animal's sweat and the urine from the manure, increases in weight. One can sense the viciousness of such a practice. Also, part of the wool from the legs and underside of the belly is often almost burned by the manure; moreover, it has a yellowish color that is not lost by washing.

19. The wools of Roussillon are superior even to those of Narbonne. Only those from Fitou, Leucate, Lapalme, and a few from Sigean come close. The Roussillon landowners have also improved their breeds by crossing them with Spanish merinos. The weight of these wools and their quality vary depending on whether the herds graze in the mountains or the plains, and depending on the locality. Thus, near Vingrau, the fleeces weigh about eight pounds, while in Sallanque they weigh ten to twelve pounds. The wools of Roussillon are highly valued and sought after for the factories in the departments of Aude, Hérault, etc.; It is made into fine cloth, shawls, etc.

Lamb wool: called agneaux, and in southern dialect, anissées.

Lamb wool is much more highly valued for hat making than that of adult sheep; it is also all the more sought after because it comes from very fine flocks. Throughout the south of France, lambs are sheared at the same time as ewes and sheep, and lambs are most often sold separately and always at a lower price than the wool. In other areas, they are sheared later to give their wool time to lengthen. The first practice seems preferable to us, because the new wool has more time to grow, and is then longer in the autumn to protect the lambs from the harsh weather during penning. What we have said about wool from the skins of animals that have died of disease or been slaughtered also applies to lambs.

We should add that the name "lambs" is also given to a Hamburg wool produced from the shearing of live or stillborn lambs, collected in the northern countries of Europe.

Wool from the Antenois.

The Antenois are the lambs of the second year; there are owners who only shear the lambs in their second year or while they are still lambs. This practice is flawed because the wool is then less fine.

Experience has, in fact, shown that the wool of Antenois lambs shorn as lambs is consistently finer than that of the lambs themselves.

Vicuna Wool.
This wool belongs to a breed of sheep of this name that appears to be native to Peru. At least, it was from these regions that these beautiful wools were transmitted to us via Spain. This wool is a brown that tends towards red, especially on the back; it takes on a blond color as it progresses towards the flanks and belly.

Cashmere Sheep Wool.
The Cashmere sheep, like the Tibetan goat, etc., has two hairs; One is long, thick, and stiff, and the other is a very fine type of wool, short and kinky. Its rarity and high price prevent it from being used for hat making.

HAIR

Rabbit Hair.
Rabbit hair is widely used in hat making; not only does it contribute essentially to felting this type of fabric, but also to giving it firmness. It is used in the making of hats, on average, for a quarter of their weight. It is obvious that these proportions increase according to the beauty or finesse of the hats to be made. It is estimated that the hat industry in France alone buys fifteen million rabbit pelts annually. Since the loss of Canada, the price of beaver hair has tripled, which means that much less of it is used, and consequently much more of rabbit hair; therefore, our manufacturers are obliged to import it from abroad.
In the sale and purchase of rabbit pelts, there is an important observation to make: during the winter they sell for 50 to 60 francs per hundred, while in the summer they are worth only 25 to 30 francs. This difference is due to the fact that the animal molts during this latter period, and consequently, the skin is much less rich in hair.
Rabbit hair varies in beauty depending on the species to which it belongs. Thus, the variety known as the rich rabbit, Cuniculus argenteus, of Linnaeus, whose hair is partly slate-colored, more or less dark, and partly silvery, far surpasses that of the ordinary gray rabbit; it is in fact softer, longer, and silkier, and is therefore used for fur. In Sweden and various parts of Germany, these pelts are worth double the ordinary price; in England, they are worth up to 25 francs per dozen. This species acclimatizes very well in France; it could be easily propagated.

Angora rabbit hair.
The Angora rabbit, Cuniculus angorensis, Lin., is already quite common in France, where it thrives very well. Its hair is long, bushy, and silky. During its molt, it sheds a lot, and it can be plucked two or three times during the summer, especially along the back, neck, ribs, and thighs, leaving the belly hair, which is of inferior quality and used for nesting, for the mothers. This hair is excellent for hat making; it is also used to make gloves, hats, etc., known as angora.

Wild or warren rabbit hair.
The hair of these is shorter than that of rabbit hutch hair; however, it is finer and produces a more beautiful felt.

The parts of France that produce the best rabbit skins or fur are: Narbonne and its surroundings, Boulonnais, Meaux, Compiègne, Chantilly, Dammartin, Pontoise, Rambouillet, Saint-Germain, Senlis, etc.

Observations on the hair of rabbit skins.
Rabbit hair varies depending on the season; we will examine it in the four periods of the year.

1. In winter. This is the most favorable season for the beauty of rabbit hair. It is then that the grain of the skin, or, if you prefer, the side that lies on the body, is of a uniform color, without spots or stripes. Add to this,[7] that the leather is thicker, that the hair is long, fine, and bushy, and that when blowing hard on it, the part that adheres to the skin is a velvety blue-grey, more intense in the wild rabbit than in the hutch rabbit, while the upper end or tip, which is dark grey, is topped with another grey hair, with a shiny blackish tip, which is very thick, and which is called the rabbit's guard hair.

Note 7: In hutch rabbits, this side is whiter than in wild rabbits.

2. In spring. This part of the year is the rabbit's mating season; its hair is then duller and its skin less furry; in males, because of the fights they engage in; in females, because of pregnancy. These pelts sell for 20 to 30 percent less than winter pelts.

3. In summer. We have already mentioned that this is the time of rabbit molting. The pelts are then stripped of a large portion of the hair, as well as the black-tipped guard hair that protrudes beyond the fine hair; the latter is dull, and the skin is thicker and dotted, on the flesh side, with black spots and stripes; these pelts are known in the trade as barred pelts. Finally, summer pelts are worth 50 to 75 percent less than winter pelts.

4. In autumn. Autumn pelts are preferable to the latter; the hair is renewed, but it has not yet acquired the proper sinew or length, and the guard hair does not extend beyond it; which makes separation not only very difficult, but also incomplete. They are called hay-covered pelts. The guard hair that remains unbroken makes this fur very common; these pelts are therefore sold for 20 to 25 percent less than winter fur.

Hare Hair.
Despite all the similarities between the rabbit and the hare, despite the latter's very fine and extremely light fur, it is nevertheless much less susceptible to felting than that of the rabbit. It is only with the help of certain preparations that it becomes suitable for felting; but thanks to these preparations, it becomes the finest and most highly valued felting material in our region.
Although hares are found throughout France, their pelts vary in quality depending on the locality. Those from Roussillon, Saint-Chinian, Saint-Pons, Anjou, Brittany, Poitou, etc., are preferred for the beauty and quality of their hair, and those from Alsace are sought after for the size of the species.

Observations on hare hair.
What we have said about the influence of the four seasons of the year on rabbit skins also applies to hare skins. Here are the ways to identify them.

1. Winter skins have thin leather, and the side that lies against the flesh has a light, even color, dotted with small blood vessels that join larger ones. The hair is fine, white, and has the color and luster of

silk; its tip is a velvety black color; the guard hair extends beyond it; it is reddish-yellow throughout its entire length, except for its upper end, which is black and shiny.

2. The spring skins have leather a little thicker and reddish on the flesh side; the hair is dull and less bushy.

3. Summer skins. Thick and strong leather; the color, on the flesh side, is red but uneven; only the large blood vessels are visible. Like rabbit skin, the hair is short, sparse, dirty white, and joined to long and short guard hair.

4. Autumn skins. Leather is somewhat thick and stained. The hair is renewed, but short and joined to the guard hair, which is the same length and always incompletely separated.

It is worth noting that there is an important difference between the guard hair of rabbits and hares; the guard hair of the former is less attached to the leather than the hair, while in the latter it is quite the opposite. Also, during molting, the hare loses most of its hair and retains almost all of its guard hair, while the rabbit retains much more fine hair than guard hair. This observation is important, both for the respective value of these pelts and for their preparation, relative to the seasons of the year in which the animal was skinned.

Beaver hair.
The beaver, Linnaeus's castor fiber, of the order Dormouse, is distinguished from all rodents by a horizontally flattened, oval-shaped tail covered with scales. This characteristic classifies it among the amphibians. It is quite common in Canada, New England, Russia, Siberia, Poland, Germany, etc.; some have even been found in France in the Rhône. The beaver has four feet; the two hind feet are more specifically intended for swimming; they have five toes bound by a membrane; It has four membranous pouches in its groin that contain a very strong-smelling liquor that thickens easily with the help of heat, and constitutes a concrete, brown, unctuous substance with a very strong odor, which is called castoreum. We will not describe here the customs or industry of beavers; on this point, we refer to Buffon. We will limit ourselves to discussing what relates to hatmaking.

Beaver hair is the most valuable material for hatmaking; it combines finesse with lightness and strength, and is also the felt-making material par excellence. Unfortunately, the high price at which it is found, due to its rarity, makes its use very limited. At the time of the establishment of the French East India Company, beaver pelts were less rare in France; now we receive very few, even from English or American trade. In trade, beaver pelts were divided into fat beaver and dry beaver.

1. The so-called dry beaver pelts were sun-dried without any further preparation.

2. The so-called fat beaver pelts were those that had already been used by the natives, either for clothing or as bedding. It is evident that they chose the finest, or, if you will, the largest and most furred, carefully removed the muscular and limb parts, and dried them in the air and not in the sun, taking care to rub them often between their hands and coat them with the fat of these animals to give them a suitable suppleness. In addition to the fact that these pelts were therefore more beautiful, due to their use, they were imbued with the liquid secreted by perspiration, such that their hair felted much better; therefore, their price was higher than that of dry beaver.

Observations on beaver hair.
Beaver pelts, due to their high cost and rarity, are now very little used in France for making hats. Their fur, like that of the hare and the rabbit, is composed of two types of hair: the fine hair and the guard hair. As with the latter, the beaver's guard hair is less attached to the skin than the fine hair; therefore, during molting, the latter sheds more quickly. The regions from which they come in greatest quantities are Hudson Bay, Canada, and Louisiana.

A. The beaver pelt from Hudson Bay offers a fur that maintains the same beauty throughout the year; it owes this advantage to the cold experienced there in almost all seasons.
B. Canada provides large quantities; but, like those of the rabbit and hare, they are affected by the influence of the seasons.
C. Louisiana produces a fair amount, but they are less highly valued than those from Hudson Bay and Canada. As this region has its four equally well-defined seasons, beaver pelts also differ in quality depending on the time of year the animal was skinned.

Otter hair.
Buffon describes the otter, Linnaeus's Mustela lutra, as a voracious animal, more eager for fish than for flesh, which rarely leaves the banks of rivers or lakes, and which sometimes depopulates ponds; it is even more adept at swimming than the beaver. The latter has membranes only on its hind feet, and its toes are separated on its front feet, while the otter has membranes on all its feet; it swims as quickly as it walks. It does not go to sea, like the beaver; but it travels through fresh waters, going up or down rivers for considerable distances. It often swims between two bodies of water and remains there for a long time, then comes to breathe at the surface of the water. It is not amphibious. It has teeth like the marten, but larger and stronger relative to its body size; it fears neither cold nor humidity; its head is poorly shaped: the ears are set low, the eyes too small and covered, the air is obscure, the movements awkward, the whole face ignoble and shapeless; a cry that seems mechanical: such is the portrait painted by the French Pliny. We add that the beaver hunts the otter and does not allow it to live on the banks it frequents.

The otter's fur hardly sheds; its winter skin, however, is browner and sells for more than its summer skin; its fur is soft and silky, a whitish gray, and the guard hair is brown and shiny. This species is generally widespread in Europe, from Sweden to Naples, and is found in North America. We also know the Canadian otter, lutra Canadensis de Geoffroy. This is larger than our species and blacker; the small otter of Guiana, didelphis palmata de Geoffroy. According to M. de Laborde, there are three species of otter in Cayenne:
1st , the black, which can weigh from forty to fifty pounds;
2nd the yellowish, which weighs from twenty to twenty-five pounds;
3rd the grayish, which weighs only three to four pounds. These animals are very common in Guiana, along all the rivers and marshes.
According to MM. Aublet and Olivier, we find in Cayenne and in the country of Oyapok otters so large that they weigh up to one hundred pounds. Their hair is very soft, but shorter than that of the beaver, and their normal color is a faint brown.

There are several other animals of related species whose hair could be used in hatmaking; we will limit ourselves to mentioning the Saricovienne, the Brasiliensis lutra, the small Guiana marten, the Lacépède guianensis mustela, etc.

Camel hair.
Camel hair comes to us from the East via Marseille; it varies in color, fineness, and quality, depending on the climate, age, diet, and upbringing of the animal. The whitish hair is consumed locally; only the blackish-gray hair toward the lower extremities of the camel is rarely used in our factories. We would even add that it is now little used in hatmaking.

Red and black balls of wool.
This woolly hair comes from the Orient and takes its name from the ball-like shape it is given in the bales used for this transport; it is produced by goats of a particular species from Asiatic Turkey. There is a notable difference between the red and black balls. The latter felt more easily, but the hair of the red ones is much finer. Tibetan goats also have very fine down, in addition to the guard hair. It has been observed that our goats also have, beneath their long hair, a type of wool excellent for hatmaking.

NOTES ON THE USE OF FURS FOR HATMAKING.

We have passed over in silence a host of furs, such as cat fur, etc., which are endowed with varying degrees of beauty and are very suitable for making hats; their rarity, their special application to other types of manufacture or various uses, exempt us from listing them, let alone describing them. We will therefore limit ourselves here to presenting a few general remarks relating to the respective merits of the furs.

We will first say that when the animal has not reached its full growth, or better, its complete development, the hair of its fur is difficult to prepare and work; these skins are defective. For a contrary reason, the skins of old animals produce a rougher and more difficult to work with hair than those of middle-aged animals.

The name "beaten" is given to those of animals killed by a firearm that almost always damages the part on which the blow landed. Thus, those from animals caught in traps are preferable because they are much more whole and untainted by blood.

The term "green hides" applies to skins from which the animal has just been skinned. In this state, their preparation is not only very difficult, but always incomplete; this is easily remedied by allowing the skins to dry thoroughly in the open, dry air, by stretching them out on ropes.

Premium or first-quality hides are those that are free from imperfections and have been removed from the animal at the most opportune season.

Throughout France, fresh or dried hare and rabbit skins are purchased at so much each. When they are completely dry, they are bundled in fifty-two or one hundred and four packs, which are then sold by the hundred, giving an additional four percent. In certain western departments, hides that are very small by weight are sold.

As for lambs, one should preferably choose not those from the merino lambs, which do not felt well, nor those from the mixed breeds, but rather from among the natives those from the flocks which provide the most beautiful wool, the silkiest and the finest.

ON HATMAKING IN FRANCE.

Count Chaptal, in his fine work on French industry, has provided some insights into hatmaking that will serve as a guide.

Before the Revolution, hatmaking was the subject of considerable foreign trade for France. The factories of the South, especially those of Lyon and Marseille, produced a great deal for Spain, Italy, and our colonies. This export is now almost nonexistent. But, on the other hand, hat factories have been established in almost every part of France. The affluence of rural dwellers and the advancement of luxury have considerably increased consumption, although the prices of hats have almost doubled. It is worth noting that many more fine hats are being made than in the past.

Fine hatmaking uses hair from hare, rabbit, beaver, seal bear, and Egyptian raccoon, which it skillfully blends; Common hat making uses lambskin or lambswool, calf, camel, and kid hair, shearings from cloth, etc.

It has been established, through the most accurate calculations, that a fine hat leaving the manufacturer's shop costs 15 francs.

Raw materials cost	*8 |*	
Labor cost	*5 |*	*15 francs*
Profit	*2 |*	
Hatter's profit for the headdress, finishing, etc.		*5 francs*
Cost of the hat at sale		*20 francs*

In rough hat making, the manufacturer's profit ranges from 5 to 12 sous per hat. Hats were once made at the low price of 12 francs per dozen in several localities, particularly in Saint-Pierre-le-Moûtier.

There are approximately 1,180 felt hat factories in France, employing nearly 18,000 workers and generating revenues of approximately 20 million francs; adding a quarter more for retail hat merchants, this trade amounts to 25 million francs annually.

Regulations concerning the manufacture of hats in France.
Hatting, according to Count Chaptal, had escaped the regulatory system, but a decree of October 23, 1699, affected it in turn, authorizing the manufacture of only two types of hats: beaver and wool.
Complaints arose from all sides against this decree; they would probably have been unsuccessful if they had not been supported by the adjudication of the Western Domain and by the deputies of Canada. A decree was then issued on August 10, 1700, authorizing the manufacture of the following four types of hats:

A C. Fine beaver, marked with the letter C.
B C. Half beaver, with vicuña wool and beaver, marked with the letter D.
C C. Rabbit or camel hair, with vicuña and beaver, marked with the letter M. (Hare hair being strictly prohibited.)
D C. Fine wool, marked L.

This same decree provided for the confiscation of all other types of hats, prescribed searches, and imposed a fine of 1,000 francs.

Complete freedom of manufacture has been restored to the hat industry; since then, not only have several products not mentioned in the list of materials whose use was authorized been included in the composition of hats, but these mixtures are also infinitely varied. The manufacture of silk hats has opened the door to a new branch of industry and reduced the consumption of felt hats. These silk hats are remarkable for their lightness, the richness of their color, their brilliance, the elegance of their shape, and above all for their low price. Mr. Fontés, a hatter from Paris, is not only one of those who has contributed most to their perfection, but he is also one of the first in France to undertake their manufacture.

SUBSTANCES USED OR CAPABLE OF BEING USED IN FINISHES, DYES, ETC., FOR HATS, ETC.

Acids.

Acetic acid (vinegar).
This is the name by which modern chemists refer to pure and concentrated vinegar. The authors of the new chemical nomenclature had given the name acetous acid to vinegar, and acetic acid to the more concentrated type, which Mr. Berthollet believed to be more oxygenated than the former. Mr. Pérès was the first to attack this theory; he announced that acetous acid contained more carbon than acetic acid, or, if you will, that concentrated acetic acid was simply acetous acid stripped of most of its carbon. Since then, the work of Mr. Adet, confirmed by that of Mr. Darracq and countless other chemists, has demonstrated that acetous and acetic acids are identical and that they differ from each other only in their degree of concentration, or, if you will, in the quantity of water they contain. We will now examine this acid in these two states.
Vinegar.
It seems that nature was the first to make vinegar, and that its discovery must have accompanied that of wine. Modern chemists have demonstrated that vinegar or acetic acid was due to the transformation of the alcohol in vinous liquors into an acid, through the loss of part of its carbon. This transformation is the product of a new fermentation that alcoholic liquors undergo when combined with a ferment, and which is called acid fermentation. Vinegar, which is obtained by fermenting wine, contains: 1. acetic acid, which is stronger or more concentrated the more generous or richer the wine was in spirit or alcohol; 2. a coloring matter; 3. a mucilage; 4. super-tartrate and potassium sulfate; 5. more or less acetic ether; and 6. more or less water.

By stripping the vinegar of these foreign bodies, it is converted into very strong acetic acid. The successful production of vinegar therefore relies on four main factors:

1. A highly alcoholic liquor;
2. A sufficient quantity of ferment;
3. A temperature of 20 to 30°C;
4. The liquor must have a large surface area exposed to the air.

You can see in my Vinegar Maker's Manual the various processes followed for the production of vinegar; this acid can be produced by the fermentation of any sugary or alcoholic substance.

Thus, in my aforementioned work, I described those obtained with brandy, sugar, honey, beer, cider, starch, and rags converted into sugar, etc. I refer my readers to them. But there is still another way of making vinegars without resorting to fermentation; I will describe it.

Wood vinegar.
Ancient chemists had published that distilling wood in closed vessels produced an acid similar to vinegar. Guided by this data, J.-B. Mollerat presented a memoir to the Institute on January 11, 1808, in which he announced that in an establishment he and his brothers had established in Pellerey for the carbonization of wood in closed vessels, they obtained the following products:
Tar;
Vinegar;
Crystallized sodium carbonate;
Alumina acetates;
Copper acetates;
Sodium acetates; etc.

Since then, this new branch of industry has grown considerably. Wood is distilled in cylindrical boilers made of very thick sheet metal, capable of holding a cord of wood. The vapors are conducted through a copper pipe that fits a copper sphere placed in a barrel filled with cold water. From this sphere, a similar pipe extends, which joins another copper sphere, also arranged; finally, from this last sphere, a final pipe extends, which plunges into the furnace hearth. When the fire is lit, at the same time as the carbonization of the wood takes place, the vapors go into the sphere of the first barrel to be condensed; those that are not liquefied are liquefied in the second, while the flammable gas, carried into the furnace by the last tube, burns and serves to maintain this distillation. The products of this operation are:

1. In the boiler or retort, a very fine charcoal that represents 28 to 30 hundredths of the wood used, while carbonization in the open air produces only 17 to 18;
2. Tar in both spheres;
3. In the same sphere, pyroligneous acid, which is nothing other than acetic acid or vinegar combined with tar.

It is removed or purified by distillation; the product of this distillation is saturated with powdered lime carbonate (marble); it is boiled; it is then decomposed with sodium sulfate; a sulfate of lime precipitates, and the liquor is evaporated; through crystallization, a sodium acetate is obtained, soiled with tar; this salt is subjected to igneous fusion to burn the tar. It is dissolved in water, filtered, and evaporated to obtain an almost pure sodium acetate, which is dissolved in a little water and decomposed with sulfuric acid, which, combining with sodium hydroxide, forms a sulfate of this alkali. The acetic acid is exposed and in a state of concentration that is all the more powerful when the sodium acetate is dissolved in a lesser quantity of water. The specific gravity of that from the Choisy factories is 1.057; it saturates approximately 0.3 with sodium subcarbonate; it is served in silver vessels.

Mr. Mollerat's vinegars presented at the Institute were of the following degree:
Simple or ordinary vinegar, 2 degrees by hydrometer for salts at 12°C.
Strong vinegar, 10.5 degrees.

Commercially available wine vinegars range from 2 to 4%. It's worth noting that those obtained by carbonizing wood are very pure and are acetic acid.

See my Vinegar Maker's Manual for a description of these various processes, the quantity of products obtained, the operating costs, and the benefits derived from them. We will now discuss acetic acid, or pure vinegar.

Acetic acid.

This acid was known before the new chemical nomenclature under the name radical vinegar; it is a liquid, colorless, very clear, with a distinctive, very strong odor and a very acidic and caustic flavor. It reddens blue vegetable dyes. It is flammable, boils above 100°C, attracts moisture from the air, dissolves in water and alcohol, exerts a significant disorganizing effect on animal substances, and dissolves camphor, resins, gum resins, and volatile oils. The purest acetic acid that can be obtained is obtained in a crystalline mass representing elongated rhomboidal tablets at a temperature of 13°C. High pressure can achieve the same effect. The specific gravity of this most concentrated acid is 1.063; in this state, it contains 14.78 hundredths of water, which is necessary for its existence. The acetic acid obtained by distilling vinegar contains only 0.15 of acid. Acetic acid, diluted with more or less water, produces a vinegar of varying strength. Vinegars can be concentrated by removing some of the water they contain. This is achieved by exposing them to the action of cold, and removing the ice that subsequently forms; this ice is almost entirely pure water. This is also achieved by boiling them; water, being more volatile, vaporizes first; the same is true for distillation.

Analysis of acetic acid: its composition is as it exists in dried acetates, according to:

Messrs. Gay-Lussac and Thénard	***According to Berzelius***
Oxygen, 44.147	*Oxygen, 46.82*
Carbon, 50.224	*Carbon, 46.83*
Hydrogen, 5.629	*Hydrogen, 6.35*
100	*100*

Purity and Adulteration of Vinegars.

There are merchants who add mineral acids to weak vinegar to give it more strength or activity. Here's how to recognize the nature of the added acid. Pour a little vinegar into distilled water to which a few drops of barite nitrate or hydrochloride have been added; if a large white precipitate immediately forms, it is proof that it contains sulfuric acid; this precipitate, which is barite sulfate, indicates it. Nitric or hydrochloric acids are rarely added because they are much more expensive; but since this could happen, I will provide the proper means to detect this fraud. The vinegar is saturated with sodium carbonate; it is filtered, evaporated, and crystallized. If hydrochloric acid is added, the resulting salt, along with sodium acetate, produces a salt with a very salty flavor and cubic crystals, which is sodium hydrochlorate, also called sea salt, table salt, or sodium chloride. If this refinement is achieved with nitric acid, a sodium nitrate in rhomboidal prisms is obtained, which has a fresh, pungent, and bitter flavor and melts on charcoal like saltpeter. Moreover, the various methods used to detect adulterations of vinegar and to identify the quantities of added acids can be found in my aforementioned work.

Citric acid.

Discovered by Scheele in lemon juice. It is obtained by saturating this juice with calcium carbonate, washing the precipitate, and decomposing it with excess sulfuric acid, which absorbs the lime to form a calcareous sulfate that precipitates.

The citric acid, which is in rhomboidal prisms, is filtered and evaporated in a silver basin. It is transparent, with an acidic, almost caustic flavor. It turns sunflower infusion red, is unalterable in air, and is soluble in half its weight of boiling water; cold water takes two-thirds. According to Gay-Lussac and Thénard, it is composed of:
Oxygen 59.8559
Carbon 33.81
Hydrogen 6.330

Hydrochloric acid.
This acid is also known as spirit of salt, marine acid, and muriatic acid. It is by its nature gaseous, colorless, with a sharp and pungent odor, a very acid flavor, spreading white vapors in the air, reddening sunflower, extinguishing burning bodies with a specific weight equal to 1.247. By high pressure and low temperature it liquefies; At that of 50°C, Mr. Davy liquefied anhydrous hydrochloric acid gas (stripped of water). This acid gas is so soluble in water that this liquid, at a temperature of 20°C and a pressure of 76°C, dissolves more than 469 times its volume; in this case, the volume of water increases by a third. Liquid hydrochloric acid is colorless and gives off white vapors; if commercial hydrochloric acid has an amber color, it is because it is not very pure. It is distinguished from sulfuric acid in that it does not precipitate water or barite salts, and from nitric acid in that it precipitates silver nitrate.
This acid is prepared by placing very dry sea salt in a retort and pouring sulfuric acid into it. The latter combines with the sodium hydroxide in the sea salt, while spirit of salt or hydrochloric acid This acid is released as a gas and condensed in flasks two-thirds full of water and surrounded by cold water. This acid is composed, by weight, of:

Chlorine..... 36
Hydrogen..... 1

Nitric acid (aqua fortis, spirits of nitre, nitrous oxide, nitric acid, etc.)
Nitrogen, when combined with oxygen, gives rise to two acids: nitrous acid and nitric acid. We will only discuss the latter.
Pure nitric acid is colorless, liquid, transparent, very acidic, giving off white vapors, with a very strong odor, which has an analogy with that of rust; it burns and disorganizes animal substances by giving them a yellow color which, when applied to the skin, only disappears with the renewal of the epidermis; it strongly reddens the dye of litmus; its specific gravity, according to Mr. Thénard, is 1.513. It has not yet been possible to obtain it deprived of water: at 1.620, it retains that which is necessary for its state. Nitric acid freezes at -50°; it boils from 35 to 86° C, depending on its degree of concentration. The gas which passes through the distillation of this acid is soluble in water in all proportions, it is only a little contaminated by a little nitrous gas which is formed. This acid, poured suddenly onto turpentine and clove oils, suddenly ignites them; this experiment must be performed with great caution to avoid burns.

Aquafortis is prepared by distilling potassium nitrate (nitrate salt) with sulfuric acid in large retorts. In this process, this acid combines with the potash in the nitrate and forms a sulfate, while the free nitric acid is released as a gas and condensed in receptacles. It is redistilled to purify it.
For this acid to be pure, it must be colorless and not precipitate barite or silver salts. It can be recognized by its rusty odor and by the property it has, when a drop is poured onto a piece of copper, of bubbling and immediately forming a green foam due to the oxidation of the copper.

Composition:

Oxygen... 100	*By volume. 2.5*
Nitrogen... 35.40	*1*

This acid is widely used in the arts, such as dyeing, hat making, to dissolve metals, etc.; in medicine, in its concentrated state, to gnaw away warts and calluses; diluted with water, it is antiseptic and refreshing. We must add that aqua fortis and concentrated mineral acids are violent poisons.
The mixture of nitric and hydrodoric acids, in various proportions, constitutes this acid, which was known as aqua regia because it was used to dissolve gold; it is now called hydrochloronitric acid.

Sulfuric Acid (Oil of Vitriol, Spirit of Sulfur)
We have said that sulfur, when combined with oxygen, can form four acids: here we will only discuss the commercially available acid.
Pure sulfuric acid is colorless, odorless, highly acidic, and highly caustic, with an oleaginous consistency. It mixes with water in all proportions, but with a remarkable phenomenon: it releases a large amount of heat. Thus, mixing equal parts of water and this concentrated acid raises the temperature to 105°C; if ice is used instead of water, it only rises to +50°C; and if one part acid is used to four parts ice, it drops to -20°C. Sulfuric acid disrupts most animal and vegetable substances; when very weak, it freezes with difficulty. Concentrated, it takes on a crystalline form at 10° or 12°. When highly concentrated, it boils at 320°; weakened, it boils well below this point; subjected to the battery, it decomposes, its oxygen passing to the positive pole and the sulfur to the negative pole. Its specific gravity is 1.85, which is equivalent to 66° of Baumé's hydrometer.

It is prepared on a large scale by burning in large lead chambers a mixture of ten parts sulfur to one part potassium nitrate. Only half a kilogram of sulfur is used for every hundred cubic feet of air filling the chamber. For details of this preparation, see my Medical Chemistry.
To be pure, this acid must be colorless and free of sulfurous and hydrochloric acids. When deprived of water, it is composed of:

Sulfur..... 100
Oxygen..... 146.43

Widely used in the arts, for the manufacture of factitious soda, dyeing, the preparation of several acids, tanning, etc. In medicine, and very diluted with water, as an antiseptic, astringent, refreshing, etc.
It has the specific characteristic of abundantly precipitating barite salts.

Tartaric acid (tartarous acid, artaric acid).
Discovered by Schele. It is obtained by boiling ten parts of cream of tartar in one hundred parts of water, and saturating its superabundant acid with powdered limestone carbonate; then calcareous hydrochloride is added which precipitates the cream of tartar or potassium tartrate, in the form of lime tartrate; the precipitate is washed and heated with sixty hundredths of sulfuric acid diluted with water; it is filtered and the acid is crystallized. The crystals obtained are either prismatic or lanceolate-like blades. This acid strongly reddens sunflower; when pure it is colorless; it is unalterable in air; it melts and boils at 120°; upon cooling it forms a whitish mass which attracts moisture from the air; it is very soluble in water; nitric acid converts it into oxalic acid. It is composed of:

Oxygen..... 69,321
Carbon..... 24,500
Hydrogen..... 6,629

It is used in the arts for dyeing; a dry lemonade is made from it by incorporating it with sugar.

WOOD.

Campewood or Indian wood.
It comes from Hoematoxylum campechianum. Lin. Decand. monogyn. fam. of the leguminous family. This tree, which is very tall and thorny, is very common in the Bay of Honduras in Yucatan, Guatemala, Jamaica, Martinique, the island of Saint Croix, etc. This wood is compact, heavier than water, very hard, though less so than that of Brazil; it is red, with an iris-like odor, and has an astringent and sweetish taste, capable of taking a beautiful polish to a bright red. It is commercially available in large logs that are blackish-red on the outside.
Logwood decoction is a red that acids make more vivid; alkalis, metallic oxides, and salts change this color to blue-violet. The coloring matter of this wood is also soluble in alcohol. It is used in dyeing blacks, blues, and purples; cabinetmakers also use this wood for its hardness and the beautiful polish it can take. Mr. Chevreul separated the coloring matter and named it hematin. According to this chemist, it dissolves in boiling water and crystallizes upon cooling. This boiling solution is orange-red; upon cooling, it turns yellow; alkalis make it acquire a purple or violet color; acids give it a yellow color that turns red.

Fustet wood.
Rhu cotinus. FLAX. Pentand. trigyn. Family of the turpentine family. It is a large shrub that grows up to ten or twelve feet tall in our gardens. Its branches are slender; its leaves, with long petioles, are entire, rounded, smooth, and a beautiful green. Long panicles formed by numerous filamentous divisions resemble a kind of hair, and following the flowers, instead of the fruit, which aborts, terminate the branches. The wood of the fustet is quite dark yellow, and is therefore used in dyeing. It is propagated by layering.

Yellowwood of the dyers.
This tree, which grows in America and particularly in Brazil, is Linnaeus's Morus tinctoria. Monoecia tetrandria, family of the urticaceae. It is grown in large sections, light, and yellow in color with orange veins. This wood is very rich in coloring matter. Its decoction is a dark reddish-yellow, which alkalis make almost red; acids cloud this decoction somewhat and weaken its color; tin hydrochloride precipitates it in yellow.

Flemish glue.
This is the name given to the gelatin extracted from the ears and feet of oxen, horses, sheep, calves, as well as from the white parts of these various animals. This glue is poured into dry, brittle, brown, yellowish, reddish, transparent, or semi-transparent tablets, depending on their degree of purity and the care taken in their preparation. Thus, the more transparent, discolored, and soluble in boiling water the glue is, the purer it is, and the more sought-after it should be. The blackish glue is very impure; it is only suitable for heavy carpentry.

Gelatin is also extracted from bones by treating them with weakened hydrochloric acid, which dissolves the calcareous phosphate and leaves the gelatin exposed. This process is due to M. Darcet. Gelatin can also be extracted from bones by subjecting them to the action of steam under high pressure; by this means, the calcareous phosphate is completely stripped. We saw some at the exhibition prepared in this way, which was very beautiful; but in general, the various glues we noticed there contained more or less ammoniacal soap, which made them partially soluble in cold water. This soap was due to the beginning of the decomposition of the gelatin.

Fish glue (isinglass).
These are the aerial vesicles of a sturgeon (Acipenser huso. LIN.), which is usually 24 feet long and 12 feet wide. These vesicles are cleaned, rolled up, and dried, giving them the shape of a heart or a lyre; or, instead of rolling them, they are folded like a napkin. Commercial fish glue is more or less valued, depending on whether it has one of the aforementioned shapes; thus:

1. Lyre-shaped fish glue, also known as small string, is the most expensive;
2. Heart-shaped fish glue, called large string, comes next;
3. Booklet-shaped fish glue is the least sought after.

It would be very difficult to establish on what property this preference is based, since there is only a difference in shape, and all yield, more or less, the same quantities of excellent gelatin.

Gum arabic.
This gum is of the same nature as that which oozes from the bark of apricot, almond, cherry, plum, etc. trees. Gum arabic is solid, often in globules, odorless, with a bland flavor, transparent, colorless when pure, golden yellow, or more or less reddish when combined with foreign matter. It is soluble in hot and cold water; insoluble in alcohol, ether, and oils; it is unalterable in air, non-crystallizable, and whitens upon prolonged contact with light. Lightly roasted, it becomes, according to M. Vauquelin, more soluble in water. Alcohol precipitates it from aqueous solutions that contain only one thousandth of it.
Commercial gum arabic is distinguished according to its degree of whiteness, into first and second white; the white gum is a mixture of colorless and colored gums. There are several varieties of gum arabic:
1. Basra gum. In irregular pieces, most often small, and sometimes the size of a thumb. It is white or yellow, odorless, less transparent than Senegal gum, yet less opaque than tragacanth;
2. French gum. This is the gum that oozes from apricot, cherry, almond, etc. trees. It is either colorless or yellowish and reddish; it is imperfectly soluble in water, and with this liquid forms a mucilage similar to that of tragacanth;
3. Senegal gum. Four varieties are imported into France: A. The completely soluble transparent gum; this constitutes almost all of the Senegal and Arabian gums; it is colorless or variously colored; it is wrinkled on the outside, and its solution turns litmus red; B. White cracked gum, also called turic gum, is a variation of the previous one; C. Film-coated gum, white and more often brownish, a film that covers some parts; less soluble and turns sunflower red; D. Green gum; its color varies from yellow to emerald green.

Indigo.
It was only around the middle of the 16th century that indigo was brought from India to Europe.

This coloring matter is provided by the leaves of several plants, almost all of which are classified in the genus to which, due to this property, the name Indigotifera has been given. The plants from which it is most particularly derived are:

1. Indigotifera argentea, wild indigo. This species produces less than the others, but, on the other hand, it is the most beautiful;

2. Indigotifera tinctoria, French indigo; This is the one that yields the most, but it is also the least beautiful of all;

3. Indigotifera disperma, or Guatimala. This plant is the tallest and most woody; its indigo is better than the previous one;

4. Indigotifera anil, or anil. Its indigo is at the minimum oxidation.

These plants are native to India and Mexico, from where they were transported to the two Americas, China, Japan, Madagascar, Egypt, etc.; they belong to the Diadelphia Decandria Lin., family Legumes. Here is how indigo is extracted from these leaves:

When they are fully ripe, they are picked, washed, and cut; they are then placed in a vat and covered with a little water; care is taken to prevent them from floating by securing them with planks loaded with stones. Fermentation soon begins, the liquor takes on a green color and becomes acidic; it displays a large number of bubbles and iridescent films on its surface. In this state, this liquor is passed into a lower vat, stirred, and the indigo is separated by adding a sufficient quantity of lime water. The deposit is washed with several waters and dried in the shade. Pure indigo is a solid, odorless, and tasteless, blue-violet in color. It is unalterable in air, capable of crystallizing into needles, insoluble in water and ether, very slightly soluble in boiling alcohol, and precipitates from it upon cooling. It is easily decolorized by chlorine. If it is heated in a retort, part volatilizes and condenses at the top into coppery needles, while the rest decomposes. Weak acids do not dissolve it, with the exception of nitric acid, which transforms it into a very bitter, yellow substance. Concentrated sulfuric acid dissolves it very easily; hydrochloric acid has no effect on indigo at atmospheric temperature; aided by the action of heat, it acquires a yellow color that appears to be the result of the decomposition of a small amount of indigo. The blue color is removed from indigo and given a yellow color by deoxygenating it through prolonged contact with deoxygenating materials; this blue color is restored by promoting its oxygenation through exposure to air. Deoxygenated indigo is soluble in water, especially by means of alkalis. Indigo, disseminated in water, is deoxygenated by hydrogen sulfide, ammonia hydrosulfide, iron protosulfate (green rosacea) and an alkali, potash and tin protoxide, etc. In dyeing, the following process is most commonly used:

Iron sulfate (green rosacea)..... 2 parts
Slaked lime..... 2
Fine indigo powder..... 1
Water..... 150

All these substances are placed in a flask and exposed to a temperature of 40 to 50°C for a few hours. The result of this reaction is that the lime combines with sulfuric acid to form an insoluble sulfate, and the precipitated iron protoxide deoxygenates the indigo, etc. Dissolving indigo in sulfuric acid is deoxygenated by iron or zinc filings; it acquires a pale gray color and returns to blue upon contact with air.

Commercial indigo is never pure; to obtain it in this state, it is heated in a tightly closed platinum crucible, which is subjected to the action of heat; Indigo sublimates into crystals.

Indigo has a fine, even fracture; scraped with a fingernail, it takes on a coppery color; preference is even given to the one with a more brilliant color, which is lighter and a dark blue-violet color.

Traders distinguish indigos by the names of the regions from which they come; thus:
1. Indigo from India is called Bengal, Madras, Coromandel, etc.;
2. Indigo from Guatemala is called Guatimolo indigo, indigoflora: it is the most esteemed of all;
3. Indigo from Louisiana, etc.

Indigo can also be extracted from the Nerium tinctorium tree, a tree native to India.

According to Mr. Chevreul, commercial indigo is a compound of:
A specific immediate principle (indigotin);
A red resin, soluble in alcohol;
A greenish-red substance, soluble in water;
Carbonate of lime;
Alumina, silica;
Iron oxide.

According to the analysis of Messrs. Dumas and Le Royer, pure indigo is composed of:

Carbon.....	*73.26*
Nitrogen.....	*13.75*
Hydrogen.....	*2.83*
Oxygen.....	*10.16*
	100.00

Gallnut.
This name is given to a round growth produced on the buds of Linnaeus's Quercus infectoria, by the bite of an insect named by the same naturalist, Cynips quercus folii, and by Geoffroy, Diplolepsis gallæ tinctoriæ. This oak is very common throughout Asia Minor; it is found from the coasts of the Archipelago to the borders of Persia, and from the banks of the Bosphorus to Syria, etc. This tree is no more than six feet tall; its trunk is twisted, its leaves deciduous and of a beautiful green, with short petioles, etc. The gall wasp is a small hymenopteran insect with a tawny body and brown antennae; it stings young shoots with its spiral stinger and lays its eggs there. This sting produces an irritation in the sap vessels, which is soon followed by a swelling which, in two or three days, has produced what is called a gall nut. The eggs deposited there grow with the gall and maintain this state of irritation. The galls must be harvested before the larvae produced by the eggs have passed into the state of flies and have burst through the gall to emerge. The size acquired by the galls is five lines to one inch in diameter. The natives give the name yerti to the first galls that are picked; in commerce they are called green galls, blue galls or black galls. The white ones are those that are picked later; they are lighter and pitted. Here are the various species of galls:

Green or Aleppo galls. Brown or greenish inside; compact, hard, heavy, bristling with tuberosities; very astringent and bitter flavor. The most highly valued come from Aleppo, Smyrna, the interior of Nato, etc.
White galls. Brownish-yellow in color; generally larger, very light, less hard, pitted, and with a slightly bitter and less astringent flavor. Not highly valued.

Oak galls. These grow in France on holm oaks. They are round, smooth, and brownish. They are much smaller than green galls, but slightly larger than white galls.
Gall nuts mainly contain a lot of tannin and gallic acid.

METAL OXIDES.

Arsenic deutoxide (arsenic, white arsenic, rat poison, etc.).
Many chemists consider this deutoxide to be an acid, which they call arsenic acid. Here are its characteristic properties. It is white when ground into powder or exposed to air; when solid, it is covered with a white crust, and its interior is as transparent as the finest crystals. It is often colorless; at other times, it has a golden hue, with yellowish or reddish streaks or layers. It is very easy to pulverize; thrown onto hot coals, it volatilizes into a white smoke and gives off a very strong garlicky odor, characteristic of this metal. If a copper plate is exposed to this arsenic vapor, it immediately turns white.
Cold arsenic deutoxide is odorless, it has a very pungent flavor that leaves a sweetish aftertaste; it is reducible by the battery; unalterable in air, soluble in fifteen parts of boiling water, and four hundred parts of cold water; the first solution produces, upon cooling, well-defined tetrahedral crystals. It is a violent poison.

Iron tritoxide (colcotar, English red, Prussian red).
This oxide is a beautiful red, tending slightly toward brown, more fusible than iron, indecomposable by heat, non-magnetic, reducing by electric fluid, insoluble in water. It is the coloring principle of sanguine, reddish brown, etc.
It is prepared by vigorously calcining iron sulfate. If this calcination is not carried out well beforehand, a portion of this salt escapes decomposition; to remove it, it is calcined again, or washed after grinding.
This oxide is composed of:
iron..... 100
oxygen.... 43.31

Prussian red is also prepared by calcining ochre clays; but it is obvious that in this case, it is less pure, since it contains alumina, silica, etc.

SALTS.

Copper deutoxide subacetate (verdet or verdigris).
In France, this salt is produced in the departments of Aude and Hérault. Thin copper plates are taken, beaten, and heated to about fifty degrees. They are then soaked in hot wine or vinegar. A layer of good grape marc is placed on the ground, and on top of that, a layer of copper plates, and successively a layer of marc and a layer of copper. After a month or a month and a half, depending on the degree of spirituosity of the marc, the plates are covered with a greenish layer. They are removed, and placed side by side transversely. They are then sprinkled several times with water acidulated with vinegar, and sometimes with lukewarm water. This layer of salt swells, and a whitish efflorescence is seen forming, which offers long needles on the edges, and which separates easily from these plates: then the verdigris is made. It is scraped, and the plates are left to rest for a while, to then repeat this operation. It is worth noting that, while it lasts, the workshop should be heated to maintain the temperature at +20°C.

This salt, as found commercially, comes in twelve- to twenty-pound loaves, packed in a white leather bag. It should be green, with white efflorescence, very dry and hard; it cannot be decomposed by carbonic acid. When treated with water, this liquid dissolves the neutral acetate, leaving the hydrated copper oxide as a residue. By the action of heat, the metal is reduced. According to Mr. Proust, verdigris is composed of:

neutral copper acetate. ...	*43*
copper hydrate.....	*37.5*
water.....	*15.5*

This salt is a violent poison; despite this, it is included in the composition of some external medicines; it is used in paint, etc.

Copper acetate (crystallized verdigris, Venus crystals).

This salt is prepared by dissolving verdigris in vinegar, filtering the solution, and allowing it to crystallize. Copper acetate has a styptic and sweet flavor; it is soluble in water and alcohol; it crystallizes into very regular rhombuses. It has a beautiful, very dark green color that verges on black. Caloric decomposes it; acetic acid is released, colored by a small amount of oxide that it carries with it; and at the same time, following Vogel's observation, a small amount of this anhydrous acid sublimes, which forms a satiny white crystal. This salt is composed of:

Acetic acid	*51.29*
Copper deutoxide	*39.05*
Water	*9.06*

This salt is used in painting for water green, for washing plans, to prepare radical vinegar, etc. It is recommended in medicine as a stimulant; but it is so poisonous that we do not hesitate to prohibit its use.

The layer of this green substance that forms on copper vessels, and which is called verdigris, is a copper subcarbonate that is even more harmful than commercial verdigris.

Iron acetate.

Three iron acetates can be obtained:

1. Protoacetate, by boiling iron turnings without contact with air, with concentrated acetic acid; In this case, the water is decomposed, its oxygen being transferred to the iron and the oxide, while its hydrogen is released.

2. Iron deuto- and triacetate, by dissolving iron deuto- or trioxide in the same acid.

3. The process followed in factories to obtain iron triacetate consists of washing the iron filings, leaving them exposed to the air for a few days, and boiling them in good vinegar or pyroacetic acid with contact with the air. In this case, the oxygen in the air and that in the water contribute to the oxidation of the iron. Iron triacetate is liquid, highly soluble, and non-crystallizable. Its evaporated solution converts into an insoluble subacetate, which the water soon converts into iron peroxide. This triacetate is now widely used in the manufacture of painted canvases, for rust colors, and as a base for black colors that do not have, like those containing iron sulfate, the disadvantage of turning brown.

Iron Citrate.

As with the previous salt, the iron filings are washed well, exposed to the air, moistened from time to time, and when converted to iron subcarbonate (rust), boiled in an iron kettle with clarified lemon juice until saturated with the acid; then filtered and evaporated thoroughly. Iron citrate is soluble in water and susceptible to crystallization. It is perhaps the best ferruginous salt that can be used for dyeing black, especially for hat making. Unfortunately, the price of citric acid is too high to make it economically viable.

Iron hydroferrocyanate (Prussian blue).
Discovered in 1710 by Diesbach of Berlin. This salt is a beautiful blue; it is tasteless, odorless, insoluble in water and alcohol, altering upon contact with air and taking on a green color over time. Distillation yields hydrocyanic and carbonic acids, ammoniacal carbonate, a flammable gas, etc. The calcined residue is attractive to a magnet. Sulfuric acid decomposes it, decolorizing it. This characteristic distinguishes Prussian blue from indigo, which this acid dissolves without altering its color. Alkalis, lime, etc., decolorize it and combine with its acid, precipitating almost all of the iron oxide.

Prussian blue is prepared in large quantities by calcining, over a red-hot heat, a mixture of equal parts of potash and dried blood, or horn debris, and several other animal substances.

This salt is formed by hydroferrocyanic acid and iron oxide. It is used in the arts and for dyeing Raymond blue.

Potassium hydroferrocyanate.
This salt is canary yellow, transparent, crystallizing into large, quadrangular prismatic crystals. It is odorless, flakes in the air, soluble in water, and retains 0.13% in its crystals. It is obtained by digesting powdered Prussian blue in sulfuric acid to remove the alumina and foreign substances it often contains; the residue is washed in several waters, and poured into a boiling solution of potash until it ceases to discolor. The solution is filtered and this salt is obtained in crystal form by evaporating part of the solution.

This salt is widely used in the dye known as Raymond blue, named after the chemist who first applied it to this art.
This salt is widely used in the dye known as Raymond blue, named after the chemist who first applied it to this art.

Mercury deutoxide nitrate.
This salt is prepared by boiling an excess of nitric acid in mercury; if the solution is then concentrated, this nitrate crystallizes into beautiful white needles, soluble in water. This solution is very corrosive; it stains the skin red and even decomposes it; these crystals, crushed and treated with water, are decomposed. The result is an insoluble sub-salt that is white if used with cold water, and yellow if used with boiling water; this latter is called nitrous turbith. The solution contains a highly acidic super-salt.

Mercury nitrate is used for felting hare and rabbit hair.

Copper deutoxide sulfate (blue rosacea, vitriolated copper, blue vitriol, copper vitriol, Cyprus vitriol, etc.)
This salt is odorless, with a pungent, highly styptic flavor. It forms transparent, irregular blue crystals, sometimes octahedral or decahedral, exhibiting double refraction, slightly efflorescensing, and then producing a greenish-white powdery substance. It is soluble in four parts cold water and undergoes aqueous fusion. Volatile alkali precipitates the oxide, which remains suspended in the solution and gives it a beautiful blue color. This preparation is called celestial water.

Iron sulfate (couperose, green couperose, green vitriol, martial vitriol, vitriolated mars, etc.)
Recently crystallized, this salt is rhomboidal prismatic, a beautiful emerald green, transparent, and flecks in the air as it absorbs its oxygen; it then converts to iron tritoxide sulfate, which appears as yellow spots on the aforementioned crystals. Iron sulfate is odorless, stytic, and so soluble in water that nine parts of this boiling liquid dissolve twelve of this salt. This salt, exposed to high temperature, first loses its water of crystallization, then a greater part of its acid, while the oxide passes through the maximum oxidation state; the product is then an iron tritoxide subsulfate, called colcotar, which is red in color.

Iron tartrate.
This salt is prepared like iron citrate, with the only difference being that tartaric acid is used instead of citric acid. It is used for dyeing black and is superior to iron sulfate, but much more expensive.

Sunflower loaf.
This coloring substance is made in Auvergne, Dauphiné, etc., from several lichens, mainly from the Varidaria orcina d'Achard. The process consists of pulverizing the leaves of these lichens, making a paste with urine and half their weight of gravelly ash, taking care to add urine as it evaporates. After forty days of putrefaction, this mixture acquires a purple color; it is then placed in another trough, and more urine is added: this is when the blue color develops. This paste is then divided and urine and lime are added. As a final preparation, calcium carbonate is added to the resulting paste to give it consistency, and it is reduced to small loaves which are then dried.

PART TWO.

FELTED HATS.

The name felt is given to a fabric resulting from the crossing and interlacing of the hairs of certain animals, produced by fulling. Experience has shown that the hairs of certain animals possess this property exclusively and that, regardless of the fineness of the plant fibers, they never felt unless, having already undergone a kind of decomposition and subjected to the continued action of a pestle or roller, they are reduced to a pulp that constitutes paper. In this case, this type of felt differs essentially from those with which we are concerned.

The theory of felting was the subject of research by one of our most illustrious physicists. Mr. Monge attributed this property to the roughnesses observed on the surface of animal hair, which roughnesses all have their direction in the same direction. In support of his opinion he cited 1st the ease with which one can succeed in untying, by means of light percussions, a knotted hair placed in the middle of the closed hand, and assuming that this hair has its root directed towards the ground; what is even more curious is that if one gives it a contrary direction, one tightens the knot more and more; 2nd the progressive movement that one can give to a hair when one rubs it longitudinally between two fingers. We note in fact, says Mr. Robiquet [8], that it constantly moves in this case on the side where its root is located. We observe on this subject that these two examples could in no way be favorable to Mr. Monge's theory. The hair is cylindrical in shape with a small longitudinal swelling like the rush. This sort of cylinder, from the bulb to its end, becomes more and more fine; It describes, so to speak, an elongated cone whose base is the bulb; it is therefore very easy to recognize the large end, or better, the one by which this hair adheres to the skin. One only has to turn it between the fingers to see the large end rise if it is at the upper part, or descend if it is at the lower part. I examined several under the Amici microscope, perfected by Vincent Chevalier and sons, and I became convinced that the hairs are not covered with a sort of small scales as is commonly believed, but that they offer a more or less large bulb, ovoid in shape, white in color, whose extension produces the hair. In the middle is a medullary canal that is about one-fifth the diameter of the hair, and which transmits the liquid proper for its nutrition. The jar is similar to this structure.

Note 8: Technological Dictionary.

Based on the data that the hair constantly moves on the side where its root is located, Mr. Monge concluded that straight hairs could not be felted without preliminary preparation, because, based on their structure, and regardless of the direction they may be given by means of the tree, they always travel directly in the direction of their bulb and would eventually escape completely. [9] The author believes this drawback is remedied by means of secretion; he believes that this operation curves the ends of the hairs, thus facilitating their interlacing or felting. This interlacing would be further aided by the temperature at which the worker operates, and by the movement he imparts both by hand and by that of the brush.

Note 9: Robiquet, loco citato.

Mr. Malard, in a memoir presented to the Society for the Encouragement of National Industry, presented a series of observations that are in no way consistent with Mr. Monge's theory. We will present them:

1. The hairs of some animals, such as those of wild rabbits, although as straight as those of hares, beavers, and other animals that only felt after the secretion process, are susceptible to felting without prior preparation;

2. Straight wools (those from Beauce and the south of France) also felt without preparation, while, on the contrary, wools from Spain and even those of mixed breeds, which are spirally twisted, are not very suitable for felting.

From these observations, it seems clear that while the roughness of the hairs or their scales promotes their felting, they are not the sole cause, as we have just seen. We will return to this subject when we discuss felting; we will limit ourselves to stating at this point that Mr. Guichardière claims that hairs with roughness resist felting. This opinion does not appear to be consistent with observation, and regardless of the author's merit and the services he has rendered to hat-making, this opinion, to be accepted, would need to be supported by numerous and carefully documented facts.

There are few manufacturing processes that require such varied operations as hat-making. We will describe them in turn.

PREPARATION OF THE HAIR ON THE SKINS.

Before felting, the skins undergo several preliminary preparations, which go by various names, and which we will present below.

Trimming.

The hair of the hides is often filled with dust and foreign matter, which must be removed: this is what is known in the art as de-hairing. This operation is performed using a type of small carding tool, known as a carrelet. The worker gently runs this tool over the hair, and then beats the hide with a stick on the opposite side; he continues these two operations until, by vigorously shaking the hides, no more dust escapes. In this state, they are subjected to the following operation:

Trimming or trimming. (Ébarbage ou éjarrage)

We have already stated that the hair of beaver, rabbit, hare, etc., is composed of down and guard hair, and that the latter not only does not felt, takes dye poorly, but also diminishes the beauty and quality of the hats. However, manufacturers have used various means to separate this guard hair from the down.

The words trimming and trimming seem roughly synonymous; However, there is a slight difference between them. We have already mentioned that in beaver and rabbit skins, the guard hair adheres less to the hide than the down; it is because of this property and given the greater length of the guard hair that we strive to remove it; this is called skinning, while trimming is also applied to these, but more commonly to hare skins, whose guard hair adheres more closely to the leather than the down. I will now describe these two operations.

Skinning rabbit skins.

This operation is also known as skinning; it is carried out as follows: the well-straightened skins are spread out for two or three days in a cellar or any other low, damp place, taking care to turn them three or four times a day so that they soften evenly.

They are then taken by the fifty to the workshop; the pattons are cut, and the skins are opened lengthwise with a type of very sharp knife with a wide, thin blade called a tranchet. The work then focuses on stretching them well, that is to say, on removing, using the wrists, the folds that these skins have contracted [10]. As the skins are stretched, they are packed one on top of the other, and they are overloaded with a board on which a very heavy body is placed. By this means not only do we prevent the rapid drying of the skins, but we also finish erasing the folds and wrinkles. After these preliminaries, the worker carries out the tearing in the following manner: she places the skin on her right knee so that the hair is on the outside, the butt, or tail side, upwards, and that of the head placed between this same knee and a workbench. Here is Mr. Morel's method [11]. The worker, armed with a cleaver, sufficiently lined with linen to prevent it from injuring her, and which she first grasps with both hands by its two ends, moves it in such a way that the blade, pressed almost vertically by its edge on the hair, comes, by a sudden and equal movement of both wrists, to the horizontal position, the edge turned towards the worker. These two movements, executed and renewed with all the speed of which the muscles are capable, and advancing little by little from the head towards the butt, make up the whole mechanism of this operation, which, in a single time, grasps and removes the guard hair without tearing out the fine hair. It is nevertheless rare that this first method is sufficient to remove all the guard hairs; this is why the tearer, after having executed it, must turn her skin end to end; and, while she holds it in her left hand, the right hand alone holds the cutting knife, between the blade of which, and the thumb covered with the thumb-piece [12], she seizes the jars which remain, and pulls them against the grain. It is easy to see that the workers must combine great skill with great experience in this work.

Note 10: Trimming is a very essential preliminary operation, as it makes plucking and cutting easier.
Note 11: Theoretical and practical treatise on felt making.
Note 12: This is the name given to a finger of skin that serves to protect it from the edge of the tool when the guard hair is pressed against the same edge with this finger.

This operation is also performed by placing the hides on a rack and applying a plane to the guard hair; this method is much less common than the previous one. We should add that trimming is only applied to the hair on the animal's back, and that great care must be taken not to reach the end of the down, which is the silkiest and finest part. As for the hair on the throat and belly, it is customary to shorten it by nearly a third. Without this precaution, it would be difficult to make the felt smooth. When the skinning is complete, the pelts are beaten with a stick to remove the cut awn that remains in the down, called the pelt. They are then placed two by two, hide against hide, in bundles of one hundred and four, which are inspected by a new worker, who performs similar operations to completely remove it. Regardless of the worker's skill, it sometimes happens that she tears off parts of the skin.
The same parts, called epaulettes, must be trimmed and joined to the skins of which they were originally part.

Trimming beaver pelts.
The operation is the same, with the difference that since the beaver pelt is larger and its awn is much stronger, it is necessary to use a much larger tool, which is then operated by a man; The latter places the skin on a rack, secures it with a foot-operated trowel, sits on one end of the rack, and, taking the plane [13] by both handles, makes it perform the same movements on the beaver skin as the knife does on rabbit skins.
After this operation, a worker uses the knife to remove any parts of the awn that may have escaped the action of the plane. This is called ironing. The beaver skins are then beaten with a stick to separate the bulk.

Note 13: (back) This plane is most often double-edged.

Trimming hare skins.

The hare awn adheres, as we have already said, much more to the skin than the down. It is therefore necessary to cut it with scissors; this is called trimming. To do this, the worker, after gently combing the hair with a rake, so that all the hairs or guard hairs are arranged in their natural position, uses long, sharp scissors to cut the guard hair over the entire surface of the skin and at the grain of the down, without touching it in any way. This work requires great attention and skill. When this operation has been done well, and on one of the finest pelts, known as "receipt" pelts, their surface offers a velvety black color on the back, without any appearance of guard hair; this color diminishes in intensity as it descends toward the flanks.

This operation, as well as plucking, is long and expensive. Attempts have been made nowadays to replace it with suitable machines. We will present the one we have been able to discover.

Description of a machine suitable for cleaning and opening wool and removing the guard hairs; by Mr. Williams.

In England, a type of wool from South America is known. It is very fine and of excellent quality, but so clumped and soiled by impurities of all kinds that it has almost no commercial value. Mr. Williams sought to remedy this drawback by purging this wool of its heterogeneous materials, and it is for this purpose that he devised the machine we are about to discuss. Although several parts of it are already known and bear close resemblance to the cotton thresher-peeler constructed by Mr. Pitret, the overall design presents a combination that is not without merit. Moreover, the machine is suitable for removing the top coat from the hairs used in hat making, and especially from cashmere wool, which arrives in Europe laden with corks and other materials that can only be separated with great difficulty.

Fig. 1, pl. 377, is a side elevation of the machine, seen from the right.
Fig. 2, the plan or bird's-eye view.
Fig. 3, a longitudinal section, taken through the middle of the machine. The same letters indicate the same objects in all the figures.

The machine is mounted on a wooden frame, **A A**; at its rear end is a horizontal endless cloth *a*, stretched over two rollers that rotate it. It is on this cloth that the worker carefully and evenly spreads the wool or materials intended to be subjected to the action of the machine. **B C**, are two feed cylinders, between which passes the wool sheet spread on the cloth *a*; these cylinders, which are pressed against each other by the effect of a Roman-shaped lever *u*, pulled by a weight *z*, receive their movement from a gear *v*, composed of a pinion and two toothed wheels: this same gear rotates the endless cloth. *d* is a drum fitted around its circumference with staves *e, e, e,* to which are fixed, in an oblique position, iron teeth *f*, the shape of which is shown on a larger scale in Fig. 5; *g* is an arch covering the upper part to prevent the wool from being thrown out by centrifugal force.

Motion is transmitted to the drum by a pulley *h*, mounted on its shaft and wrapped by a belt communicating with a steam engine or any other motor. The same shaft carries another pulley *i*, which, by means of a crossed ribbon *j*, turns a pulley *k*, mounted on the shaft of the feed cylinder **C**.

In this first operation, the wool, emerging from the endless cloth, passes between the cylinders **B C**; there, it is caught by the drum teeth, which detach the wool and impurities, which fall onto the inclined board *m*, after passing through the screen *l*.

The woolen web is then drawn onto the endless cloth *n*, which passes it between the cylinders *o p*; above this cloth is a grate *x*, which allows passage of the dust produced by the rotation of the drum. This rotates the cylinders *o p* by means of a crossed belt *q*, passing from the pulley *r* to that *s*, fixed to the axis of the cylinder *p*. The movement is transmitted to the endless cloth *n* by a gear *t*, composed, like the previous one, of a pinion and two toothed wheels. A Roman-shaped lever *y*, from which a weight *a* is suspended, presses the cylinders together.

The wool, after passing between these cylinders, is subjected to the action of the rotating combs *b*, mounted in an oblique position on staves secured to crosspieces *c*, of a drum smaller than the previous one. These combs, drawn on a larger scale, Fig. 4, rotate under the action of a large pulley *f*, wrapped in a belt *e*, which embraces a pulley *d*, fixed to the shaft of the combs. As they operate at a very high speed, any impurities that might have escaped the teeth of the drum *d* are permanently detached and thrown both against the arch *g* covering the combs and against a curved iron board *h'*; they then escape through the opening *i'*.
After this operation, the wool strands, perfectly cleaned and opened, descend, in the form of a sheet, onto the inclined board *k'*.

Mr. Malartre has also successfully addressed this important point; we will transcribe the report made on this subject by Mr. Cadet Gassicourt to the Society for the Encouragement of National Industry.

Report prepared by Mr. Cadet de Gassicourt on behalf of the Committee of Chemical Arts, on a process for removing hare skins, invented by Mr. Malartre, hatter, 60 Rue du Temple, Paris.
Gentlemen, to enable you to appreciate the advantages of the new hat-making process invented by Mr. Malartre, it is necessary that we go into some detail about hat making.
The animal hair used by hatters is composed of two very distinct species: one silky, flexible, sometimes cottony, whose parts naturally adhere well to each other, and whose main function appears to be to retain the animal's warmth; this is called down; the other, stiffer, more elastic, and having no adhesion between its parts, seems intended to protect the down from friction with external bodies; this is called stubble.

Experience has shown that among the substances suitable for felting, those which have this quality to the highest degree are the most delicate and the most homogeneous, and that the presence of the jar in the felt takes away its suppleness and strength by making it hard and brittle. A prejudice may have led inexperienced hatters to believe, for some time, that the jar gave solidity to the hats; skilled men did not share this error, and they sought, by all sorts of means, to separate the jar from the down; but they succeeded only imperfectly.
We will not describe the well-known method hatters use to remove the guard hair, a process called trimming. This process is so inaccurate that, when the hat is finished, they need to use pliers to pull out the protruding guard hairs on its surface, thus concealing their presence, at the risk of scratching and stripping the hat.

It had not yet been observed that there are two types of guard hairs on hare skins: one that the animal sheds at birth and which becomes very long: it is usually two-colored; the other, almost as short as the down, is undoubtedly intended to replace the long one when the animal is molting. However, by the process used so far, a large part of the long guard hair is removed, but the short one remains in the down.

Mr. Malartre set himself the following problem: to find a process for removing the guard hair from all the hairs used in hat making, a process that is simple, easy, quick, and economical, extracting the guard hair from its root to its last strand, and leaving the down in its pure, natural state, without the slightest alteration.
We believe, gentlemen, that Mr. Malartre has completely solved the problem, judging only the products he obtains; for since the substances and manipulations he uses are, and must remain, secret, we cannot comment on the economy of the process.

Mr. Malartre was kind enough, at our request, to provide us with hare skins from Russia and France, secreted and dehaired using the old and new methods. He presented to us down purified by himself and unpurified down. We examined these different products under a magnifying glass; We compared felts he made from pure down with the finest commercially available felts, and we recognized an undeniable superiority in Mr. Malartre's felts. Skilled hatters, to whom we presented these products, agreed with your committee.
Now, gentlemen, what are the advantages of the new process? Here we will let Mr. Malartre himself speak, because he does not stray far from the truth, and we could not explain ourselves more clearly than he does.

"If we compare," he says, "hats or gauze hats with hats made using only down, experience and reasoning equally prove that the latter are of a more even and more adherent felt, since they are composed of a finer and more homogeneous material; that they are stronger, more supple, and easier to use; that they are more pleasing to the eye with their silky, wavy, and shiny appearance, and to the hand with the softness of their substance; finally, that they are capable of taking on more beautiful colors, since the dye adheres better to a fine, divided material.

"Common materials, previously considered poor and unsuitable for hatmaking, produce, by removing the awn, hats of a beauty and strength equal to those of the finest hats currently manufactured; and, when choice materials are used, hats made of pure down can rival beaver hats. The latter are only gilded on the outer surface: the body of the hat is composed of materials other than beaver. The beaver itself is not deprived of a guard hair, and if we add that beaver hats lose their color and turn red in a very short time, while the color is fixed on down hats, perhaps we will find that the latter, without being inferior to beaver hats in any of their parts, have on the contrary some parts in which they are superior to them."

We will make only one observation on this presentation; it is claimed that beaver hats and others, which turned red when dyed black with iron sulfate, do not turn red when dyed with pyrolignite, or, as in England, with iron nitrate.
There are still other advantages to M. Malartre's process. By using pure down, two workers do the work of three in the shedding process. In the appropriating process, which consists of three operations: straightening and two passes, the first pass is unnecessary; because its ordinarily only purpose is to lay down the down and straighten the shank, so that it can be grasped with pliers. But here there is no shank. In the shanking, there is less dust with pure down, less hairs flying around, and which, when breathed in by the worker, harm his health. Thus, Mr. Malartre's discovery improves and simplifies the other processes of hat-making.

We have gone into all these details, gentlemen, because we regard this improvement as very important.

It represents a very great step forward in the art of hat-making, and if Mr. Malartre's process could become the secret of the factories of France, this branch of commerce would soon make foreigners tributary; for we would make exclusively the most beautiful, strongest, and lightest hats, with the hair provided by the animals of our soil, and even by those whose skins were disdained, as containing more guard hair than down, or a guard hair too short to be separated.
In the meantime, we have the honor to request that this process be announced in the Society's bulletin, with the praise that Mr. Malartre has deserved. [14].
--Adopted at the meeting on March 11, 1818.

Note 14: Mr. Malartre's hats without a fur liner sell at the same price as ordinary hats made of hare and rabbit.

Means for extracting the fur liner from the down of skins intended for hat making, by Mr. MALARTRE, hatter. (15-year patent.)
This process was granted a fifteen-year patent on March 30, 1818, which was revoked by an order dated May 4, 1823. It consists of the following:

The skins are first soaked in a light lime water, which cannot penetrate the skin, that is, its effect cannot be felt beyond the root of the down. This operation is performed by passing a brush dipped in lime water over both sides of the skin until it is completely softened. In this state, the guard hair has little adhesion to the skins, and is easily removed by pinching it between the thumb and a kind of blunt knife. The guard hair remaining after this operation is cut with scissors. The down is then removed from the hides, which comes off very easily without dragging along any remaining guard hairs that have resisted being removed, because their roots, being deeper than those of the down, have not been reached by the liquid, whose action is limited to the surface of the hide.
It is worth noting that the hides soaked in limewater must be allowed to dry, and that they must then be beaten with a small rod before removing the guard hairs.
Since Mr. Malartre's method was not described in the bulletin of the *Société d'encouragement*, we learned that the author had obtained a patent for this invention. Consequently, we obtained a copy of his patent, and we have just published it as the author filed it with the Ministry of the Interior.

Classification of hides.
As soon as the pelts have been trimmed or quartered, the manufacturer sorts them several times to sort them according to their beauty and quality.

1. Within each type of pelt and each kind, the first is to set aside the pelts that must be cut immediately, and which are called "en veule," thus separating them from the others that must be subjected to secretion;
2. The pelts of rabbits are also separated from those of wild rabbits;
3. The first of these pelts are made into separate bundles according to their colors;
4. The pelts of fat beavers are also separated from those of dry beavers;
5. Finally, if any are not properly quartered or quartered, they are returned to the worker. After these preliminary steps, the following operation is carried out:

Secretion.
Secretion is a process performed on hair to increase its felting properties. From the beginning, a decoction of marshmallow root and symphitum or comfrey was used for this purpose in France, but with little success. It was around 1730 that a hatter named Mathieu brought the process of secreting hides using mercury nitrate from England.

The all-important preparation of this salt appears to be different in all factories; it varies depending on the proportions of the constituents; thus, Mr. Morel indicates:
nitric acid (aqua fortis)..... 1 pound.
mercury..... 3 to 4 ounces.

Dissolve over gentle heat, and add:
rain or river water... five to six times its volume, that is, five to six pounds.

Mr. Robiquet says that the generally accepted mercurial solution is composed of:
Nitric acid 500 grams (1 pound)
Mercury. ..... 32 grams (1 ounce)
Water ... from half to two-thirds depending on the concentration of the acid.

Mr. Guichardière claims that he has obtained better results by combining the old method with the new one. Consequently, he recommends the following proportions and method:
Nitric acid at 34..... 1 pound.
Pure mercury..... 6 ounces.

After dissolving, he adds:
Decoction of marshmallow and comfrey.... 16 parts.

Here is how to perform this operation:
Carefully spread the already trimmed or pared hides on a table or easel; then dip a boar's brush in the mercury solution and vigorously brush it over the entire surface of the hair, both in its natural direction and against the grain; the brush is again immersed in the liquor, passed over the hair, and continued until it is wet about two-thirds of its length; if the hair is a little rough, the hair is soaked even more deeply. It is worth noting that each time the hair of the brush is immersed in the liquor, it must be shaken after removal so that it is not too charged with liquid. The worker must be placed in a ventilated place, in order to protect himself from mercurial exhalations [15] . Finally, to make the wetting or secretion more even, the skins are joined in two and hair against hair; they are then taken to the oven which must be heated quite strongly so that drying is rapid. The temperature of the oven must be all the higher as the dissolution of the mercury nitrate has been more extensive with water. It is all the more necessary for drying to occur quickly since it is the concentration of the salt that must produce the desired effect; for, if this drying is slow and successive, experience has shown that the hair does not contract to the necessary degree.

Note 15: Hat makers often experience very serious accidents due to this mercurial salt.

The solution of acidic mercury nitrate exerts a very strong chemical action on the hair, which acquires a more or less intense golden yellow color, depending on the part of the skin. No one has tried in vain to understand the mode of action that nitric acid and mercurial salt exert on the hair; we still have only hypotheses on this point; the problem remains to be solved. This solution would, however, be all the more important for this art, as it would lead experimenters to substitute some other salt or some other harmless substance, or one less dangerous than mercury nitrate. The art of hatting relies largely on the felting process; thus, several manufacturers have attempted several experiments to exclude mercury salt from it. In 1817, Mr. Guichardière presented to the Société d'encouragement hats made from sea bear, native otter, and Mexican raccoon, secreted without mercury, as well as a hat without secretion, filled with sulfuric acid. We are not aware of him following up on these experiments.

Mr. Morel has attempted a few unsuccessful experiments with weakened acids and alkalis. All the processes based on one of these agents were either useless or problematic. some by destroying the very substance of the hairs, others by attacking it in such a way as to significantly alter their solidity. The author, however, believes he has discovered a very advantageous mode of secretion for rabbit skins; he limits himself to exposing them suspended from the joists of a stable, and leaving them there for several weeks. The hair then became fatter, and felted as easily as if it had been secreted by mercury nitrate. It was not the same with hare hair. Mr. Morel thinks that it should have remained exposed there longer than that of rabbit. But his experiments, on this last point, offer nothing positive.

The Society for the Encouragement of National Industry, convinced of the harmful effects of mercury nitrate on the health of workers, proposed, in 1815, a prize relating to secretion without mercury preparation. This prize having not been awarded in 1816, it was put back to competition in 1817. Messrs. Malard and Desfossés entered the competition, and the Society decided that the competition would be closed, and that the prize would be awarded to these two authors, in the event that new experiments, carried out on a larger scale and continued for a sufficient time, would not only confirm the results obtained, but would also give an absolute guarantee of the goodness of the process. It appears that this process, although very good, did not entirely meet the hopes it had raised, since the Society, in withdrawing this prize, limited itself to awarding an encouragement medal of 200 francs to Messrs. Malard and Desfossés. We are sharing the report that Mr. Bréant made on this subject to this Society.
As we have not found Messrs. Malard and Desfossés' secretion process anywhere, we have reason to believe that it is the one for which they had already taken out a patent. We will transcribe it here.

New secretion process for felting hair intended for hat making, by Messrs. MALARD and DESFOSSÉS. (Patent of invention of 1817.)

Composition of the liquor.
Add to 250 grams of raw soda ash, known as Alicante soda, also called mixed barille, used in soap factories and cotton dyeing workshops, 125 grams of quicklime, which you slake by immersing it in water before mixing, and filter after adding enough water so that the filtered liquor registers 10 degrees on the Assier-Périca hydrometer: the resulting liquor registers 19 to 20 degrees on Mr. Descroizilles' alkalimeter.
Soak the hairs of the hides to be secreted with this liquor, using a hog bristle brush, as is usually done for dissolving mercurial salts.
This method of secretion is also suitable for jockey hats and large hats.
The hats secreted in this way are placed in an oven.
The jockey hat is composed of four ounces of hair, three parts secreted hair and one part wiry hair. The hair, either secreted or wiry, is made up of six parts hare hair and one part rabbit hair.
The large hat is made with nine ounces of the same mixture; the wiry hair is present in the same proportions.

Here is the report that was submitted to the Society for the Promotion of this process.

Report submitted by Mr. Bréant on the work relating to the secretion of hair without the use of mercury salts, by Messrs. MALARD and DESFOSSÉS.

Gentlemen, last year, based on the report of your Committee of Chemical Arts on the prize relating to secretion without mercury preparation, you decided that the competition would be closed, and that the prize would be awarded to Messrs. Malard and Desfossés, in the event that new experiments, conducted on a larger scale and continued for a sufficient period of time, confirmed the results obtained and provided absolute assurance of the efficacy of the process.

As a result of this determination, your committee had Messrs. Desfossés and Malard prepare, last spring, the solution they substituted for mercury nitrate, and had a sufficient quantity of hides secreted for the experiments. The cut hairs were then distributed to various hatters, each allowing them to mix as they saw fit.

The first experiments gave us opposing results; the hats prepared by one of the hatters we approached were found to be of mediocre quality, while those prepared by another were deemed to be of sufficiently good quality. Surprised by this difference, and also surprised that the best of these hats were inferior to those prepared under the eyes of your commissioners, in Mr. Malard's workshop, your committee must have thought that the success was due to some particular circumstances, either in the secreting process or in the making of the hats. It therefore resolved to repeat the operation, preferably entrusting it to the hatter who had been most successful. And since there was reason to believe that the secretion had not been carried out, especially since the skins, placed in a very small oven, must have experienced excessive heat, the committee had the experiment repeated with particular care. It had reason to applaud this precaution, which impartiality dictated, since the result was felts as good as those secreted with mercury, and these felts, pressed in wine lees, like ordinary hats, required no more time.

Caught between two contradictory reports, unable to raise doubts about the accuracy of either, your committee had to seek the cause of these differences, and it found it, not in the greater or lesser goodwill of those who participated in the experiments, but in the difference in the materials they used and in their particular methods. The objections raised against the new secretion concern the following points:
1. The hairs are damp, and yet, when being worked, they produce dust.
2. The building process is more agile.
3. When shed, they return less quickly, to the point that it took six hours for a large hat.
4. The hairs are not sufficiently adherent, since they are removed with a brush.
5. Finally, they do not turn a beautiful black.

To this, your committee responds that the dust must have resulted from the lack of precautions taken in the first secretion operation. This drawback was not observed last year, and with a very slight modification to the process, it could easily be remedied.
Nor can it attribute the slowness of the building process, observed by one of the manufacturers who worked on the experiments, to anything other than the same cause that produced the dust; Because last year this operation was carried out very well, and it was also carried out well in the latest trials that took place.
Since the first secretion operation was not well conducted, it is not surprising that the results obtained with the crowd were not as satisfactory as those of the previous year. They were the same as soon as the process was used with greater care.

As for the effect of these hats when dyed, it is not surprising that they did not turn such a beautiful black. The secretion necessarily influences the mordant, and the dye bath must be modified according to the substances used for the secretion; but nothing is easier than preparing a dye bath in which they will turn a black as perfect as that obtained with hairs secreted with mercury.

After carefully comparing the contradictory results of the experiments, which it repeated several times, your committee remains convinced:
1. That by the process of Messrs. Desfossés and Malard, it is possible to secrete the hairs to the point of making them suitable for making excellent felts; but that this process does not impart to the hairs all the felting energy that mercury nitrate gives them.
2. That the success of this process is due to such delicate circumstances that it is difficult to be able to vouch for them consistently.

Thus, it cannot be denied that the use of mercury nitrate has a marked advantage, since it never fails to achieve its intended effect.

Based on this presentation, gentlemen, your committee must declare that the program's conditions do not appear to be met, and that the prize has not been won; but it would be unjust if it did not recognize that those who have come so close to the goal deserve the most honorable encouragement.

By granting it to them, you will encourage them to make further efforts to add to their process what it lacks to consistently succeed in the hands of all manufacturers. They alone can achieve this, because they are the inventors, they have an interest in perfecting their discovery, and the combination of their knowledge and talents offers them every means of success.

Your committee therefore proposes that you award, as an incentive, a gold medal to the secretion process presented by Messrs. Desfossés and Malard.

Information obtained from several manufacturers has revealed that mercury tremor is now rare among hatters, no doubt because less mercury is used today. However, while hatters are no longer as exposed to this disease, it does attack those who secrete hides, and although the number of these hair preparers is very small, we must not neglect the means to protect them from this cruel disease.
Your committee does not, however, believe that the problem of secretion should be referred to the competition; it undertakes to seek a solution in the event that, contrary to its hopes, Messrs. Desfossés and Malard abandon further attempts. The conclusions of this report were adopted: consequently, the president awarded Messrs. Malard and Desfossés an incentive medal worth 200 francs.

Shearing or cutting of hair.
The worker begins by cutting off all the unevenness and horns of the skins, as well as the tail and the legs, this is what is called bordering the skin; the cut parts are called chiquettes: they are put aside. We then take the skins, we moisten them on the flesh side with a sponge soaked in water or, even better, soaked in weakened lime water, and we stick the skins two by two on the wet side [16] , by fifty; we load them with boards overloaded with a large stone, and we leave them in this state for twelve to twenty-four hours, so that the leather is more supple, and the hair can be extracted more easily. For this we resort to two methods: we tear it off or we cut it. M. Guichardière gives preference to the first method, for the manufacture of hairy hats. He assures that if the felting of torn hairs is more difficult, on the other hand the felt which comes from it is more solid, and does not perish under the hand of the worker.

Moreover, he adds, by this method one has the advantage of taking advantage of the common hair of the belly of the hare, which in ordinary circumstances has very little value. Most manufacturers do not share the opinion of M. Guichardière; they give preference to the cutting of the hairs, based on the conviction which they have acquired through experience that the bulb of these hairs was very harmful to felting.

Note 16: Great care must be taken to ensure that the hair is not wet at all.
In all factories, cutting is carried out for rabbit and beaver hair, and plucking or pulling for hare hair. Here is how to perform these two operations.

Cutting hair from rabbits [17].
They begin by lightly unraveling the hair using a carding machine, this is called decatizing; after this, the cutters spread and fix the skin crosswise on a table or a well-level board, with the hair facing out and lying from right to left. Then, in their left hand, they take a tin plate seven to eight inches long by four or five inches wide, one of the long sides of which is folded back and rounded to protect the hand from cuts; with this hand thus armed, they uncover the base of an even row of hairs across the entire width of the skin. Then, they take in their right hand a kind of sharp and very cutting knife, which is vertically handled and surrounded by skin or cloth in part of its length. With this knife, the cutter cuts the hairs along this entire length by two movements: the first which pushes the knife towards the edge of the skin opposite the worker; the second which brings it back to the edge from which it started. This last movement is immediately followed by that of the left hand, which brings the plate back over the cut hairs to make them pass behind and reveal a new row of hairs, which are cut like the first and collected by the plate, continuing in this way from behind the ears to the end of the butt. We must add that to each of these two principal movements which push and bring back the knife, is joined a small oscillating movement of the wrist which, by preventing the knife from remaining in the same trace, regulates its progress towards the butt, by a series of very acute angles [18] . We will continue to let Mr. Morel speak. The perfection of the cut consists of using a thick and fine cutting stroke to make the leather very clean, without chopping the hair, and to obtain its full length. Once the cutter's knife has reached the rear end of the hide, the cutter sets the leather aside, after cleaning it by rubbing it with a moistened hand. She then unwinds the hair, which, first gathered by the plate, then rolls up onto itself to form a small fleece, which has been called a trim. This fleece is then spread out on a table, and the worker separates 1st the different qualities of hair, thus setting aside the belly hair, called the common hair; 2nd that of the flanks and throat, or middle hair; 3rd that of the middle of the back, to the width of three to four fingers: this, which is the finest, is called the ridge.

Note 17: We borrow this description in part from Mr. Morel.
Note 18: The cutter must take care to sharpen the knife as soon as she notices that the edge is beginning to dull.

Cutting beaver hair.
The process is almost the same as the previous one, with the difference that the beaver skin is too wide for the cutter to cut the hair across the entire width of the same skin. Because of this, it is cut into several strips, each approximately the width of the slab. Three types of hair are separated from the beaver fleece: 1st the awn or black; 2nd the in-between or the hair of the flanks and throat; 3rd the white or the hair of the head and belly.

As for the hare, says the aforementioned author, only the ridge of the unsecreted skins is removed in this way, intended to make what is called feather or gilding.

Plucking or pulling the hare's hair.
In this operation, the cutters pinch the down between their thumb and the blade of a knife called a tranchet, and pulling it toward them, the down is removed, and almost all of the guard hair remains on the skin. This plucking completes the trimming. The hare's fleece offers four qualities of hair that are separated and set aside; these hairs are:
1st the awn,
2nd the sides,
3rd the red,
4th the common.
When the hair cutting is finished, the shreds are cut, which the worker divides and classifies by quality according to the part of the skin to which they belong.
The skins stripped of their hair are sold for the manufacture of a type of glue widely used in the arts. [19]

Note 19: As for the wool, manufacturers are advised to buy it washed; or, if not, to separate all defective parts and all debris by hand before washing.

Hand-cutting the hair was a very long and expensive operation; It also attracted the attention of the Society for the Encouragement of National Industry, which made it one of its prizes, which was won in 1829 by Mr. Coffin.
We will present the machine he invented for this purpose, as well as the report made to this society by Mr. Molard.

Description of a machine suitable for cutting the hair of hides used in hat making, invented by Mr. Coffin, a mechanical engineer in Boston, United States of America.
This machine, which won the prize of 1,000 francs, offered by the national industry incentive societies, is composed of a wooden or iron frame, A A' A'', Fig. 6, bearing on its upper crosspiece A' a horizontal iron shaft 1, surrounded by helical steel cutting blades J, which rotate rapidly against a fixed vertical knife K, also made of steel and very sharp. The helical blades are arranged so as to present the knife with an oblique face that favors the effect of their cutting edge.

The hide, engaged between two cylindrical iron rods q, set in front of the knife k, is successively brought against the cutting edge of the helical blades by the rotation of these rods, operated by means of a gear n' o p, Fig. 9, which communicates with a drive pulley L, rotating on the shaft I', outside the frame. The cylindrical rods have independent movement of each other, in order to be able to use various thicknesses of hide without cause the gears to unravel.

The movement of the helical blade shaft is produced on each side of the machine by a pulley G, wrapped in a belt H, passing around the periphery of a large cast iron wheel E, which receives its impulse from a bent axle D, which the operator operates by means of a pedal B. At the same time, he presses on a rocking frame S, which clamps the cylindrical rods Q, R against each other, between which the hide is inserted, hair underneath. The operator guides this hide with his hand so that it remains taut and presents itself squarely to the helical blades. These blades, by shaving against and behind the knife k, divide the hide into fine clippings, while the hair is cut by the sharp, well-honed edge of the knife. By this maneuver, the hair falls successively in the form of a sheet into a tin trough U, placed below the feed rollers, while the hide clippings fall into a wooden box V, below the shaft with helical blades.

A cover Z, which is closed during operation, prevents the detached hide clippings from being thrown out by the centrifugal force of the blades.
This machine, operated by a single worker, cuts the same quantity of hair as three workers using the ordinary method.

Explanation of the figures.
Fig. 6. Side elevation of the hair-cutting machine, fully assembled.
Fig. 7. Plan of the same, showing the arrangement of the helical blades.
Fig. 8. Section of the machine on line A B of the plan.
Fig. 9. Gears of the feed rollers seen from the front.
Fig. Fig. 10. Section of the drive pulleys of the helical blade shaft and the feed rollers.
Fig. 11. Section and plan of the fixed knife.
Fig. 12. Crank shafts, seen separately and in section.

The same letters indicate the same objects in all the figures.
A. A. Wooden frame supporting the machine's mechanism; it can also be made of iron. A' A" Upper and lower crosspieces of the frame.
B. Treadle operated by the worker in front of the machine with his foot.
C. C. Small connecting rods attached to the treadle and hooked, by their upper ends, to the elbows of a horizontal shaft D. Which turns on bearings fixed to the crosspiece A' of the frame.
E. E. Large cast iron wheels mounted on the shaft D.
F. Small pulleys fixed on the same shaft.
G. G. Curved wooden pulleys, threaded onto the square part of the shaft I, and which transmit to it the movement they receive from the large wheels E. E. via the belts H. H. with which they are wrapped.
J. Shaft carrying the helical cutting blades J.
K. Fixed knife, whose blade is well sharpened, and which is placed in front of and at the level of the helical blades.
L. L'. Grooved pulleys, rotating freely on the shaft I.
M. M. Crossed ropes passing over pulleys F and L, transmitting to the latter the motion they receive from the bent shaft D.
N. N'. Pinions integral with pulley L, one of which drives the toothed wheel O, fixed to the lower feed roller, and the other drives the wheel P, mounted on the upper roller.
Q. Lower feed roller rotating in collars that rest on the crosspiece A' of the frame.
R. Upper feed roller attached with its toothed wheel P to the rocking frame S. This cylinder is equipped with asperities, to grip and guide the hide as it passes over the fixed knife towards the helical blades. It rotates in the opposite direction to that of cylinder Q.
S. Rocking frame carrying the upper feed roller, which the operator raises to the position indicated by the dotted lines, Fig. 8, when he wants to insert the hide, and then lowers it, guiding the hide with his hand, while simultaneously operating the pedal.
T. T'. Center of motion of the rocking frame S.
U. Tinplate trough placed below the feed cylinders, into which the cut hair falls in the form of a sheet.
V. Wooden box that receives the hide clippings detached by the helical blades.
X. X'. Solid cast iron pulleys, serving as flywheels.
Y. Spring that presses the knife K against the helical blades.
Z. Tinplate lid that covers the helical blades and prevents the hide clippings thrown by centrifugal force from mixing with the layer of hair.

Report on the proposed price for the construction of a machine suitable for shaving the hair from hides used in hat making; by Mr. MOLARD.

Among the prizes proposed to be awarded this year, there is one of great interest: the construction of a machine suitable for shaving the hair from hides used in hat making.
Your program, published on this subject, after listing the various drawbacks resulting from the manual process used to date for shaving hair from hides, and describing the length of the work and the expense it entails, announces that, considering that the mechanical methods used in recent times are not in general use, and that it is not known to society that they are even within the reach of the majority of manufacturers, you have deemed it necessary to promise a prize worth one thousand francs to the designer of a machine simple in construction, quick and easy to use, inexpensive, and with which all kinds of hides suitable for hat making can be shaved or sheared, once the hair has been excreted. At the same time, you required that the machine produce twelve pounds of hair per day, and that it hold the hides taut to facilitate hair removal, because the mercurial solution often causes them to become stiff.

We know that a worker employed to shave hides using the ordinary process receives 70 centimes, on average, for each pound of hair, and that she cuts a pound and a half per day; from which it follows that the twelve pounds that the machine should produce, according to the program, would cost 8 francs 40 centimes using the usual method.

Only one machine, life-size, was submitted to this competition.

We will not go into all the details of its composition here; we will simply say that it is based on a principle that is both simple and ingenious. The hide is presented to the action of the machine by a pair of feeding cylinders, the hair underneath, where it is cut by the sharp, well-honed edge of a blade fixed to its back, and serving as a counter-knife for two helical blades mounted on the same shaft, which, as they rotate, cut the hide into very narrow strips. And since the action of these blades exerts a certain successive pressure on the hide, as they cut it, the hair, immediately supported by the edge of the counter-knife, is cut at the same time as the hide is divided into very narrow strips. The fur falls successively in a sheet-like manner into a container below the feed rollers, while the skin clippings fall below the helical knife shaft as they are detached.

The experiments your Mechanical Arts Committee has conducted with this machine have proven that, by its means, the hair can be separated from a secreted rabbit skin in a minute and a half, the hair produced being one and a half ounces; which proves that in ten hours of work, 40 pounds 10 ounces of hair will be obtained.
This quantity of hair obtained in ten hours represents approximately 400 heavy hutch hides, skidded, that is, prepared to be subjected to the action of the machine.

The machine in question can be operated by four women; Two should be sufficient for preparing the hides, the third for passing them through the machine, and the fourth for separating the various qualities of hair obtained from the hide and bundling the hair.

The daily cost of each of them can be estimated at 1 franc 25 centimes..... 5 francs

Interest per day, acquisition costs
on 400 francs, price of the machine..... » 5
Maintenance costs also per day. » 2 7c.

40 pounds 10 ounces would therefore have »
cost handling..... 5 7c.

This brought the pound of hair to about twelve and a half centimes, while the forty pounds ten ounces of hair extracted by the current process would have cost 28 francs 60 centimes handling, and the employment of twenty-five workers per day.
Finally, the hides may or may not be subjected to mercury dissolution, in order to be machine-sheared.

Based on these advantageous and incontestable results, the committee, convinced that the machine presented meets all the conditions required by the program, has the honor to propose that you award the prize of 1,000 francs to Mr. Coffin, a mechanic in Boston, United States of America, inventor of the machine presented in the competition.
Before concluding this report, we believe it is our duty, gentlemen, to propose that you express our thanks to Mr. Malard, for the useful information that this skilled hat maker hastened to provide on the current state of his art, and as an enlightened appraiser of the new means that the society has just acquired to perfect it.

Approved at the general meeting, December 16, 1829. Signed, Molard, rapporteur.

Mixture of materials.
The beauty and quality of hats depends on the nature, beauty and proportions of the secreted hairs used, and that which is not, and which is called soft. Thus, in the composition of the mixture of raw materials, the manufacturer regulates them, 1st according to the degree of fineness that he intends to give to the hats; in this case he looks for the good species and the beautiful qualities of hairs; 2nd according to the time that must be spent in their work; this time is relative to the proportions of secreted hair and soft[20]; 3rd according to the degree of binding required by the felts. This case is regulated by the use for which they are intended and their size when they are manufactured. This is communicated to them by the addition of woolen materials that are called filler, and whose proportions vary between at least one ninth and at most one quarter of the weight of the mixture. It is essential to use a quality of wool whose beauty is relative to that of the other materials used, or, if you like, to their fineness.
Thus,
1st when there is a lot of common hair in the mixture, coarse wool or balls will be used;
2nd camel hair will be used for the finer mixtures;
3rd for those containing the finest hair of each species, the finest red vicuña wool, well peeled, will form the warp;
4th finally, for the finest, when beaver is not used, it is always the hair of the hare's ridge that is taken; about a quarter of an ounce of fine red vicuña is added to form the warp.
The mixtures of materials therefore differ according to the quality of the hats. We can add that each manufacturer has his own, which he always believes to be the best. As a general rule, one should, on this point, note all the tests carried out on a particular register, and follow the formulas given by Mr. Morel.

Note 20: As a general rule, common mixtures should be less worked than fine mixtures.

Mélange de poils flamands.

ANNÉE MOIS ET JOUR	MATIÈRES EMPLOYÉES	VALEUR	f.	c.	OBSERVATIONS
1er juin 1830	Lièvre sécrété, arête..	5 liv. à 24 fr.	120	»	L'once de ce mélange revient à environ 1 fr. 50 c.
	Id. à-côtés.....	2 liv. à 16 fr.	32	»	
	Lièvre veule, arête....	2 liv. à 30 fr.	60	»	
	Vigogne rouge	1 liv. à 16 fr.	16	»	
		10 liv., ci.	228	»	Ce mélange est propre à toutes sortes d'ouvrages, soit légers, soit étoffés, prix moyen 23 fr. 60 c. la livre.
	Déchet.....	4 onces cardage .	2	»	
	Reste	9 liv. 22 onces, ci.....	2	»	

Mélange du n° 1, première qualité.

ANNÉE MOIS ET JOUR	MATIÈRES EMPLOYÉES	VALEUR		OBSERVATIONS
		f.	c.	
10 juillet 1830	Clapier sécrété, arête. .	5 liv. à 8 fr. 40	»	Ce mélange est composé de manière à pouvoir supporter un cinquième de dorure.
	Garenne veule, id. . . .	2 liv. 8 onces à 8 fr. . . . 20	»	
	Lièvre sécrété, à côtés.	1 liv. à 16 fr. 16	»	
	Id . . . . *id.* . . . roux. . .	2 liv. à 9 fr. 18	»	
	Chameau, beau	1 livre 1/2 à 8 fr. 12	»	
		12 livres, ci. 106	»	Il ferait de très beaux fonds pour des oursons première qualité.
	Déchet	6 cardages 4	»	
	Reste	11 liv. 10 onces, ci. 110	»	Ce mélange revient à 9 fr. 47 c. la livre.

Mélange du n° + croix.

		f.	c.	
1er août 1830	Garenne sécrété, arête.	1 liv. à 8 fr.. 8	»	Ce mélange est destiné à faire les plus beaux feutres et les ouvrages les plus légers; il revient à 64 fr. 32 c. la livre, ou 4 fr. 2 c. l'once.
	Id. . . . . . *id.* . . . . *veule.*	1 liv. à 8 fr.. 8	»	
	Castor sécrété blanc et moyen	3 liv. à 90 fr. 270	»	
	Id. veule, arête	1 liv. 4 onc. à 110 fr.. 137	50	
	Vigogne rouge épluchée.	0 liv.12 onc.à 21 f.50. 16	15	
	Poids total. . .	7 liv. Prix total 439	65	
	Déchet	2 cardages. 2	35	
		6 liv. 14 onc. ci.. 442	»	

Carding.
The carding process is almost entirely eliminated; it only takes place when there is a bundle of mixed hair, for common hats or fur hats and bear hats (= *oursons?*). The hairs suitable for making Flemish-style hats are only passed through the fiddler, in order to blend them so that the quality is uniform. However, to make our work more complete, we will describe the carder's work.

The first step is to thoroughly stretch the hair and then give it one or two turns of the carder's blades so that, being well divided or opened, it can be more easily distributed throughout the mixture; each type of hair is then beaten separately with a rod. After that, all the materials are combined. The carded hairs are thoroughly mixed in, and the whole is beaten with a rod. This is the beginning of the blend, which is made more perfect with the fiddler. This operation has been very well described by Mr. Morel; we will borrow most of it from him.

By the name of fiddle is meant an assembly of sixteen to eighteen whip cords, about eight feet in length, which are held by their ends in two cleats pierced with a sufficient number of holes spaced two to three inches from each other. The cords thus arranged whip easily when one of the cleats being fixed to the floor, the carder strikes repeatedly in front of him with the other cleat which is equipped with a handle a foot and a half long. The worker must take care to stir the pile from time to time with two sticks so that the work or mixing takes place equally; he continues to whip until the various materials are well mixed, which in terms of the art is called effaced. For the finest mixtures, the work of the carder is often finished there; but when they must then be carded, he gathers the mixture, which then bears the name of fabric, into a pile; breaks the cloth with a card and then passes it gently over the card, in order to comb the hairs and spread them without breaking them. He continues this operation if he notices that there are still small agglomerations or balls of hair known as buds.

The fabric is then taken to a room called a weighing room, from where it is immediately subjected to the felting process. If it is to be kept for some time, to protect it from humidity, dust, fermentation, and moths, the hairs, either separately or mixed, must be placed in tightly closed barrels without tamping or pressing them. The secreted hairs carry their own protection against moths; but they are prone to bud or ball, just like the spineless warren and beaver.
In the interest of the manufacturer, it is therefore advisable to allow as little time as possible to elapse between the mixing of the raw materials and their felting.

On the felting process.
The foreman distributes to the fuller, known as a journeyman, the weight required for the type of felt requested, and at the same time indicates the dimensions. This one divides the fabric into two or four parts, depending on whether the felt he is to make is composed of two to four feet, and whether it is to be of regular or irregular shape. Formerly, four pieces were made for jockey hats. It is more convenient to make only two; this is a Flemish imitation. But when making hats with horns, it is better; we would even say that it is necessary to make four pieces, because of the large quantity of material and the smallness of the saddle tree table. It is also important to form the felt from four pieces, which must have some thickness; finally, we should limit ourselves to two only for those that are endowed with great lightness. Here now is how Mr. Robiquet describes the process of saddle making. Far from seeking to appropriate the work of others, by twisting their phrases to make their thoughts our own, we prefer to transcribe them while indicating the sources from which we drew. The saddle tree is a kind of large bow, which is suspended from the floor towards its middle, in order to be able to place it in all possible directions. This bow is placed above a table covered with a fine wicker screen, and tight enough to let only the garbage pass through.

The hair is placed on this screen; the string of the saddle tree is brought into the pile, and, without it coming out, it is put into play with the help of a notch, a kind of spindle of hard wood, ending at each end with a mushroom-shaped button. It is by hooking the string with this button, and pulling it strongly, that it ends up sliding on the button, and that it begins to vibrate all the more accelerated, the more abrupt the movement of the saddler has been. The worker takes care to raise or lower the saddle tree, to carry it forward and backward, according to his judgment; he continues in this way until the mixture is intimate and no nuance can be distinguished. This manipulation is completed by what is called rowing the fabric, that is to say by bowing it in such a way that its smallest parts, successively pinched by the rope, are removed and transported from left to right, making a journey of more than two feet in the air. The down falls very slightly and ends up forming a pile of such rarefaction that the slightest breath could dissipate it all in an instant. The worker, with the help of a clayon, pushes the pile to his left and gives a second row, but with such dexterity that he makes it fall in a space of a determined figure, and in such a way that the layers vary in thickness in such or such parts according to the need. Having arrived at this point, the rack is removed, the table is cleaned, then it is wetted, in order to facilitate the adhesion of the hairs; This is when we move on to the first level of felting, called *bastissage.*

Harnessing is far from having reached the point of perfection it is capable of attaining: it would indeed be necessary to be able to draw the pieces in a single stroke without, when the hauling begins, the action of the rope experiencing the slightest interruption. One could then hope to obtain an equal connection of all parts of a piece and a complete interweaving of all the materials. It cannot be denied that it requires great skill on the part of the craftsman and the most practiced eye to form on the hurdle, in a single stroke and only by means of the well-directed play of the saddle-bow, a projected or better still, a given figure. The craftsman, whatever his skill, only achieves this approximately; There is another obstacle that opposes this, namely the interruption of the hauling, both to beat and reopen from time to time the unhauled fabric, which sags under the weight of the saddle pole, and to remove the passing debris. [21]

Note 21: Morel, loco citato.

The perfection of hauling, says Mr. Morel, depends on the observance of the following five fundamental rules:

1. Only sail the fabric after it has been perfectly beaten and opened in all its parts;
2. Only pinch a very small amount of fabric at a time while sailing, and do not bunch or pass the saddle string over what has already been sailed;
3. Assemble the pieces according to the shape and size they should have, and combine the various degrees of thickness;
4. Clean the fabric, either by bowing it or by walking it, and purge it of galls, chips, points, and other debris;
5. Finally, prevent waste as much as possible by taking care of the fabric, preventing it from falling to the ground, etc.

The pieces after sailing, far from having the necessary consistency or firmness; They partly acquire both through the following operation:

The basin and the frame.

This operation is one of the principal in hat making; it must be carried out in a specific room so that the worker does not continue to be exposed to the fumes produced during the bowing process. Before describing it, we will say that the name basin refers to a workbench made of hard, well-knitted wood; and that of felt-bed refers to a strong *Alençon* cloth, approximately one ell wide by one and a half ell long, half of which is spread over the basin, the other half hanging down. The felt-bed is then moistened either with a brush, a handful of willow, briar, or a small rice broom; when it is sufficiently damp, a few squares of thick, soft paper are placed on it, the hanging part is covered, and the whole thing is rolled up so that the moisture is distributed evenly. In this state, the worker unrolls the felting machine, and, after removing the papers, arranges it, as we have already said, that is, one half on the pelt, and the other hanging down at the front. Everything thus prepared, the worker spreads the pieces on the felting machine, one on top of the other, taking great care to ensure they are evenly spread, and especially to ensure there are no folds or wrinkles on each piece. After lightly watering it, he places a sheet of the aforementioned paper on top; finally, the last piece is covered by the half of the felting machine that remains hanging down.

The pile required for the fabric is, as can be seen, divided into several batches called capades. Mr. Guichardière recommends making only two. Thus, the felting machine would contain only two capades, between which would be interposed a sheet of thick paper; At this stage of the operation, the worker folds and refolds, or, in terms of the art, walks and rewalks in all directions, continuing to water from time to time, and very lightly, so that the capades do not contract adhesion with the felt. The work continues until it is recognized 1st that they have become consistent and firm enough not to open or spread; 2nd that they are at the same time soft enough so that, when they are assembled, they unite and bind in such a way as to form only one and the same felt. This is what is called building a felt.

Here is how Mr. Morel describes this operation: the worker spreads on the felt, as exactly as possible, a piece or capade; on the middle of this piece, he places the flap [22] , and folds over it the wings of the piece, on which he places a second one which adheres with the folded edges of the first. It is good to note that the worker must make the opening of one of the large sides to remove the flap which is placed between the two pieces. This done, he turns the felt over so that the second piece is underneath; he then takes the wings of this one, and folds them over the top one, taking care to spread and unite the capades well one on the other, so that there are no folds, no wrinkles, no interposed air. After that, he covers with the part of the hanging felt, forms the folds necessary to maintain and stop the pieces in their position. Then, by other folds made in the same direction, he reduces the whole thing into a long and narrow bundle, and walks over the whole length, placing his hands alternately on the middle and at each of the ends; he changes all the folds again to form them successively in all directions, and walk equally. We call a cross (or basin), the set of all the folds and all the movements that the worker is obliged to make each time he walks while basting. After the first cross, the worker unfolds, removes the flap which is between the two pieces, and uncrosses, that is to say he gives other folds to the assembly of the first two pieces, which is always double by the effect of the interposition of the flap. This is replaced, after the traces of the old folds have been made to disappear, and it is then that the crosses are applied, if the work includes them, and that this first assembly is doubled with the other two pieces, if the composition of the felt requires four.

The procedure for these last two is the same as for the others, with the difference that, since they must be applied to the first, and form a single unit with them, no paper or scrap should be interposed between them.

We must add, with the aforementioned author, that for the greatest perfection of four-piece felts, the surfaces of the pieces that, during the bowing process, were immediately on the saddle table or on the hutch should be brought into contact. As soon as all the pieces have been joined or assembled, they are placed in the damp felting chamber, and the craftsman makes another cross, which is followed by two or three others.

Note 22: The scrap is a paper model, representing the shape that the frame should have; the scrap is smaller than the piece or capade; and the parts of the piece that extend beyond it are called wings of the piece; they must be thinner than the other parts of the capade.

If the felt has some weaker or thinner areas than it should be, pieces of another capade, set aside for this purpose and called a tow piece, are applied to it, and these pieces are incorporated and bound by these last three crosses, and by walking firmly on these parts. Finally, when the fabric is well towed, or the hairs are well woven and adherent to each other, all that remains is to make the basting sufficiently felted to be able to be stirred as quickly as possible to the shed. When this point is reached, the worker smooths the basting, turns it over to put the outside in, and folds it to lower it to the shed. [23]

Note 23: In a plain felt, it is this same surface that is on the outside when it is brought to the shed that must form the top when it is finished. Morel, loco citato.

In the current style, the hat is usually made very large, narrow, and tall at the same time; the base and side must be thin, and the edge fairly strong, as well as the binding, but care must be taken to keep the edge a little loose.

Mr. Morel gives very sound advice for achieving excellent basting; we will quote it. There are two main faults to avoid when basting:
1. Causing the fabric to bunch up, the other, breaking it or causing it to spread apart. The first of these defects occurs when the second pieces are joined to the first, or, in two-piece felts, when the folded edges do not adhere to their full extent, and there are places where they form pockets or pouches. This most often results from either having worked the pieces too much before assembling them, or from having wetted them and the felt maker too much. Those who construct with only two pieces, thick and dense felts, are prone to this problem, because the edges of the pieces being too thick, cannot easily take hold if they have been walked on too much, or if air has entered between the two surfaces intended to join.
2. The second defect is when the fabric becomes veined and cuts in several places, particularly at the folds of the crossbars; this occurs when the felter is too dry, or when the worker walks too long on the same fold.

We must add, according to the same author, 1. that felts containing more filler than necessary are more likely to buckle than others; 2. that when there is too much rabbit fur secreted, especially wild rabbit fur, it is prone to cutting at the folds of the crossbars; 3. finally, if it is too loose, it tends to spread.

C. Mackenzie [24] saw two mechanically constructed buildings brought from the United States; but, not knowing the machine used, he was unable to provide any information about this work.

Note 24: One thousand experiments in chemistry.

About fulling.

The felt, after the operation of basting, is far from having the consistency, strength and solidity suitable to ensure its durability; these qualities are given to it by means of fulling, which makes the hairs fold in all directions on themselves and thus tightens the fabric by making it more consistent, much stronger, or, in terms of art, more substantial. The hairs, by taking this new arrangement, occupy a smaller space than before; thus the fabric shrinks in all directions; thus the felt, on leaving the basting, must have a third or double the extent that it will have after the fulling. This new felting is always carried out hot by means of some agents which increase the felting quality of the materials without this new mode of action having yet been chemically determined. For this, a bath is prepared which contains for each muid of water about seventy-two pounds of pressed wine lees. The water is first brought to the boil; At this point, the dregs are stirred using a broom, and the scum that forms is removed. The liquor is kept at a temperature close to boiling. Then, says Mr. Robiquet, the workers bring their building materials and place themselves around the boiler with a sloping bench in front of them, called a fulling bench [25]; each person dips their folded building materials into the bath, then unfolds them to ensure that they are well soaked; if not, they supplement this with the lustre or brush; then they spread them out on the fulling bench, press them out using the roller [26], throw a little cold water on them, and full them by hand [27], successively taking them up in all directions; they inspect them frequently to ensure that they are entering equally well, and they work more on the parts that require it. This first cross must be light.

When the felt is well formed, we resort to the pressure of the brush, taking care to clean the hat well beforehand by rubbing it with the bare hand. At this time the felt is still soft enough to easily give way to the jars contained therein. It is good to note that when we begin to use the brush, the pressure we exert by its means must not be strong. We begin first with the head, then move on to the edge, and continue this operation for five or six crosses; the rolling of the felts is done in opposite directions. Thus, if rolling No. 1 is done on one side, No. 2 will be done on the other, and, consequently, all the odd numbers will be in the same direction as No. 1, and all the even numbers in that of No. 2. We must add that before making a new rolling we must turn the felt upside down. Mr. Morel, for greater clarity, has attached figures to his presentation that make it clearer. In Figure 13, roll No. 1 is directly opposite roll No. 2, but it is not inverse to it; Figure 14 shows two rolls Nos. 1 and 2, both opposite and inverse to each other. Now, we see, from this last example, that before proceeding with roll No. 2, it is necessary, with roll No. 1 in place, to first turn the felt end to end and upside down.

Note 25: This beginning of fulling requires great precautions; if one does not want to run the risk of opening the felt, one must first full with great care, gradually bringing the fabric, properly arranged by heat, humidity, and scale, to better bind, to draw in well, and to acquire a good consistency. Robiquet, loco citato.

Note 26: It is a well-rounded ash wood roller, eighteen inches long, with a diameter of one inch in the middle and gradually decreasing toward the rounded ends.

Note 27: To full a felt is, after rolling it on itself, to undo and remake the roller alternately by lowering and raising it several times under the hands, depending on the inclination of the shedding bench; a shed cross is the set of all the movements required to roll the felt successively on all the sides of its shape and to full it on each of these rolls. Thus, assuming the shape of the frame is a long square, the cross will consist of four rolls, two along the length and two along the width. Before moving from one cross to the next, the cross is uncrossed, as with a basin, but a little at a time so that the work is more even. Morel, l. c.

In artistic terms, the first two or three crosses are called advancing by hand, or walking with the shed. The former term comes from the fact that most of this work is done with the bare hands.

The fuller must be careful to only wet the felt in the bath for each roll he is about to perform. In the first crosses, this roll should not be tight; it should even be a little loose, and the fulling should be done lightly, so as not to cause any tears in the felt, which has not yet acquired the desired consistency. It is at this stage of the shed that the surface of the felt takes on a rough appearance that workers call "*grigne*", and which indicates that the felting is tightening. The more even and apparent this grainy appearance is, says Mr. Morel, the better one can predict the return of the felt, and be ready to slow it down, if necessary, by taking it to the water early and frequently.
When the felting is advanced, one uses the manicles [28] , a sort of instrument composed of leather soles, by means of which one plunges, without burning oneself, the unrolled felts into the boiler at each rolling, and even the felts whose rolling is finished; the felt is then very hot. It is then necessary that the worker pinches, as one says vulgarly, more and more the first turn that he gives to the rollings, and this as and when he sees that the fabric by felting more, becomes more consistent, firmer and tighter. It is this part of the work of the basting, the crowd, that one calls rolling closed and dipping hot. The pressure that the worker must exert on the turns of these rollings must not be strong, however, because one must not express in this way the liquor of the bath interposed between the interstices of the felt, which contributes powerfully to activating and, as one says, to nourishing the felting. There is another operation that is carried out at the same time, that of fluffing. This is done by gently rubbing the external surface of the felt with the flat part of the instrument called a manicle, in order to detach and remove the guard hair, which, having remained mixed with the hair, would appear on the outside; these last works usually last two hours: if they have been carried out with care and intelligence, and if nothing has disturbed the operation, the felt is in a state close to the body and the qualities that it should have. To bring it completely there, it is given a few new crosses that are called tightening, because then one fills it strongly and tightens the rolls as much as possible. For this, one uses the roller around which one rolls with force in order to tighten the fabric, to crush it in a way and to make it less thick. By this new work the fabric shrinks again, and this is continued until it is reduced to the desired point. This is the time of the most difficult work of the crowd for the workmen, because of the greater force they are obliged to employ. This work is less difficult and gives more certain results, if the fabric is constantly kept at the highest temperature; it is needless to say that the bath must then be as hot as possible.

Note 28: Mr. Guichardière, to whom the hat-making industry owes such important work, follows another method, more laborious, it is true, but which produces far superior products; here it is. After the first five or six crosses, the hat is laid out on the board: it is turned over and rubbed again by hand to extract any jars that may have remained there. Then, the brush is used only on the edge, to bring in, felt, and develop the down, for five or six crosses: it is laid out again on the board, turned over, and greater pressure is used, as the felt takes on consistency: it is turned over, and brushed until the hat is small enough to fit on the last. If the felt is not even, says Mr. Robiquet, the thin areas should be brushed more to even them out. Finally, to obtain shine, it is necessary to soak it often, very hot, and to tread for three or four hours. We will devote a special article to Mr. Guichardière's methods.

Fulling is considered perfect when the roughness we have mentioned, referred to as "*crumple*", has disappeared; then the felt is drained by moving the roller over the stretched felt with pressure to expel the fulling water it contains. There is yet another way to be convinced of the effectiveness of this operation: when the drained felt has reached the desired dimensions and is no longer susceptible to further shrinkage during further fulling; in technical terms, the felt is then said to have reached the prescribed size and to be affected by "*crumple*."

It sometimes happens that, due to inefficient mixing of raw materials, or through negligence or inexperience on the part of the workers, the resulting felts exhibit some imperfections; the main ones are crumple and flake.

Crumple-stained felts.
We have already explained what is meant by crumple; We will add here that we call squalled felts those which, after being worked out and pressed between the fingers, sliding them horizontally over each other, still exhibit the roughness and grain that constitute squall. This defect is caused by:
1. a too short basting given to the felt by the worker, in order to make it reach the desired size more quickly;
2. a flaw in the blending process that produced a fabric too soft to be basted larger.

Squalled felts.
These felts, after being made and pressed between the fingers as above, exhibit points where the fabric has so little consistency that it is on the verge of unfelting, or, if you prefer, of losing the adhesion and interlacing of the down that results from basting and fulling. According to Mr. Morel, this defect arises from the fact that the felt, having been made too large, and finding itself affected by a fulling before being reduced to the required dimensions, the worker continued to full the felt in the hope of reducing it to this size; or, when having been made to the correct proportions, the too-loose fabric spread at the pelvis and peeled off towards the end of the shedding process. When this defect, the author adds, is carried to excess, it causes cracks and holes. We then say that the fabric has given way.

The chemical action exerted by wine lees on the hairs to activate their adhesion has not yet been studied or recognized; we only know that it is cream of tartar (potassium tartaric acid) that produces this effect. Various means have been sought to replace it. Sulfuric acid has even been used instead of this salt; But this method was abandoned, and the use of wine lees was reverted because it was found that this acid gave greater activity to the mercury nitrate of this metal used for secretion, and that the workers were more seriously affected. Mr. Guichardière, who conducted his investigations into all branches related to hat making, recommended adding a certain amount of tan to the bath along with the wine lees. This addition, according to him, facilitates felting and, by its principles, prepares the hair to acquire a more beautiful black.

The precepts and procedure we have just outlined are primarily applicable to the manufacture of fine hats. For the manufacture of second-quality hats, much greater difficulties are encountered because the hairs intended for this process are even more difficult to felt. These hairs are usually those from the sides and the finest from the throats, to which about a coarse of red vicuña is added. In addition, the hat is gilded at the pelvis with a quarter of a hair from the secreted back [29]. This addition makes the base fit more strongly, and gives it solidity and beauty at the same time.

Note 29: In millinery terms, gilding means covering the felt with a pile that is long and shiny, and that is incorporated only toward its base, and at most a third of its length.
Gilding with a basin is performed on the base, which is sometimes carried out on a slightly heated plate called a basin. Gilding with the secreted and torn hair makes shedding very difficult because this type of hair remains crimped for a long time. To make this quality of felt smooth, it must be dipped hot and often, brushed with strong pressure, and the base less thick than for the first quality.
Robiquet, loco citato.

As for the third quality of hats, the worst throat hair, the common belly hair, and a quarter of an ounce of red vicuña are used. A quarter of the secreted back hair is gilded with an ounce.

The same operation is performed on the basin and the shedding; but the shanking and shaping are shorter than for the second quality, because the coarser the hair, the less well it felts, and to achieve this, it must be thoroughly fulled, beginning this fulling with a closed rolling with the pelts, and finishing it with four or five crosses with the roller.

Hats called hairy (Flemish style) are almost never fulled with a closed rolling. Only the pressure of the brush is used, especially when the hairs are pulled out. The hat is more beautiful, stronger, and silkier. Formerly, when hair and bear hats (*oursons?*) were made, they were fulled hot in a common hat; now they use tarpaulin, a type of packaging in which cotton from the Levant comes.

Dressing hats.
To dress a hat is to shape it, in order to give it the desired shape. To do this, when the fulling is finished, and the fabric comes out of the oven and has been put into a shell, it is soaked in hot water, either with the thumb and fist, or with a pusher, pressing from the center to the circumference; the point is crushed and enough of the following folds to place a wooden form, which is inserted from the wrong side, and on which it is applied exactly. The worker then takes a double string with which he ties the middle of the form, and then brings this turn of string down to the bottom of the form, by means of the shock or the swallow. Then he dips the hat several times in hot water, he pulls it to remove the folds well. The point where the turn of string is located separates the crown from the brim. These are raised, which in terms of art is called *abattre*; We dip again, we unravel these edges lengthwise and widthwise, holding with one hand and pulling with the other with all our strength, along the length and a little across, so as to arrange and hold everything in place. [30]

Note 30: Robiquet, loco citato. In some factories, we dip the hat in the lees bath during dressing. It is much better to use only the pure water bath, in order to make the subsequent disgorging easier, the hair cleaner, brighter, and easier to dye.

When the worker has dressed his hat and it is dry, he takes a pumice stone and passes it over its surface until all the hair is cut and the felt is smooth; he then replaces it with the robe (a piece of dogfish skin), which he passes lightly over the hat. This operation serves to produce a fine hair, suitable for a short hat. The pumice stone and the robe have now been replaced by the square, which is used to develop the down suitable for the hairy hats that are now fashionable. This hair has already developed by fulling, by the pressure of the brush. The worker should use only a very soft square, and use only very light pressure; because a strong square and equally strong pressure would break down the felt instead of revealing all the hair. It is worthy of note that felts made with plucked hairs are stronger and less easy to break down than those made with cut hairs. Dressing is a painful and difficult job, especially when the shapes are broken into five or seven parts, in order to be able to introduce them piece by piece into the crown of the hat, mainly when the diameter of the top is larger than that of the entrance to the head. But when the shape is cylindrical or conical, dressing is much easier. Once the hat is trimmed, it is re-trimmed, that is, the top is re-dressed.

The trimming process serves only to flatten the down and raise the guard hairs, so that the trimmer can more easily grasp them with pliers [31] and extract them, without breaking them, as much as possible. To make this operation easier, the head should be re-trimmed only after trimming. Re-trimming the head strengthens the guard hairs, and they are broken when trying to extract them [32] . When the hats have been in storage for some time, the guard hairs rise to the surface and destroy the softness of the hat. They must then be trimmed and brushed.

Note 31: Before the manufacture of hairy hats, pliers were rarely used, but pumice stone and a razor were used instead.

Note 32: (back) Mackensie, loco citato.
The marks by which one recognizes that a felt is well made, and that all proportions have been properly observed, are: 1. when it is free from scuffs and smooth throughout; 2. when it is of medium strength at the head; 3. very strong in the binding; 4. when its thickness decreases towards the edge, which must be fine and very round.

Various felts.
Not all felts are similar to the so-called plain felts, the handling of which we have just described. However, their manufacture differs from these only by a few differences in the processes; we will give an idea of this by following the division established into:
1. Plain felts,
2. Flemish hair,
3. Gold felts,
4. Feather felts.

1. Plain felts.
We have just introduced them.

2. Flemish hair felts
This name comes from the fact that this method of preparation was originally imported from the factories of Flanders. This felt is most often made with pure hare hair and is brushed with a rubbing tool during the shedding process, which produces a very long and smooth pile, which constitutes its quality and principal beauty. However, one should only begin brushing in this way when the felt has acquired a sufficient consistency, or, if you prefer, when the felting is strong enough to avoid the slightest alteration of the fabric by the action of the rubbing tool. On this point, as Mr. Morel so wisely observes, French manufacturers are superior to Flemish manufacturers. The latter, from the very first sheddings, rub and plank the felts so vigorously that they alter them before they are even made. When shedding, Flemish hairs are handled almost like plain felts; the only difference is that they must be kept continuously moistened and that each roll must not be stopped for as long. After these felts are dry, they are gently brushed, pulled with a square, and then beaten, without ever sanding them.

Here is how Mr. Morel describes this operation: the worker, armed with the square, scrapes the entire outer surface of the felt, which produces a more or less long and very dense pile. This operation is similar to that of woolen felting, which is carried out using a fulling thistle in cloth factories. The square must be passed very lightly at first, pressing a little harder, and gradually, on each part of the felt.

3. Gilded Felts.
The name gilded felt is given to those of ordinary or inferior quality, whose external surface is covered with a thin layer of finer material or hair. We must only deal here with mixed felts whose gilding is always done with hare hair or beaver hair. This gilding is prepared at the saddle-bow, like the pieces, and is never worked except at the quarte. The gilding is distinguished into gilding at the basin and gilding at the shed, according to the different periods of the operation at which it is carried out. We have already said a word about it in the preceding pages; we will add new developments.
1st The gilding at the basin is carried out after the building is guaranteed. The worker makes it take by giving two or more crosses in the felt-box.

2nd . The gilding process is that which is only carried out when the felt is being worked on the crowd. This has less extent and more thickness than the previous one, which makes its incorporation into the felt much more difficult. Here is the procedure which is followed for this operation [33] . We take one of these rough cloths used to wrap the merchandise of the Levant, and which is called *couverte*; we immerse it in the boiler and then spread it on the fulling bench; we place on top the felt which we have taken care to thoroughly roughen beforehand. We then successively cover the two surfaces of the felt with the pieces of gilding, taking care not to leave any folds; we then fix the gilding by means of a little hot water which is projected onto it by means of a brush with long bristles called striking, because it is used after this projection to strike well with repeated blows on the gilding to make it stick to the felt. After this, to make this incorporation more complete, the worker gives a few crosses by rolling the felt and the cover one inside the other, so that each of the surfaces of the felt which has just received the gilding, is in contact with the cover. At each new roll that he makes, he uncrosses and strikes the felt with the brush in order to remove the small blowholes which form, especially at the folds of the crosses. To facilitate the operation, he removes from time to time the felt from above the cover, and plunges it into the boiler, and as soon as he has removed it he immediately replaces the felt which is thus heated. As soon as he notices that the scratch is even and tight, it is a proof that the gilding is well adhered to the felt; from then on he turns it over to put it inside; he thus treads one or two crosses with the handles; But he soon returns to the felt and finishes the fulling, keeping the gilding on the outside so that it becomes spread and does not become tangled with the hair that forms the base of the felt. At the end of the operation, he even gives it a few strokes with a rubbing tool to thoroughly detach the gilding hairs.

Note 33: Morel, loco citato.
Hats, or better, felts gilded with fulling, as soon as they have been dried in the oven, must be gently brushed, drawn with a square, and subjected to the action of the rod.

4. Feather felt.

Felts called feather felts are a richer gilding for which the finest hare hair [34] and beaver hair are used. In general, this gilding is only applied after the felt has been fulled, with the difference between the process for gilded felts and those with feathers, where several layers of hair or gilding are applied. This number of layers establishes two divisions within this type of felt, which are:

1. Half-hair hats.
2. So-called bear hats.

Note 34: Mr. Morel believes that although all kinds of French hare are used for feathers, even Barbary hare, we only have one type that is very successful: Breton hare. He adds that, in general, foreign hare is not suitable for this use.

Half-hair hats.

The term "half-hair" indicates that this gilding is superior to that of ordinary gold felts and inferior to that of bear hats. This quality therefore strikes a balance between the two mentioned above. The two gildings applied to this felt are called, in terms of art: first and second application. The first is given when the felt only has two or three finger widths left to be drawn in. As soon as this is well adhered, the second application is applied, and after each of these applications is taken, the felt is pressed hot for about three-quarters of an hour for each application, that is to say, the worker follows his crosses during this time by rolling the felt in the cover and pressing it with plenty of water and very lightly to maintain it in a great heat [35] .

After the complete pressing of the last application, the felt is taken out of the cover to be pressed bare, giving it with great care, so as not to remove the feather, two or three crosses which finally complete the retraction of the felt which is then drained and dried. After this, the feather is brought out by removing it from the felt by means of the square *(=carrelet*?). As for the knots [36] that may be found there, they are extracted using a soft comb.

Note 35: Mr. Morel, loco citato. The purpose of this operation is to incorporate the feather with the ground, without the latter deteriorating or noticeably retracting, ibid.
Note 36: The name knots is given to small balls of hair from the gilding, which are felted together on the surface of the gilding without adhering to the felt.

Bear-hats or fur hats.
The difference between the formation of half-hairs and bear-shaped hats is, 1st , that the former only receives two layers, and never more than three, while the latter receive five layers, and that these layers are only applied when the ground is completely pressed down; 2nd After the final application has been pressed while still hot, the hat is soaked for about half an hour, that is, it is immersed entirely in the kettle and briskly swirled through the water in the opposite direction. This rapid agitation in the water has such a beneficial effect on the feather that it releases all the hairs, which then, adhering to the felt only at their base, are embedded in it like wig hairs on the fabric that serves as their base, or, if you will, like on the animal's skin.
After this operation, and after the bear hat is drained, dressed, and dried, it is combed to separate any knots or balls of hair that may be present. [37]

Note 37: We will add here an interesting remark from Mr. Morel. Feathered hats, he says, of whatever type, are singe-dried before receiving the first application. To do this, when the worker has reduced the base to the size where it is to be applied, he drains it as much as possible using a rolling pin, and passes the surfaces to which the layers are to be applied over a fire of straw or shavings, in order to remove the hairs that cover them and that would hinder the introduction of those that make up the feather. After this singeing, a light rub is given with a rubbing tool to thoroughly clean these surfaces.

The so-called *plumet* hats, as well as the bordered hats, etc., differ from the *oursons* only in that, like the latter, they are gilded only on one side or only on the edges, etc.; since the process does not differ in any way from the one we have just described, we will refrain from any repetition. We will also pass over in silence the manufacture of hats, which vary in their strength, lightness, size, and shape: the former are related to the quantity and quality of the materials used in felting, the latter are related to the fashions that follow one another so quickly. Thus, in addition to hats with a low and high square shape, cylindrical, conical, etc., are made; hunting bonnets, caps, toques, shakos, etc. are also made. The method of manufacture is constantly the same, as for square felt fabrics, which have received numerous applications in our day, both for dressing and for furnishings. The shape to be given to them varies according to the use to which they are to be put; it is mainly during the building that they are given the desired shape. We will not go into further details on this subject: that would deviate from our goal: we will limit ourselves to saying that the largest pieces of felt that have yet been made do not exceed five square feet.

Hat Dyeing.
Each hat maker has their own dyeing processes, which they keep secret. Despite this, we do not hesitate to say that this part of the art is still far from having reached the necessary degree of perfection, to which the chemist's discerning eye can lead it.

Those who have successfully dealt with the special dyeing of hats have not taken sufficient account of the specific processes to which the hairs and materials used have been subjected, primarily the felting process, which exerts such an effect, or even alteration, on the hairs that, in addition to changing their color, their felting properties are considerably enhanced. The various felting processes must therefore make these fabrics less suitable for dyeing, despite their apparent discoloration. Let us add to this that for dye baths, independently of the insoluble and consequently useless substances that are added to the other ingredients, and which only complicate the operation, iron sulfate reacts in the long run on the fabric by its acid, while a part of the oxide peroxidizes, by the absorption of oxygen from the air, takes on a reddish color, and changes the black of the hat to brownish black. This is what led good manufacturers to replace iron sulfate (green couperose) by another iron salt whose acid had no effect on the fabric. Thus, iron acetate is now used with some success, and better, following the example of the English, the citrate of this metal; unfortunately it is too expensive. The Society for the Encouragement of National Industry, convinced of the defectiveness of the processes for dyeing hats, has made it one of its prize subjects. We believe it is necessary to report the entire program because of the interesting insights it contains.

Prize for the improvement of hat dyeing.

The coloring materials are either simple or compound, that is to say, sometimes they are sui generis substances that are simply extracted from the bodies that contain them, and other times they result from the combination of several elements, which together constitute a true insoluble combination in determined proportions and which produces a color pronounced enough to be used in dyeing. The simple color is fixed by means of a mordant; the other is produced in the dye bath and precipitates onto the fabric, or its formation on the fabric itself is determined by successively impregnating it with the various materials that go into this composition. We will not cite here the numerous known examples of these two types of dyeing; we will only concern ourselves with the composition that produces black. In general, this color is nothing other than the union of gallic acid with iron oxide, and this multitude of ingredients that are added to these two principles only serves, in all appearances, to nourish or to shine the tint. Considering things in their greatest state of simplicity, we see that, to dye black, it is only a matter of producing iron gallate, and of combining it with the organic matter that one wishes to cover with this color. Now, any combination, to be intimate, requires immediate contact; it is therefore necessary that the surfaces that are to be united be of great clarity, and it is in fact a principle received in dyeing that a color will be all the more beautiful and purer that the surface of the fibers has been better rid of any foreign substance, better stripped, if one can use this expression. Another consequence of this same principle is that nothing must be interposed between the surfaces to be dyed and the dyeing molecules, and this is most likely one of the serious drawbacks hat dyers constantly fall into. They compose their bath from a multitude of ingredients that contain a large quantity of insoluble substances: it is in the midst of the resulting magma or mud that the dyeing must take place. It is therefore understandable that the color will necessarily be dirty and nuanced by all these foreign bodies that become interspersed; hence the need to overload the dye to mask these defects; and the fiber, thus enveloped, loses all its luster and suppleness.

Based on these theoretical data, the approach that would seem the most rational would therefore consist of:

1. Using only the substances strictly necessary for the production of black;

2. To act, for soluble substances, only on filtered or clear solutions;

3. To bring the iron to its oxidation medium, either by calcining ordinary couperose, or by boiling its solution with a little nitric acid, or finally by treating the iron rust with acetic acid or another acid capable of dissolving this oxide.

In dyeing, it has generally been observed, with regard to this last point, that the sulfuric acid in iron sulfate exerts a detrimental influence on the fibers, and several practitioners have rightly proposed substituting acetic acid. Indeed, much more favorable results are obtained by this method; and if success has not always been complete, this is undoubtedly due only to the poor preparation of this product, which is rarely delivered properly manufactured. Most commonly, crude pyroligneous acid is used for this purpose, or one that has undergone at most only a simple rectification; In this state, it still contains a large quantity of tar, which is deposited here and there on the fabric, and prevents the coating and consequently the dye from taking equally. It is therefore the acid derived from the decomposition of sodium acetate by sulfuric acid that must be used, and not the crude acid or acid that has undergone a single distillation; the use of well-prepared pyrolignite offers the dual advantage of causing no alteration of the organic fiber, and also of facilitating its combination with iron oxide. This volatile acid abandons the bases combined with it so easily that, in this sense, it deserves preference over all others.

This is the set of observations that the current state of science allows us to indicate; but it could be that here, as in many other circumstances, theory does not agree with practice. We have criticized, for example, and everything seems to support this, the use of these muddy baths, in which the dye molecules are so disseminated that their reconciliation can only be achieved with the greatest difficulty; but could it not be possible that these obstacles were more beneficial than harmful, by allowing, as in tanning, only a slow and successive, and therefore more complete, combination? It is therefore with great reserve that we present the preceding views, and they should be considered more as a subject for experiments and observations than as a definitive and absolute result.

The Société d'encouragement, wishing to promote as much as possible the improvement it demands in the common interest, offers a prize of three thousand francs to anyone who can propose a process for dyeing hats black, such that the color is capable of resisting the prolonged action of the sun's rays without the luster or suppleness of the hair being noticeably altered. The essential conditions to be met by the competitors are as follows:
1. Submissions must be submitted before July 1, 1830;
2. The processes must be described clearly and precisely, and the quantities of each ingredient must be indicated in known weights;
3. Each submission must be accompanied by samples dyed using the proposed processes.

The prize will be awarded, if applicable, at the general meeting in the second half of 1830.
We will now present the processes generally followed for dyeing hats; we will then add the various improvements that have been proposed.

Preparing the hats for dyeing.
After the hats have been carefully inspected by the manufacturer and branded inside the hat form with a hot iron to indicate their quality, they undergo the following four (*only 3 listed?*) operations:
1. Trimming. Flemish hats and those with plumes must first be combed; as for ordinary hair hats, they are dressed, that is to say, the surface is gently brushed with a piece of sea dog skin, in order to produce a short, thick and fine hair.
2. Matching. Matching a hat involves placing it, after the previous operation, in a shape similar to the one it should have, taking care to adopt a shape slightly higher than that of the shedding, so that the string does not occupy the same point as that where it was in the shedding, and thus to avoid compressions of the felt which produce a kind of constriction. This is what in art is called lowering the string.

3. Stringing. After partially fitting the hats onto the appropriate shapes and securing them with a string, they are immersed in a bath of pure boiling water to drain them and extract any cream of tartar that the hair may contain. After holding them for a few moments in the covered boiler, they are removed and placed on trays similar to those of the shed, and having at their lower end a rim which carries the water which flows from the felts out of the boiler. It is then that the felt is pulled onto the form, until it is well applied and there are no folds. Two turns of string are then made towards the middle of the form by means of a slip knot which is tightened moderately. The felt is then heated in the boiler, and the string is pushed down to the base of the form. The hat is immersed in the boiler, and the felt is spread evenly over the form by rolling it, that is, by striking the flat side of the form against a block, and following the movement with the string, which is stopped a little above the first strand of the straightening process. This is because, as we have already mentioned, the dyeing form is stronger than that of the shed. This prevents the hat from cutting at this point. When this new straightening process is complete, the hat is again immersed in boiling water, placed flat on the board or bench, drained with the piece, and removed with a square to smooth the pile. The dyeing process is then carried out as follows:

Dyeing bath.
We have already mentioned that the composition of the dye varies greatly; it would be impossible to list all those that are known. We will limit ourselves to presenting one of the most widely used, that described by Mr. Robiquet. Here it is:

Dye for three hundred hats, by Mr. Robiquet.

Chopped logwood.	*100 pounds*
Crushed gall nuts.	*16*
Local gum, ditto.	*6*
Iron sulfate	*12*
Verdigris (copper subacetate).	*7*
Pure water.	*4-1/2 muids*

Boil the logwood, gall nuts, and gum in water for about two and a half hours, stirring the mixture frequently; let the broth drain and add the verdigris and iron sulfate. After a few moments, the dye can be prepared. Here's how to do it, according to Mr. Robiquet. [38] . Cover the bath with hats placed on the head; on top of this first layer, place a second layer, form upon form; the third is arranged like the first, and the fourth like the second, and so on until half of the hats (one hundred and fifty) are placed. This last bed is covered with boards, and loaded with weights so that all the hats can be immersed equally, and the bath has a more uniform heat. It is left like this for about an hour and a half, then raised, allowed to drain for a few moments on the edges of the boiler, and the hats are placed on shelves. After this, three or four buckets of cold water are poured into the boiler, brought to a boil, and then the other one hundred and fifty hats are immersed in it in the same manner as above. During this time, the hats of the first bath remain exposed to the air; by this exposure, vent in time of art, the black color takes on more intensity as the oxide of the iron gallate, by absorbing the oxygen, passes to the peak of oxidation. A hot, or immersion, and an vent are given alternately; but as in each heat the felt absorbs a part of the coloring matter, it is good to add new proportions of the main materials used. Thus Mr. Robiquet prescribes to add:

Note 38 Loco citato.

1st For the first heat of the second half of the hats:

Powdered verdigris. 3 lbs.
Iron sulfate. 4 lbs.
This addition is repeated before the fifth and sixth heats, and the heats and vents are repeated up to three or four times for each half of the hats, and sometimes more. We recommend adding two pounds of crushed gall nuts beforehand. Some dyers use larger proportions of these ingredients, but we believe them to be unnecessary.

This operation is greatly shortened, says the aforementioned chemist, by using iron sulfate dissolved in water, which has been exposed to air for a long time to superoxidize the iron, or by boiling it with a little nitric acid. Iron sulfate can also be dried and even slightly calcined; By this method, a more beautiful black is obtained more quickly, and some manufacturers even believe it to be more durable. This method has recently been replaced by a more advantageous and expeditious one: instead of iron sulfate, it uses pyroacetate or iron acetate. The latter salt is preferable, unless the former is thoroughly stripped of the tar contained in pyroacetic acid (pyroligneous), which, by making the hairs glutinous, makes drying difficult. The English use iron citrate with great advantage.
The dye bath must be kept at a high temperature; for, according to an old dyer's adage, what boils well dyes well. After each operation, dyers usually immerse the hats in a boiling water bath and drain them by *pièce* [39], in order to remove all impurities and make the felt more apt to take the new dye.

Note 39: The piece is a copper tool used to remove the liquid and any impurities that the felt may contain.

If the hats to be dyed are of the same quality, they should be placed alternately at the bottom of the kettle for each heat [40] . When, on the other hand, the hats are of different qualities, the finest should be placed at the bottom of the kettle, and the others on top, since the finest materials combine with more coloring matter. Fine hats, Flemish style, made of pure winter hare's back hair, can safely withstand eight or nine heats; the same is true for half-hair, bearskin, and gold-colored hats; but the process must be carried out at a lower temperature and with less iron sulfate. In all cases, the felts must be stored in the kettle in such a way that they cannot be damaged in any way.

Note 40: (return) The hot dye is also known as a plunge or fire; its duration is one and a half to two hours.

To obtain an intense and solid black, it is necessary to prepare a dye bath rich in color, and not to use the old, exhausted dye bath for galling the felts. This process, says Mr. Mackensie [41] , is very vicious, and prevents the new color from being able to fix itself on the hairs that are already impregnated with the mud floating in the water of the old bath and preventing the color from reaching them. The new, clear bath makes the down shiny, while the old bath is always muddy and makes it dull. Mr. Mackensie is right. However, we believe that the old bath should not be allowed to go to waste. It would perhaps be better to decant it from the mud, filter it, and replace a large part of the water of the new bath with this exhausted dye, which is still quite rich in coloring principles. Since economy is the soul of factories, this one seems to us to deserve some consideration.

Note 41: Loco citato.

Dye bath for 200 hats, from Mr. Morel.

Indian wood, logwood, finely chopped.	*100 lb.*
Crushed black Aleppo gall nuts.	*6*
Cherry gum.	*5*
Montpellier verdigris [42]	*4*
Iron sulfate.	*5*

Note 42: (return) Mr. Mackensie rightly prefers Mr. Mollerat's verdigris, which is much purer than that of Montpellier.

This bath is prepared as described above. As for the additions to be made before the third, seventh, ninth, and twelfth heats, he recommends for each the same proportions of iron sulfate, verdigris, and gall nuts as for the original bath; the hats, according to his method, must all pass through the boiler eight times, that is, receive eight heats and eight vents.

As soon as the dyeing or burnishing is finished, the felt is quickly stripped of all impurities and uncombined coloring matter. This is achieved by numerous washes in the disgorging boiler containing pure water heated to about fifty degrees; They are brushed with several waters, and then immersed in boiling water to thoroughly drain them; [43] they are then taken to the river and washed until the water runs clear from the felt. This operation has the triple advantage of washing the hair, draining the felt, and fixing the color at the same time. Once the hats are well drained, they are immersed in boiling water, put back on the last, and care is taken to wash them well by rubbing them with a semi-luster brush, until the hair is clear and shiny. They are then carefully drained and dried in an oven, heated to about 35 degrees, and not in the sun, which alters the blackness and sometimes turns them bronze.

Note 43: There are manufacturers who do not immerse them in boiling water; they are content with immersing them in a boiler at 50 degrees.

The same manufacturer reports the following recipe, from his father, Mr. Morel-Beaujolin, for 200 hats. Assuming that the quantity of water that must be poured in the usual way is twenty-five parts, and that the amount lost during each heat is three buckets, which makes twenty-three parts lost or evaporated for the total, according to his method, one must add forty-eight parts of water, in which one boils for eight to nine hours, the same proportions of ingredients; that is to say, first:

Indian wood.	*100 lb.*
Aleppo galls.	*24 lb.*
Cherry gum.	*5 lb.*

After this boiling, a quantity of decoction equal to the excess water added is removed, approximately twenty-three times, and poured in four equal parts into four vats or barrels placed near the boiler, at the bottom of each of which is placed:

Iron sulfate.	*5 lb.*
Copper subacetate (verdigris).	*3*

Then add to the boiler:

Iron sulfate.	*5 lb.*
Verdigris.	*4*

These proportions are the same as those ordinarily used; but their use is different. The bath is stirred well, and half an hour after adding the last drugs, the first half of the caps are added. The procedure is then the same as for the other methods, with the difference that the evaporated water is replaced at each heat by the liquor placed in each tub and barrel, and stirred well before pouring it into the boiler.

Whatever the merits of Mr. Morel-Beaujolin, we do not believe that this method will ever be adopted by manufacturers, since it only offers changes that seem to us to lengthen and complicate the operation, rather than simplify it.

These are the methods most commonly used for dyeing. We will now describe the new processes that have been proposed; we will begin with that of Mr. Guichardière, which was largely copied by Mr. Mackensie, as can be seen by comparing them.

Description of the processes to follow for dyeing hats, and observations on the improvements achieved in the art of hatmaking; by Mr. GUICHARDIÈRE. (Ann. de l'indust. nat. et étrang., May 1824, p. 131.)
To obtain an intense and solid black, according to the author, it is necessary to compose a bath rich in color, and never use, as almost all dyers do, the old, exhausted bath for winding felts. The new and clear bath makes the down shiny, while the old bath is always muddy and makes it dull. One must use M. Mollerat's powdered verdet, which is much purer than that which comes in loaves from Montpellier, and calcined couperose (colcotar of the ancients, red iron tritoxide of the moderns); by this process one browns much more quickly, and the black is much more beautiful, provided that the temperature is well regulated, and at the right height so that the felt is not altered. The author means by this that the highest temperature is that which fixes the color best. After each operation, it is essential to thoroughly drain the hats in a boiling water bath, and then drain them thoroughly with the piece[44] to remove all foreign matter.

Note 44: The pièce is a copper tool used by the hatter to remove the liquid and dirt from the felt.

When the bath is prepared, if the items to be dyed are of a single quality, care must be taken, during the various firings or immersions they undergo, to place them alternately at the bottom of the boiler; without this precaution, the intended goal would be missed.

When several qualities of hats are to be dyed in the same bath, the finest ones should be placed at the bottom of the boiler, and the less fine ones on top, since the dye atoms always precipitate, and the finest materials absorb a greater quantity. Fine hats, Flemish style, made of pure winter hare's back hair, can safely be dipped eight or nine times;[45] those called half-hair, bearhats, and golden can be dipped as many times, but at a much lower temperature, and less iron sulfate (green rosacea) must be used.

Note 45: (back) In hat making, what ordinary dyers call a fire, we call a dipping or a hot dipping. The duration of each dipping or hot dipping is one and a half to two hours.

As soon as the drizzling is complete, the felt must be freed from all the dirt it may contain, which is produced by the residue of the ingredients used to make the bath. To do this, as soon as the felts come out of the boiler, they are taken to the river where they are washed and wrung out until the water runs clear. This operation has the triple advantage of washing the hair, disgorging the felt, and fixing the color at the same time. The hats must then be immersed in boiling water, shaped, and carefully washed by rubbing them with a semi-lustrous brush until the hair is clear and shiny.

They are drained as much as possible, then dried in a moderately heated oven by a stove to avoid the bronze produced by oxygen combining with the surface at a high temperature. When the hats are dry, they must be brushed with the greatest care until no more dust comes out; then they are polished with river water, dried, and brushed again.

In the past two or three years, dyeing has made some progress, and several factories are producing quite beautiful blacks; their products are also highly sought after, as it is true that it is the intensity of the color, rather than the quality of the felt, that sells hats. It is important to note that the English have only produced beautiful black since they substituted iron citrate for the sulfate of the same metal; the author believes that iron tartrate, gallate, and acetate could produce the same effects; he intends to conduct a series of experiments on all these salts and to publish the results as soon as they are completed. He then indicates, as communicated to him, the processes used in Naples and Trieste for dyeing hats. We will refrain from citing them, having found them described in Mackenzie's work from which we have already extracted them.

Process for dyeing hats; by Mr. BUFFUM.
The hats to be dyed are placed on the pegs of a vertical wheel rotating on an axis in the vat. As this wheel turns, the hat dips into the dye and comes out of it. This wheel can be made to turn very slowly, by a gear that connects its axis to some motor, or it can be made to make only half a revolution, at intervals of about ten minutes. By this process, the hats placed on the pegs will be alternately immersed for ten minutes in the dye, and then they will be exposed for the same time to atmospheric air. The author believes that this way of dyeing hats is very advantageous, because by passing successively from the dye bath into the air, and from the air into the dye bath, the oxygenation by the atmospheric air will fix the coloring matter more firmly and more quickly in the fabric of the hat, than by prolonged immersion for a much longer time. (London Journal of Arts, September 1828.)

Improvements in hat dyeing; by Mr. Pichard.
The author indicates various improvements that are possible in dyeing hats. He suggests: 1st dyeing with wicker forms, in order to avoid breaking the edges and tearing the edges; 2nd replacing round boilers with long boilers; 3rd placing the hats in a wheel with an open hole, one half of which would be immersed in the vat, while the other half would be exposed to a current of air, so that half of the hats could fan themselves for a given time, while the other half would be dyed, and vice versa. By this process, the hats would no longer be in contact with the bottom of the vat, they could be agitated in the bath and in the air at the same time, by giving a movement to the wheel; This would save a great deal of time and produce a more beautiful black, because the hats, suspended and agitated in the air, would absorb much more oxygen than on the pavement, where they are usually thrown.

To dye one hundred fine hats, the author uses the following preparation: boil six pounds of crushed gall nuts and fifty pounds of logwood for two hours in a copper boiler filled with a sufficient quantity of water. When this bath, which will be designated No. 1, is prepared, place half of it in a boiler; after adding twenty pounds of copper sulfate, the hats are placed in it for a quarter of an hour, and then raised for half an hour.

Pour one-third of what remains of No. 1 into the boiler, along with thirty pounds of iron pyrolignite; Keep the fire going, return to the boiler, strain for a quarter of an hour, simmer for an hour and a half, lift, and vent for half an hour.

Cool again with the remaining second third of bath No. 1; heat to 75°C, add fifteen liters of iron pyrolignite, place the caps in the boiler for half an hour, and vent for half an hour.
Return to the boiler for one hour, vent for half an hour; cool again with the remaining bath No. 1; heat to 75°C, add fifteen liters of iron pyrolignite; place the caps in the boiler for one hour, and vent.
Return to the boiler for an hour and a half, lift to wash in running water; dry in an oven, form, and polish. (Industriel, December 1828.)

Processes used by the people of Trieste to dye hats in five or six dips, lasting two hours each and as many vents.

To dye twenty bell-shaped hats with formillions, the people of Trieste use:
8 pounds of good Indian wood;
7 ounces of black gall;
8 ounces of yellow wood;
2 pounds of green rosacea;
7 ounces of verdigris;
8 ounces of calcined Cyprus vitriol;
20 small sunflower stones;
2 ounces of fine pulverized gum arabic;
16 3/4 ounces of flax seeds.

Note: I give the old name here so that it can be better understood by the workers.

To prepare the bath, one must:
1. Soak the Indian wood for four days, then cook it for six hours;
2. Macerate the rosacea, verdet, and sunflower seeds separately in human urine for four days, then boil them for a few minutes;
3. Bath composition. Add half of the verdet, gum arabic, three-quarters of an ounce of flax seeds, and eighteen ounces of rosacea to the decoction of Indian wood. Allow these substances to dissolve thoroughly.

First dip. Immerse the twenty caps; raise the temperature to 75°C; leave them for two hours; remove them, and allow two hours of venting.
Second dip. Add half of the unused verdet and two ounces of rosacea to the bath; two hours of bathing and the same amount of venting.
Third dip. Add half of the unused verdet and two ounces of rosacea to the bath; two hours of bathing and the same amount of venting.
Fourth dip. Add half of the gallnut decoction, half of the sunflower, all of the yellow wood decoction, and two ounces of rosacea to the bath.
Fifth dip. Six ounces of gravelly ash are added; this alkali is, in technical terms, used to wash copper, that is, to prevent the bronze effect that usually forms on the surface; the remaining eight ounces of couperose, and the remainder of the gall nut decoction. To avoid bronze, care must be taken to thoroughly swirl the hats with a stick in the bath.
*Sixth operatio*n. To ensure the blackness of the hats is dazzling, they are immersed in a bath of boiling water into which a pound of sifted flaxseed meal has been added, taking care to drain the hats well to purge them of the oleaginous principle.

Observation. The effects that the high temperature of the ovens has on the color of the hats deserve careful study. I believe it would be extremely important for the progress of our industry to determine as much as possible the effect that the heat of the ovens has on the black color of the hats; for it is certain that the felts dried there are a more intense and brilliant black than those left to dry in the open air. Could oxygen not play the main role here, and could the temperature of the oven not favor its combination with the substances that form the dye? I leave to others, more learned than I, the task of solving this important problem and finding the cause of the fact I am reporting.

Neapolitan method for dyeing hats in two dips.

The Neapolitans dye in only two dips of three hours each and a half-hour of venting. [46] What greatly facilitates this operation and makes it shorter is that they never dye hats in forms; they only use formics. [47] Indeed, the form with which we fill our hats prevents the dye from easily penetrating from the outside to the inside; Color can only be communicated from the outside, so it takes much longer and a greater number of dips for the dye to communicate from the outside to the inside, passing through the entire thickness of the felt. With the help of the mold, the entire interior of the hat is empty, and the dye enters freely through both surfaces and penetrates the felt more easily. I consider this idea extremely successful.

Note 46: Until now, it was thought that it was only possible to obtain a beautiful dye with the help of air. For this reason, a vent was given for as long as the dip. The Neapolitans, between their two fires, only give a half-hour of venting, the time necessary to prepare the second or hot dip. This practice would seem to prove that the vent is unnecessary: I will verify this through experimentation.

Note 47: A formillion is a one-inch-thick wooden disc that is inserted into the bottom of the hat's head to keep it stretched and prevent it from returning to its conical shape.

The first bath consists of a strong decoction of Indian wood, to which a suitable dose of verdet is added to turn it black, and a certain quantity of indigo liquor (I think it is indigo dissolved in sulfuric acid, or indigo sulfate; this composition is known). As soon as this bath is prepared, the hats are immersed in it and left for three and a quarter hours at boiling temperature. During this time, the hats become impregnated with a beautiful black color, but it has no solidity. They are left to ventilate for half an hour, sufficient time to prepare the second bath.

The second bath is prepared like the first; but calcined couperose is added, that is, iron oxidized to the maximum, the colcotar I mentioned (because until now no one has found a way to produce black without iron oxide); the hats are immediately immersed in it for the same amount of time as in the first hot bath, but at a lower temperature, 75 to 78° Réaumur. This second fire is intended only to fix the color.

Three and a quarter hours after the hats have been immersed for the second time, they are removed, carefully washed in cold well water, the hair is brushed, and wrung out until the pores of the felt are completely free of any dirty parts. They are then immersed in a boiler full of boiling water to completely remove any remaining dirty parts, and then shaped. They dry their hats in an oven at a very mild temperature. After drying, they polish and polish them like us.

The Neapolitans know their dye is good when they see that their bath is completely exhausted.

I think this method of dyeing is preferable to ours, since our hats remain at a temperature of 72°C, under the influence of iron oxide, for sixteen, eighteen, and often twenty hours, which alters and corrodes the felts; while theirs only stay there for three and a quarter hours; so ours stay there at least six times longer. This is why their hats are softer and more intensely black than ours.

Preparing the hats.
The name "hat dressing" refers to the addition of a glue that, while maintaining the fabric's flexibility, binds the felted parts together, making it more consistent, firmer, and more likely to retain its given shape; finally, it makes them impervious to water. The dressing is usually made with a solution of gum and strong glue. Some manufacturers use ox gall, vinegar, and a few other substances; gum and glue are preferable. Among the large number of known recipes, we will limit ourselves to the one published by Mr. Morel; here it is:

Sizing bath. (*apprêt*)

Local gum, depending on its purity	
Strong glue, s.q.	*12 to 30 pounds*
Water.	*5 to 6 ways.*

Without following Mr. Morel step by step, we will say that the gum must be cleaned as much as possible, reduced to a coarse powder, and then gradually thrown into boiling water, stirring with a wide wooden spatula. When the gum is dissolved, the solution must be passed through a cloth to separate the impurities. This avoids boiling for twelve or fifteen hours, as Mr. Morel recommends; this boiling is unnecessary; it is only long, expensive, and ineffective. It is sufficient to boil it for a quarter of an hour and skim it off; this gum solution is then poured into a barrel.

The worker then takes the necessary glue and soaks half of it in water for twenty-four hours, and the other half in the gum solution. Each of these glues is dissolved separately in these liquids; the solution of glue in the gum water is called *head dressing*. The liquid melted in water is usually combined in equal parts with gum water, and sometimes in different proportions, depending on whether the felt is to be more or less firm and consistent. This is the liquid that is called, in art terms, brim dressing. Here is how to dress the hat:

Applying the dressing.
We begin by heating and maintaining at about 50 or 60 C°, the head dressing; then, using a large brush, we carefully and evenly coat the inside of the hats which have previously been placed on a strong table, called a block, in which large holes are made to receive the shape of the hats. The hats in this state are called head-dressed; they are dried in an oven, and replaced in the same way on the block. Then we heat the rim dressing to 60 and 65 C°., and the dresser coats the underside of the hat, which then presents the upper surface, by means of a large brush, with a layer of rim dressing, and gently strikes with the flat of the hand on the parts of the hat thus coated, gradually rotating the hat in the block. After this, he applies a second coat of primer, which he works in with his hand, as we have just described, and if a little primer has fallen inside the head, he lightly brushes it over to smooth it out.

Mr. Robiquet describes this operation in a way that seemed more rational to us; we will let him speak. A polished iron basin, equipped with a furnace, is placed next to the primer bath, its bottom covered with a wet cloth. The primer turns the hat upside down on the block, dips the brush into the primer, and impregnates the inside edge of the hat with it, taking care not to reach the rim.

He thoroughly sprays the cloth from the basin to release a lot of steam; he applies the hat to it from the primer side, which is introduced as the steam penetrates. After two or three minutes, the hat is removed, then replaced in the block, and by passing the flat of the hand over it, it is checked whether the surface is no longer sticky; which would imply that the dressing has not penetrated far enough; then it would be necessary to expose it to steam. The opposite excess must be carefully avoided; because, if the dressing reaches the other surface, the hat becomes scabby, and it is necessary to clean it with hot soap, and to start the operation again. When the dressing of the brim is finished, the hat is dressed at the head, by applying with a brush, towards the middle of the base, a rosette of strong glue, which is immediately covered with two coats of dressing, thicker and less hot than that which was used for the brim, and which is spread over the entire inside of the hat without making it go back, since the inside of the head is covered by the cap. This process is more expeditious than the previous one, which also requires the following operation to complete it.

Sizing and rewashing basin.

This process consists of placing a circular, convex cast iron plate on a furnace, exactly covering the hearth. When this plate is very hot, a layer of wet, well-crumpled straw is placed on it, secured with a triple, extremely light-colored wrapping cloth. This cloth is then watered with a very fine watering can or a brush. The cap is placed on this cloth, and covered with a sort of copper bell, which is removed and lowered by means of a pulley. During this operation, the heat from the furnace continues to heat the plate, which, by transmitting its heat to the water, reduces it to vapors that fill the bell and draw in the sizing. In this way, all the hats are successively put through the dressing, watering the cloth each time a new hat is placed on it. As the hats come out of the basin, they are quickly wiped gently with a piece of very dry rough cloth; the hair is then removed using the square; they are then taken to the oven to be subjected to the rewashing operation. This operation aims to rid the surface of the felts of the excess dressing which is there and which keeps the hairs stuck together, which is noticed in those which have not been subjected to the basin. To do this, the edges of these hats are soaked in a weak solution of soap in boiling water; it is then drained, wiped, the hair is removed, and dried in the oven to be subjected to the dressing.

The finishing process requires a lot of care; because a poorly finished hat not only loses its value, but is also discarded. The so-called gelatin glue deserves preference over ordinary glue, because it has been recognized that it is more elastic, stronger, less soluble and less hygrometric. Nowadays, the rewashing basin is almost entirely unused; however, it is not without utility for hats with large brims, called horned hats: this rewashing operation only dates from the elimination of short hats, the finishing of which was limited to gummed water. But for Flemish-style hats, as the felt is less tight, a stronger finishing was necessarily required; gummed water was therefore combined with the gelatin solution. In England, when the hat is finished, to remove the excess finish remaining on its surface, water containing a solution of black soap is boiled, and the hats are immersed in it up to the middle of the head, until the excess finish is dissolved. The procedure is then followed as we have already described.

Approval of Hats.

Hats that have reached the stage of manufacture we have described lack the shine and softness that constitute their beauty. These are the qualities given to them by appropriating. As for felts intended for headdresses, they are simply ironed or pressed to form a sizing, like woolen fabrics.

We will transcribe the various stages of this operation:

This dressing is a painful and difficult operation at the same time, since the forms are broken into six or seven pieces, and they must be introduced piece by piece into the head.

Before this, the hats are put in the cellar for one or two days in order to soften the felt well; this softening is completed by smoking it, as they say, with a clog. This operation is done by placing, on the hot iron of the appropriator, a wet cloth, which is called a *fumette*, and covering the whole with the hat which acts as a bell. The water vapor which is released makes the felt more elastic. In this state, it is immediately shaped, and pulled very carefully and from all sides, so that it adapts well to the entire form, and preserves all its contours; it is good to note that the hat must be secured to its form, by means of a string placed at its base, as in fulling. When this work is finished, and the edges are well arranged, the hat is tightened, that is to say, the appropriator dries the hat by means of the hot iron. Ordinarily, he uses two iron heats for the head, and at least one for the edge, taking care to wet the hat from time to time with the luster brush; because without this the felt would be hollow and dull, and the finish uneven, while it should be tight, of an even and shiny finish. When it is recognized that some jars still reappear, they are torn off. When the hat is thus well dry on the outside, it is removed from the form, and is taken to a dry place so that the inside dries equally. In this state, the hats are subjected to a new or second tightening, which is called passing in second. This operation tends to give the hair all the brilliance, luster and velvety possible. We then alternately use the iron and the luster brush, and at the end, to give the hair more shine, we run a piece of padded cloth over it, which is called a ball. There are manufacturers who, to obtain a more beautiful luster, dip their luster brush in some suitable liquid instead of water. I have analyzed several similar compositions, and in many I have found indigo solution and a little gum arabic in undetermined proportions, but which we believe can be established in the following proportions:

Luster water.

Pure water.	*25 kg.*
Gum arabic dissolved in water.	*4 ounces.*
Neutral solution of indigo in sulfuric acid.	*1 ounce.*

Hats that have undergone this second tightening are taken to the store; but if they remain there for a long time unsold, to restore their shine, they are tightened a third time. In these various operations, the worker must be careful that the iron is not too hot, so as not to burn the hair of the felt, or, as they say, shave the felt; they must also avoid creating grooves, which occurs when the felt has been too wet, and then passed over with a low-heat iron slowly, or with an iron that is too hot. In this case, since not all the water is vaporized, the remaining water soaks the finish and creates grooves. To remove them, the dressing that forms the gutters must be completely removed using boiling soapy water, and then a new dressing applied. These parts could also be subjected to steam, which would remove the dressing.

Hat-making.

This operation consists of gluing strong paper to the bottom of the hat, and a lighter one around the perimeter. It is necessary, especially when the lasts are large in diameter; the dressing serves to keep the hat's shape and make it more solid; it is usually done before shaping. We should also note that many of these hats are not made of cardboard. Merchants simply add a base and a rim of thin paper.

Hat-trimming.

This work is in no way the responsibility of the hatmaker; it is the domain of the hat merchant, who gives them the proper shape and cut, edges them, and applies the cap, rim, etc. We will therefore limit ourselves to saying, on this subject, that in the past, the felt was pierced with a needle to sew the leather around it.

As a result, if the hat had been damaged by dyeing, and whether the hair was thick or not, it would perish from this stitching, since the stitch cut through the felt by two-thirds of its circumference. Now, a small frame is made onto which the leather is sewn. In England, a type of knife has been invented that not only cuts the leather but also traces all the stitches of the needle, making this work shorter and much less arduous. Some hatters in France have already adopted it.

These are the various operations used to make felt hats. We will now present most of the improvements that have been proposed. We will begin by giving an excerpt from Mr. Guichardière's memoir, which is recorded in the Annals of National and Foreign Industry, 1824.

Memoir on New Processes for Making Felt Hats; By Mr. GUICHARDIÈRE, hat maker in Paris.
In this memoir, Mr. Guichardière establishes that, to make hats like the Italians, hare hair from any country can be used, but that French hair is preferable, as are those from Savoy, Switzerland, Tyrol, Carinthia, Carniola, Styria, etc., since the down from these hides felts more vigorously than those from the north. This work is divided into several paragraphs, and the method followed in this new type of manufacturing is described.

The first paragraph contains the *preparation* and cleaning of the hides before trimming them. This preparation consists of scraping the hair several times and alternately beating it until the down and guard hair are free, and no more dust comes out. This operation serves to rid the hair of the blood that soiled the hide.

Trimming.--This is the operation by which the awn is cut with scissors at the level of the down. This precaution requires a light hand to cut only the awn without reaching the down. Without this preparation it would be difficult to have a smooth or even felt.

Secreting.--Secreting is done by touching the hairs with a solution of six ounces of mercury in one pound of pure nitric acid, diluted with sixteen parts of marshmallow and comfrey decoction, the decoction of the plants giving the felt softness and aiding felting. Once the solution is prepared, the brush must be immersed in the solution and the hairs rubbed with light pressure until they have fallen off two-thirds of their length, and more if possible. They must then be dried in an oven at a very high temperature; the acid being weakened, the hair cannot be burned.

Method of moistening the hides to prepare them to release their down.--This operation is done using a preparation of alkaline water, containing one-twentieth of lime water, with which the leather is soaked. Care must be taken to join them two by two to prevent the hair from getting wet. They are placed in piles of fifty, then covered with a board on which a very heavy weight is placed to press them through and soften the leather, which can be done in twenty-four hours.

Plucking.--For the new manufacturing system, the hairs must be plucked, which is done by pinching them between the blade of a knife and the thumb, and by applying strong pressure, they are extracted. The hair is plucked until none remains on the leather, taking care to separate the various qualities: the hairs from the back, sides, throat, and belly.

Observation on the difference between plucked and cut hairs.--Plucked hairs, being blunt at the root and deprived of their guard hairs, have more difficulty producing felt; their action must be slower than that of cut hairs, but they produce shiny and strong hats.

Many of the primitive operations for preparing hats using this new method are more laborious, but it has the advantage of using common hare belly hair, which is of very little value. Moreover, by this process, a hat never deteriorates under the worker's hand; the more he works it, the shinier it becomes, and the more similar it is in all its parts.

Top-quality hat making and shaping.--This term includes the operations of weighing the necessary hair according to the desired strength, then mixing with this hair a coarse coat of fine red vicuña. The whole is placed on the rack and mixed with the bow until the mixture is of the same shade, and all foreign matter and debris are separated.
Those things thus arranged, the rack is removed, the table is cleaned, and it is moistened to help the hair adhere. The material is divided into two equal parts to form two pieces; they are saddled, and care is taken to spread them as much as possible and make them very high. Before starting, the fabric must be opened, the hairs well divided, all the small debris that may have escaped during the initial operations must be extracted, and the material must be made more manageable, in order to have greater ease in spreading them in the felting cloth. When these same parts are worked with strong pressure on the pelvis, a very large, narrow, and high hat must be made at the same time; the base and side must be thin, the edge must be fairly strong, as must the binding and the ridge. When the hat is also saddled, care must be taken to make the hairs adhere well, that is, the frame must be felted enough to be able to brush as quickly as possible with the shed.

Fulling.--The fulling of the hat is done in a highly acidulated bath using cream of tartar and oak bark decoction. The hat is immersed in this bath when it is boiling; care is taken to ensure it is thoroughly soaked throughout; if any part is not, this is supplemented by the brush. Two or three crosses are fulled without tins, with a closed bearing, without soaking much, and, when the felt is well formed, the pressure of the brush is used. But first, the hat must be thoroughly cleaned by rubbing with the bare hand; the felt being still soft, the guard hairs escape more easily than when it is more formed. The fulling is continued in such a way as to make the hat small enough to be placed on the last.

The second quality is produced with more effort than the first; it is done with the side hairs, and the finest of those from the throat, which have less felting action than the back hairs. A large piece of fine vicuña is added, and the hat is gilded at the pelvis with an ounce and a quarter of secreted back hair. This addition gives strength and beauty at the same time. The crowd is painful, since the gilding of the secreted and torn hair wrinkles for a very long time.

The third quality, similar to the previous one, is made with the common belly hair and two vicuna groins, and gilded with an ounce and a quarter of secreted back hair. These hats need to be vigorously crushed, as it is difficult to smooth out the wrinkle.

Forming.--For this operation, the work is the same as for other hats. The hat should always be formed in hot, clear water. This precaution forces the hat to draw out its color and enhances its brilliance.

The drawing must be done with care. A very soft felting tool should be used, and light pressure should be applied to avoid breaking down the felt and creating waste.

Dyeing.--Hats prepared in this way are easier to dye than those made by ordinary methods, since the pressed wine lees contain two ingredients, one acidic, the other alkaline. The first serves to create felting, and the second helps the hairs to give shine; which makes the hat more capable of drawing its color.

The finest is always the blackest, and the coarsest is less so. According to Mr. Guichardière, care must be taken to ensure that the salts used in dyeing do not contain an excess of iron, as excess iron harms the beauty of the color, which is not the case with an excess of acid. To turn the bath, a mild temperature is required, and eight to ten fires should be used. Without this precaution, the second quality would be damaged, and the third would be burned. Boiling water is required to deboil the hats; without this precaution, the hats are dull and dusty. They must be dried using gentle heat in an oven, where the hats are placed only after burning.

Shaping the hat is less easy, since the felt is more resilient; but as a reward, it is less difficult to dehair, since there is much less awn to extract than in hats made by the ordinary process. Mr. Guichardière also reported in the same journal (1825) the method followed by the English in France; here it is:

Eleventh notice on a new type of felt hats established in France by English manufacturers; by Mr. GUICHARDIÈRE. (Annal of the National and Foreign Industry, August 1825, page 207.)
About three or four years ago, the English established a factory in Caen (Calvados) for producing inexpensive hats, similar to those made in England and the United States. All the workers employed in this factory are English; no Frenchmen are admitted. Here is roughly how they operate.

First operation. They use lamb's wool from all countries, but preferably from Sologne. They give these wools a preliminary preparation by letting them macerate either in putrefied urine or in a decoction rich in tannin; that is, in any decoction that has the property of giving the wool a felting and felting effect. The base, which is to form the base of the hat, is all wool, a very coarse material, in truth, but which has the advantage of producing a solid hat due to its strength. When the base is built, they tread it in a solution of gravel (or raw tartar), which has the dual advantage of simultaneously steeping and felting, due to its astringent properties. Before bringing the hats to the floor, they take care to boil them in one of the decoctions or solutions mentioned above, and after treading them, they boil them again in astringent baths, so that the pores of the felt are as tight as possible. After this operation, they singe them and clean them with a brush, so that no debris or burnt hairs remain on the base.

Second operation.--To produce the hair suitable for the surface of these bases, they use wild rabbit hair, preferably that of Brittany. Before using it, they have it trimmed and cut like hare hair, and they make it adherent by the same means that we use for hare and beaver, on grounds composed of finer materials, with this difference, however, that, when the gilding is adherent, they take care to cover it with a layer or cotton gilding which forces the first gilding to adhere to the ground, but which does not adhere itself, since it is true that during the fulling operation, it is partly detached, and during the unsoiling it separates completely as the real gilding develops. After this operation which opens the pores of the felt, and makes it very easy to put the hat on the form, the greatest difficulty in this new kind of manufacture, is to find a way to properly stretch the hat. The ground can, in truth, resist the high temperature of the bath, but the gilding does not. There is a complete difference between these hats and the half-fur hats whose base is made of common materials like hares and rabbits. The base of the latter is guaranteed by gilding, while in the others, the gilding is guaranteed by the base. To overcome the drawback of dyeing, the author believes it would be more appropriate to use iron dissolved in vinegar (or iron acetate), which is less corrosive than the same metal dissolved in oil of vitriol (iron sulfate); copper should be used in preference to iron, that is, anything that could harm the material should be avoided, or used only sparingly. The author notes that this type of manufacturing is perfectly suited for junk goods, and that it would also be very useful for the consumption of our rabbit fur.

New ways of making round hats; by PERRIN. (Five-year patent.)

Until now, hatters have traditionally made hats on round lasts, although the head presents a more or less regular oval. This shape has the disadvantage of causing discomfort until the head has formed its shape at the entrance to the hat.

The brims of ordinary hats also have the disadvantage of being on the same plane, which is uncomfortable for wearers; they are simply bent a little with an iron, but soon afterward they assume their flat shape.

To remedy these two drawbacks, I set the hats on an oval last, and I give an arched shape to the part that forms the brim. By this means, the head is not hindered in the hat, and the ears are free and unobstructed.

Explanation of the figures.
Fig. 14. Hat dyed, dressed, and softened with hot water steam, which must be made with two opposing lips A, intended to form the extension of the last at the front and back.
Fig. 15. Broken balloon last, front view; it is round at the top and tapers to an oval at the base. The prepared hat is placed on this last, Fig. 14.
Fig. 16. The same last, side view.
Fig. 17. Saddle, side view; it is arranged to receive the last, Fig. 15.
Fig. 18. The balloon last mounted on its saddle, side view.
Fig. 19. The same last, front view.
Fig. 20. The hat mounted on its balloon last after it has been beaten, the bumps removed, and the bond formed. It is added to a second curved saddle B, front view, onto which the brim of the hat is folded down and laid flat. The last is fixed to the saddle with two pegs.
Fig. 21. The previous figure, front view.
Fig. 22 and 23. Elevation and horizontal section of the press.
C. Piece of wood forming the press, which, by means of screw D, applies pressure to the hat E placed in the frame. F. Frame open to insert the hat.
Fig. 24. Ironing the brim of the hat onto the press frame.
Fig. 25. Copper mold, seen from the side; it is used to raise the brim of the hat.
Fig. 26. The preceding figure seen from the front.

Hatmaking, perfected by Borradaille. (London Journal of Arts; July 1826, page 353.)
The body of men's hats, the outside of which is covered with beaver or other hair, is usually made of carded wool and hand-knitted into a conical cap, which can be shaped in various other ways according to fashion and with the aid of molds prepared for this purpose.

The author's goal was to prepare hat bodies for mechanics. To this end, he designed two truncated cones, placed base to base and rotating together. Two other truncated cones of the same height, but with smaller bases, each rotate on its own axis and, in their motion, drive the double cone, against which they press lightly. A strand of wool coming from a carding machine is spread out and passed between the large double cone and the smaller ones; it wraps around the first, and a slight back-and-forth movement imparted to it crosses the filaments and creates a kind of felting. When the thickness is sufficient, a sharp instrument cuts the fabric at the junction of the bases of the double cone, and two conical caps are thus obtained, ready to form hats.

Improvement in the manufacture of hats. Patent to Th. Chaming Moore. (London Journal of Arts, April 1829, p. 26.)

This improvement consists in the construction and use of machines by means of which a series of filaments of wool or other suitable material is taken from a card and wrapped around a mold to make the shell or shape of two hats or caps in a single operation. The shape of this mold is cylindrical, about fifteen inches long, and twelve inches in diameter; its conical ends are rounded at their summit, and project about ten inches at each end of the cylinder. This mold, arranged to rotate on its axis, is carried on a carriage which has a back and forth movement at the head of the drawing cylinder of the carding machine. When it has been covered with a sufficient quantity of filaments of wool or other material, this fabric is cut circularly towards the middle of the cylinder, and is slid towards each of its ends; by this means two hats or caps are obtained, which, worked according to known processes, are capable of taking the shape given to ordinary hats. The mold should be as light as possible, so that it can turn easily; the author advises, for this purpose, to make it hollow and of light wood.

Method for varnishing hats to make them waterproof.

Messrs. Ritchard and Francs recently took out a patent for the following method of making hats waterproof. The ingredients used are so numerous that they are not economical. We will designate with italics those useful ingredients in this composition, noting that the quantity of alcohol must be proportional.

The exterior of the hat is prepared with ordinary materials, dyed, and shaped. When it is perfectly dry, the interior surface is treated with the following composition:

One pound of *gum kino*, eight ounces of gum elemi, three pounds of gum olibanum, three pounds of gum copal, two pounds of *gum juniper*, one pound of *gum ladanum*, one pound of *gum mastic*, ten pounds of *lacquer*, and eight ounces of *frankincense*. All these materials are ground and mixed together; Then they are dissolved in an earthenware vessel containing about four liters of alcohol, and stirred frequently.

When all these ingredients are well dissolved, a pint of liquid ammonia and an ounce of lavender oil are added to the mixture, along with a pound of *gum myrrh* and *gum opopanax*, dissolved in three pints of spirits of wine.

All these substances, perfectly incorporated and well dissolved, constitute the proofing mixture with which the inside of the hat is treated.

When the exterior is dyed, shaped, and perfectly dry, the inside surface and the underside of the brim are varnished with this mixture using a brush. The hat is then placed in a drying oven and this operation is repeated several times, taking care that the varnish does not penetrate the piece, so that it can be seen from the other side. Perspiration from the head is wicked away by means of small holes made in the crown of the hat: the beaver hair, etc., is arranged in the usual manner, and the copal varnish is applied to the opposite side.

HATS MADE WITH THE DOWN OF KASHMIRE GOATS.

Report prepared by Mr. de Lasteyrie, on behalf of the Committee of Economic Arts, on goat down from the Hautes-Alpes.

Mr. Serres, sub-prefect of Embrun, Hautes-Alpes department, sent the promotion society a hat, two samples of felt, and a small sample of knitwear, all made with the down of native goats.

The hat is perfectly made, the felting is even, solid, firm and elastic: the dye is a beautiful black and appears to be solid, but it does not have the shine found in rabbit hair hats. The hatter from Lyon who made it believes that the dye destroys the softness and shine of the hair. We see, in fact, for the two samples of felt taken from the same piece, that the one that has been dyed is hard and stiff, while the one that has not undergone this operation is much more supple and softer. This type of hat also lacks the beautiful shine that beaver or rabbit hair gives, but it would be easy to obtain this quality by mixing one of these hairs with goat down. It is also worth noting that, for equal dimensions, the weight of a goat down hat is less than one-eighth, compared to that of a hat made with hare hair. Moreover, it seems that the use of goat down in hat making has long been known under the name of *Abyssinian Chevron*; it has been recognized that it greatly strengthens felt.

It follows from all these facts that excellent hats can be made with the down of our native goats, and everything suggests that they will be as strong and durable as ordinary hats. The manufacturing cost is roughly the same.

The material used in the one sent to you is estimated by the Lyon hatter at	*6 francs 90c.*
The felting at	*3. 30c.*
The dyeing, finishing, and trimming at	*5 c.*
Total:	*15 francs 20c.*

Evaluating the manufacturing profits at about a quarter, we will have hats that will cost 20 or 21 francs.

Mr. Serres also sent a small sample of knitted fabric, whose fineness, silkiness, and especially softness, are highly commendable. This is another type of industry that deserves the attention of manufacturers and can be applied to other aspects of hosiery. Finally, experience has taught him that, by crossbreeding native breeds with Asian goats, one can obtain products as fine and as abundant as those obtained from the latter.

We believe that the Promotion Society should thank the Sub-Prefect of Embrun for the active zeal he has shown in seeking to give new impetus to our industry, and ask him to share with you, as he proposes, the method he uses to extract goat down.

Signed DE LASTEYRIE, rapporteur. Adopted in session, May 9, 1822.

Manner of making otter hair hats, by Mr. TROUSIER.

To prepare the skins, one begins by removing the awn from the hide; this is a common hair that is good for nothing. Then, the skin is rubbed with aqua fortis prepared with mercury. It is prepared by mixing, for a dozen skins, three ounces of mercury per pound of aqua fortis; it is left to digest in a bain-marie for six hours. Then, three pounds of river water are added to each pound of prepared aqua fortis, and the said skin is rubbed with it.

It is left for forty-eight hours before being placed in the ovens to dry. It is carefully covered with a cloth on which something heavy is placed so that it is well soaked and the secret does not evaporate.

The skin is placed in a cellar to soften and the hair can be cut.
Once the hair is cut, three ounces of this secreted otter hair are added, along with two ounces of natural soft hair, half an ounce of secreted beaver, and half an ounce of fine red vicuña. The whole thing is carded together, making six ounces of cloth to make a hat.
The six ounces of cloth are divided into four equal parts, which are then rounded off one after the other. Once the four capades are made, about half an ounce of cloth remains, which is used for what is called the crosspiece, which is divided into two parts to form the hat's binding. The rounding must produce a very smooth cloth to form the four capades, and no four hairs must be placed together, as this would create a defect in the hat.

We begin by taking two capades, between which we place paper so that only the head and the sides are held together.
This assembly is done in a cloth called a felting cloth, in which we begin to felt; then we expand the felting cloth, which forms the beginning of the hat.
We add the cross-section to give it strength; after that, we baste the cross-section with a brush; we place these last two capades, and wrap everything in the felting cloth so that everything is felted together.
Take the said hat, soak it in a bucket of cold water, since hot water would make it felt too strongly, and put it in the mill. Pour three buckets of water into a cauldron, into which are added half a bucket of pressed wine lees. Boil this water, and mill the hat in this water for about four hours.
At intervals, take care to turn the hat over to drain it and rub it with a brush. When the hat has had enough work, place it on a regular mold, where it is left to dry.

Composition of a second quality of hats.
Two and a half ounces of beaver secretion, half an ounce of otter secretion, two and a half ounces of soft otter, half an ounce of fine vicuña.
Three-quarter beaver hats are composed of three ounces of secreted hare, half an ounce of secreted beaver, and half an ounce of fine vicuña.
For the gilding, one and a half ounces of soft beaver.

A mixture of half-beavers.
Two and a half ounces of secreted hare, one and a half ounces of soft rabbit, one ounce of secreted rabbit, and two ounces of fine vicuña.
For the gilding, one ounce of soft beaver.
To secrete the beaver, hare, and rabbit, I add two pounds of river water and one pound of aqua fortis prepared with the same amount of mercury, as I have marked above.
My new way of making my beaver, three-quarter beaver, half-beaver, and other hats gives the hats much more solidity and finesse, because I place my gilding between my capes while lowering my hat, and by this means the beaver is well incorporated and well penetrated, and neither the pumice nor the robe can damage it; this makes the beaver appear equally on top and underneath; the hats are as beautiful, after being ironed and turned inside out, as when new, and are not prone to taking on water, which is essential for the public.

The difference is that all hat makers only apply their gilding when the hat is brought from work to the mill; by this means the gilding remains only on one side, and cannot penetrate the hat, which means that the gilding is half cut by the pumice and carried away by the robe, and, when the hat is turned inside out, it is much more common and of much less use.

Method for making silk-blend hats; by Mr. Miraglio of Paris.
Process. The seed cocoon, which has not been smothered in the oven, is taken and carded, producing a hair that is cut straight from the carder without any further preparation, to the length of eighteen lines. Two and a half ounces of this hair, thus cut, are mixed with one and a half ounces of secreted rabbit hair, six ounces of unsecreted hare feathers, and six ounces of hare hair; the whole is carded together; the hat is bowed; the hair is gathered into the shape of a hat of the desired size; the hat is tightened to the bow, and it is filled in the usual way.

The finished hat is then dyed, where it turns a beautiful black; finally, it is subjected to the usual preparation, which is done with much greater success.
This process produces a much lighter, more beautiful, very soft, more durable hat, and less prone to water absorption. In fact, it is necessary to mix it with beaver, hare, or any other animal hair, but only half and half.
Cocoon hair works very well with animal hair; it even has the advantage of providing greater strength and luster. Since it is much longer, it does not require the secretion of mercury and etching, a process that is harmful to the workers.

Mr. Robiquet, in his excellent article in the Dictionnaire technologique (Technological Dictionary) on the art of hatting, announced that Mr. Guichardière had succeeded in making an excessively light and fine felt with sea otter hair. This manufacturer has since written to him to tell him that he had made a mistake and that he had only covered the hats with this hair, which is different. Mr. Robiquet believes he is certain he was not mistaken. As proof, he cites the passage from Mr. Guichardière's memoir, included in the Annals of Industry for 1824, in which he announces this fact in these terms: That he had succeeded in felting seal hair, etc. If he wanted to repudiate his discovery, Mr. Trousier did well to seize it and take it further.

Finally, Mr. Lousteau obtained a five-year patent for improvement, for hats composed of any filamentary material, coated with a finish of gum and strong glue, and covered with a fabric imitating beaver, to which is applied a coating composed of linseed oil, white lead, and litharge.

MANUFACTURE OF MEN'S AND WOMEN'S HATS, MADE OF POULTRY FEATHERS;
BY Mr. MASNIAC. (By patent of invention dated August 14, 1824)

Description of the process.
A small ring is taken, through which a few feathers are threaded, which are tightened between two threads using a knot that cannot be loosened. The first is eight or ten threads attached to a small piece of round leather; they are doubled as the work grows. This leather rotates vertically in front of the worker to form the base and brim, and moves horizontally to form the body of the hat; feathers are placed at each knot, which tightens the tubes.

In this way, hats are obtained that are warmer than those commonly used, weighing only four ounces and, in addition to the advantage of being waterproof, also have the advantage of not losing their shape, of not losing their luster, and of lasting much longer than other hats.

First patent for the improvement and addition of the following mechanism, specific to the making of hats with poultry feathers.
This mechanism consists of an iron frame, representing the shape of the hat, which can be made larger or smaller, depending on the size of the hats. On the side where the work is done, there are two cylinders that serve as uprights and are brought together so that only a single feather can pass between them. The worker secures the feather with one hand and with the other, he sews the feathers together with a needle and thread, taking care, with the point of the needle, to push the down outwards. The work turns before the worker between the two cylinders, which give the desired smoothness and shape. All the stitches required in sewing can be used to make a feather hat; brass wire is also used, but it has the disadvantage of making the work heavier. Hats made of poultry feathers can be made in the same way as felt hats, using gummed water to bind the down, which is then ironed over; they are given the smoothness and shine of glass.

Second patent of improvement and addition, dated April 7, 1826.
The feather intended for making hats must be dyed, unless it is used in its natural color. The feathers are taken one after the other, the point is glued down to the down; this glued point is placed on another point, which is pushed into a small groove which is inside a circle, either made of wood, tin or lead, etc. Thus, this preparation of the feather contains the dressing in the body of the work, and turns the down on the same side. To make the brim of the hat, the feathers are glued one on top of the other, without a groove, and the down remains on both sides, which makes hair above and below the edge. The feather thus prepared and glued, forms ribbons of the desired length, which can also be obtained with fine thread. The worker sews these ribbons in braids one on top of the other, putting the down outside for the body of the hat, and for the brim he leaves it on both sides. Feathers can also be prepared in many ways, by gluing them to straw wrapped in down, or to wicker, whalebone, cord, or any other type of solid and lightweight material. Feather ribbons, made with glue or thread, can even be used to create fabrics with a weft of any filamentary material; the fabric obtained in this way can be used to advantage for headdresses or other objects, according to tastes and fashions. Feathers can also be woven from which the down attached to a raindrop has been torn off, and when carefully placed in a weft, they still produce a beautiful fabric. The author adds that the mechanism he described in his first patent for improvement did not produce all the results he had hoped for.

Third patent for improvement, etc., dated October 27, 1826.

The great strength of fowl feather hats means that the processes by which they are obtained can be applied advantageously to footwear and other useful objects. The feather down can be torn and woven with a weft to obtain a fabric which, when applied to waterproof paper, cardboard, or braid, produces lightweight, waterproof hats, free from the ribs and shafts of the feather. The down cut against the rib, mixed with hair of all kinds and secreted, felts and produces attractive hats. Any type of thread, of any material whatsoever, soaked in glue, gum, etc., dipped into down, which attaches and twists around it with a rotating motion, then passed through a tube of suitable size, narrower on the side where the thread is pulled, which is completely enveloped in down, and then woven with a weft of any filamentary material, produces a fabric that can be used for an infinite number of useful purposes. Hats are then made like those made of silk and plush. This fabric is glued onto paper or canvas, and the edges and bottom are sewn.

Using a specially made loom, the down prepared as just described can be woven in the round; in this case, the hat is seamless.

PART THREE.

SILK HATS, OR BETTER SILK PLUSH.

Silk hats are remarkable for their beautiful colors, their shine, their elegance, and their beauty. The black ones, in particular, offer a shine that seems far superior to that of felt hats. Like the latter, they can easily be given any desired shape; but over felts, they have the precious advantage of being lighter, just as long-lasting, more pleasing in appearance [48], and much lower in price. Silk hats were in use for a long time in Spain before they became known in France. It was only since the beginning of the nineteenth century that we gradually began to adopt their use; strictly speaking, one could even say that this use only became widespread after the 1823 exhibition. Spanish silk hats would seem to still attest to the infancy of this art; But thanks to the successful attempts of a few French manufacturers, this type of manufacturing has reached such a level of perfection and such great importance that in summer, the rentier and the fashionable have generally adopted the finest qualities, and the lesser ones are now sold to all classes of society.

Note 48: Men's silk hats surpass all felt hats in beauty, with the exception of the first qualities, which cost 30 to 35 francs finished, while the finest silk hats do not cost more than 12 to 18 francs, whether in black, gray, or various other fancy colors.

Among the French manufacturers who have contributed significantly to the perfection of this type of industry, we like to mention one of the most skilled hatters in Paris, Mr. Fontés, of Rue de la Harpe, whose waterproof silk hats rival those of all other manufacturers in the capital in their beauty, elegance, and price, as can be judged by those he exhibited in 1827; one of his hats, among others, was immersed in a tub full of water before the spectators without being soaked. Mr. Fontés never took out a patent for his invention; this modesty on his part is the reason why many people have adopted some of his methods, for we must add that Mr. Fontés is very communicative.

Silk plush hats require two operations. First, the frame of the hat is made either from cardboard or from very strong hemp or cotton canvas, followed by various layers of varnish. However, they are almost always made from cardboard first, onto which a canvas is glued (with a waterproof glue) and then covered with several layers of equally waterproof varnish. When the hat frame is thus prepared, the plush cover is then glued to it, after having been properly arranged and sewn. Once the hat is thus prepared, the brim is edged, the cap is fitted, and it is ironed like felt hats.

It goes without saying that each hatter has his own particular waterproof varnish and method of preparing the frame, which he believes to be far superior to that of his colleagues; but we, who are not motivated by any motive of self-interest, must assert, in the interest of art, that all these waterproof varnishes or coatings owe this property to wax, resinous solutions in alcohol or turpentine, incorporated into starch glue, gum arabic, gelatin, etc. Without going into greater detail, we believe we cannot better explain the processes followed by the best manufacturers than by describing here the patents obtained on this subject.

New Processes for the Manufacture of Silk Hats; by Mr. John Wilcox. (By patent.)
The body or felt of my hats is composed of two fabrics of sufficient strength, one of cotton canvas and the other of coarse velvet, known as panne or plush.

I cut strips of cotton canvas, about six inches wide, depending on how much height I want to give my hat, and of a relative length. I join the two ends of these strips with a tight, precise seam, and I fit a piece of the same canvas, of a diameter equal to that of my hat forms, into the upper part.

I make plush forms in the same way, taking care to form the seams on the fabric side, placed on the inside.

With my forms thus arranged, I coat the cotton one on the outside and the plush one on the inside, that is, on the fabric side, with a glue composed of half ordinary glue and half Flanders glue. I then take a cotton canvas form and a plush form; I cover the first with the second, arranging them so that the bottoms of the two forms correspond perfectly. I then insert into these two joined forms a wooden mandrel composed of four pieces and a wedge, such as those used by hatters under the name of broken forms. I push the wedge in as far as necessary to ensure that no creases remain, and that the surfaces of the two forms adhere perfectly.

At this point, I let them dry for three or four days, or even longer, depending on the season and the temperature.

The brims of the hat are made from the same fabrics and in much the same way, with the only difference being that the cotton canvas is covered on both sides with panne, which is firmly fixed there by sizing and using a press. They are only attached to the form when everything is dry, and by a neatly sewn seam.

To make very light hats, I use, instead of cotton canvas, a fabric made from thin filaments of willow wood.
It can be seen that, according to my methods, the silks that line the hat can only be firmly attached and evenly distributed over its entire surface, since they are part of the very fabric that makes up the body of the hat.

Process for manufacturing men's and women's hats from waterproof silk felt. (Five-year patent of invention and improvement granted on December 31, 1821, to Messrs. MIERQUE (Jacques François), owner, and DRULHON, merchant, both in Anduze, Gard department.)

The felt that makes up these hats is made of good lamb's wool, which is fulled; it is shaped as usual. The hat thus prepared is wrapped in paper soaked in a gum-resinous preparation, the recipe for which will be described below; Immediately afterward, a second, perfectly tight covering of twill velvet, made of long-pile silk organza, is applied, which is firmly glued with the gum just mentioned. This velvet is attached to the base of the brim or edge of the hat, and the rest of the felt is covered in the same way. The hat is then ironed with a half-hot iron, taking care each time it is placed on the hat to dip it in cold water, lest one risk burning the hair, which immediately curls and then falls out, along with its luster. Too much attention should not be paid to this operation, for it is this that, when properly done, preserves the hat's blackness and shine.

Recipe for the composition of waterproof glue, for fifteen hats:

Four grosgrains of gum arabic;
Half a grosgrain of virgin wax;
Two grosgrains of almond oil;
Fourteen ounces of rosin.

Pulverize the gum, heat it gently in the oil, and stir continuously with a spatula until it becomes a soft paste. Then add the wax, cut in half, while continuing to apply gentle heat. The mixture is complete when everything is melted and well blended.
When you want to use this glue, melt the rosin separately, to which, after melting, add the above mixture; this way, you obtain a varnish that you spread while still hot on the thin paper and then apply to the felt.

This composition forms a body so hard that no fluid can pass through, ensuring that the hat always retains its original shape.

Men's and women's hats made of plush, silk, or cotton, mounted on frames made of cardboard, leather, and waterproof or non-waterproof canvas, and for those mounted only on waterproof or non-waterproof canvas and paper; by Messrs. ACHARD and AUDET of Lyon. (Importation and Improvement Patent.)
After soaking the cardboard for some time in water heavily impregnated with alum, it is removed and allowed to dry. The frames are then formed around it. The top of the same cardboard is placed on top of this frame, which is covered with a piece of cardboard for added strength. The edge of the top of the hat is extended by about six lines; after which the brim is fitted as follows.

A strip of skin is used to form a circle divided into two parts, one of which is intended to join the edge to the shape of the hat, and the other to receive the cardboard which must give the necessary consistency to the edge or wing of the hat. This cardboard, thus adapted to this part of the skin, is then covered above and below with a cotton cloth which overflows onto the part of the circle of skin intended to join the edge of the hat. The edge, having reached this state, is fixed to the shape of the hat by the first part of the circle of skin. Once this operation is completed, the frame is coated with a varnish made with:

Alcohol.	*2 liters.*
Shellac.	*1/2 kilogram.*
Fish glue.	*2 hectograms.*
Elemi gum.	*15 grams.*
Briançon chalk.	*20 grams.*
The juice of six garlic cloves.	
Molasses syrup.	*20 grams.*

Melt the shellac in the alcohol over the heat of the sand bath; add the elemi gum, then the garlic juice, stir, and add the molasses syrup. Melt the glue over a gentle heat in half a liter of spirits, dissolve the Briançon chalk into an impalpable powder, and mix the two mixtures well.
This varnish not only makes the cardboard waterproof, but also gives it flexibility, which can be increased at will, depending on the degree of density given to the varnish.

The frames coated with this varnish are then covered with black or variously colored silk plush; when the seams are completed, the plush is fixed as will be seen.

The part of the plush that is to be adhered to the frame is covered with a cloth soaked in spirits of wine, and a hot iron is passed over the cloth. The vapor from the spirits of wine, penetrating the plush, softens the varnish, which is incorporated into the fabric of the plush and makes it adhere to the frame; this prevents moisture from penetrating the fabric of the plush, and consequently softens the frame, which is truly waterproof. Hats mounted on canvas or paper are lighter than the previous ones, while remaining equally waterproof.

Manufacture of hats from cotton fabric and all kinds of filamentary fabrics. (Five-year patent granted on June 7, 1816, to Mr. GURY, in Paris.)
The interior lining forming the hat box is made of smoothed and varnished cardboard.
The top of the last, also made of cardboard, is supported by a thin wooden hoop.
The cover is made of fabric of any color.
The rim is made of wire, and lends itself very well to any curved or uncurved shape.

These hats do not require oiling; they withstand all the ravages of the seasons without deterioration, because they do not require, like felt hats, a preparation that has the disadvantage of deteriorating in humidity and breaking in dryness. They are also much lighter and cost less than felt hats.

Certificate of additions issued to Mr. LOUSTAU, assignee of Mr. GURY.
These additions are intended to eliminate the differences that existed between Mr. Gury's cloth hats and his felt hats.
The cloth covering the base of Mr. Gury's hats was not fixed, and the brims offered neither roundness nor firmness.
The cloth is now fixed to the outside of the base of the hat using carefully prepared glue and imperceptible stitches, so as to provide all the necessary strength.

The perfect firmness and roundness of the turned-up brims are achieved by using beaten leather, which, although very thin and very light, is nevertheless of equal strength to felt. This leather is covered on both sides by the cloth, which is applied with glue; three rows of stitches strengthen it so that it cannot be damaged by either humidity or dryness.

Improvement in the manufacture of silk hats, patent to W. Mathew and W. White. (London Journal of Arts, January 1826, page 388.)
The patentees point out that two objections have been raised to the use of silk hats: the roughness of the body to which the silk is attached frequently injures the head, and since the edges of the hat are more exposed to shocks, the silk is prone to peeling off and exposing the cotton fabric underneath, which, being a vegetable material, is not as well suited to dyeing as silk, and then the hat wears out quickly.

To remedy these defects, the body of the hat must be made of silk as usual, and to correct the hardness of the inner brim, it is covered with castor, which makes it soft and prone to bending. The hat is then dyed a beautiful black color inside and out, and after having sufficiently gummed it, it is covered with silk. Instead of using cotton to fix it, which does not take color well, the covering is made of silk alone, so that the hat retains its color in all its parts.

Process for manufacturing tanned sheepskin hats. (Five-year patent granted on June 14, 1816, to Mr. Ch. Pebrec, in Brest.)

Process.
Soak a tanned sheepskin of the required strength in warm water; pound this hide in a mortar for eight to ten minutes; place it on a sheet metal mold provided for this purpose; brush over it a layer of linseed oil, made into a siccative, in which copal has been dissolved, at a rate of one ounce per pint; let this quantity of dressing drink at moderate heat in an oven. Repeat this process three times, and after each, dry-sand your hat, which you then paint with two coats of a black color, composed of the above linseed oil dressing and ivory black. Once these arrangements are made, sand the hat all around with crushed, sieved, and wet pumice, and apply two coats of varnish, taking care to sand the first coat.

SHAKOS.
The shako is a headdress specific to the troops and takes various cylindrical shapes, sometimes tapering slightly at the top, and sometimes, on the contrary, widening considerably. Shakos are made like wool felt hats; they can also be made with silk plush, cotton, horsehair, or leather, and generally in the same way as the various hats we have listed. Strictly speaking, shakos are hats of a particular shape, without a brim, with a leather crown, and often fitted with a patent leather visor. As this method of manufacture differs in no way from that of hats, we will pass over it in silence; But faithful to our system of publicizing the progress of the manufacturing techniques we are concerned with, we will present the patents that have been obtained on this subject.

Two-felt shakos. (Five-year patent granted on May 8, 1820, to Mr. DELPONT, in Paris.)
These shakos are composed of two felts: one, the inner one, is undyed and coated with a finish, the composition of which we will see; the other, the outer one, is glue-free and without any finish; it is strong enough to be unraveled, and it cannot turn red or become scabby; finally, rain and humidity cannot damage it; it dries like a sheet.
These two felts are made of pure French wool.

Finish for the inner felt.

Cherry gum,	*4 parts.*
Paris Strong Glue	*8*
Resin	*4*

Manufacture of polished leather shakos, intended particularly for light infantry; by Mr. Bercy junior. (By patent.)
These shakos are made from cowhides weighing fifteen to eighteen pounds.
The first step is to thoroughly scrape both surfaces of the hide to make it spongy and ready to receive the finishing touches.

Once the shako is sewn, it is immersed in water heated to the point where it can be held in one's hand. There, it softens and becomes capable of taking any shape desired. It is then placed on a copper mold with eight keys, the insulated base of which is also made of copper. The whole thing is then placed under a balance press, where the shako is shaped by applying strong pressure.

It is removed from the press and mold to be placed on another wooden mold, with only five keys, but of the same caliber. This mold is topped with a wooden pad, which is intended to form the concave bottom of the shako, whose depth is 15 lines by 8 inches, 3 lines in diameter.

The mold and pad are pressed and held together by four iron clamps which, extending outwardly along the shako, are fixed with the same number of screws to the edge of the iron plate of the same caliber as the shako on which the mold rests. In this state, it is allowed to dry, without warping in any of its parts.

The shako is thus prepared to receive the following two dressings:

The first dressing consists of one pound of good glue dissolved in four pints of water, which is reduced by boiling to two and a half pints. Care is taken to remove the scum as it forms. Allow this glue to cool until it is only lukewarm, and pour a sufficient amount into the shako to coat it. Allow it to dry halfway; replace the copper shako with the well-soaked wooden mold and its flanges; allow it to dry again in this state.

For the second dressing, melt together, in a bain-marie, three pounds of raw yellow wax with one and a half pounds of dry pitch. Remove the boiler from the heat and add one pound of powdered ivory black, passed through a silk sieve; stir this mixture until it is reduced, since the ivory black makes it rise first.

With the shako still on the wooden mold and completely dry, and the iron flanges removed, you coat the exterior of the shako with a coat of this composition using a brush. After this, you screw an iron handle into a hole provided for this purpose on the middle key. With this handle, you hold this shako over a gentle fire to allow the composition to penetrate the pores of the leather. As soon as the coating begins to disappear, remove it from the fire and brush it vigorously to evenly spread any remaining material on the surface.

While it is still hot, you place it under the press again, where, as it cools, it resumes its original shape. After this, you place it on the nose of a lathe with its wooden form, and with a suitably cut piece of wood, you give it the desired polish.

Fig. 27. Boiler mounted on its furnace, in which the leather is softened to make it suitable for working.
Fig. 28. Copper form with eight keys.
Fig. 29. Copper thimbles to form the base of the shako.
Fig. Fig. 30. Screw and balance press. It is assumed that the copper mold fitted with a shaker is under pressure.
Fig. 31. Wooden mold with five keys.
Fig. 32. Wooden buffer forming the bottom of the shaker.
Fig. 33. Four iron clamps, used to hold the buffer and the mold together.
Fig. 34. Iron plate placed under the mold and against which the four screws above are fixed with clamps.
Fig. 35. Boiler with its furnace, in which the first preparations are being made: only the pipe is visible, because this apparatus is similar to the following one.
Fig. 36. Boiler on its furnace, for the second preparation.
Fig. 37. Shaker on the wooden mold presented to the fire.
Fig. 38. Iron handle screwed onto the mold.
Fig. 39. Chimney, called Prussian style, made of sheet iron.
Fig. 40. Stiff brush for spreading the finish.
Fig. 41. Lathe in the air for polishing the shakos.
Fig. 42. Piece of wood to be polished.
Fig. 43. Completed shako fitted with its visor.

Fig. 44. Two concentric rings used to grip the upper rim of the shako for polishing.
Fig. 45. Iron frame, hinged on a board, used to adjust and join together the various brass pieces that make up the chinstraps.
Fig. 46. Fully fitted shako placed on the head of a voltigeur.

Process for re-dying cotton shakos whose color has faded.

This process involves boiling a quarter of a piece of Indian or logwood in three liters of water, which is enough to dye twenty shakos.
This liquor is spread with a well-furnished soft brush, in the direction of the hair, taking care not to damage the braid, and so that the hair is soaked. When the shako is dry, it is brushed with another soft, dry brush, to decatize and smooth the hair. (Ann. mar. et col., January and February 1824, page 47.)

PART FOUR.

STRAW AND WOODEN HATS.

Straw hats.
Italy has long been able to supply Europe with these beautiful straw hats, so sought after by ladies, whose price still rises to 1,200 francs for the finest quality hats made near Florence. Since the industry has taken off in France, this type of manufacturing has become increasingly important, in order to free ourselves from the tribute that luxury goods pay to Italy. Already in 1819, straw hats made by our factories, whose beauty was remarkable, were exhibited at the exhibition of French industrial products. Among these manufacturers, we note:

1st Mr. Clairvaux, in Troyes (Aube), for very pretty samples of straw hat fabrics, imitating Italian hats quite well.
2nd Mr. Thibault, from the same place, for his yellow and white straw hats, of all qualities, very well made.
3rd Mr. N., in Saint-Loup (Haute-Saône), for straw hats, the manufacture of which employed about 350 children.
4th Mr. N., in Ban-de-la-Roche (Vosges), for pretty samples of straw hats made by young girls.

The 1823 exhibition produced even more satisfactory results; finally, the 1827 exhibition largely fulfilled the hopes that the 1823 exhibition had raised. Indeed, the departments of Ain and Isère seem to have vied with each other in their efforts to import this type of industry, which, generally unsatisfactory, tended to suggest was unlikely to prosper in France.

MM. Héricart de Thury and Migneron, in their report on the products of French industry in 1827, presented on behalf of the central jury to the Minister of Commerce and Manufactures, and Mr. Ad. Blanqui in his history of the products of the 1827 exhibition, highlighted the hat makers who achieved the most successful results. Here they are:

Mr. Dupré, in Lagnieux (Ain), who was honorably mentioned in 1823, won a silver medal. He exhibited a series of Italian-style straw hats of very diverse qualities: the most common are 2 francs each and the finest 200 francs. Each type has a degree of finesse and softness corresponding to its price, and all are remarkable for their careful workmanship. In 1827, this manufacturer employed fifteen hundred workers, compared to the five hundred he employed in 1823. His production, which was only eight to ten thousand hats, has increased from fifty to sixty thousand. This gives an idea of the development and progress of his industry.

Mr. Dupré also exhibited samples of the straw he uses to obtain the quantity necessary for the maximum production indicated above; it was necessary to sow thirteen hundred and sixty bushels of wheat, which amounts to two and one-tenth bushels for every hundred hats.

Messrs. Pecherand, Dubois and Co., in Moirans (Isère), were awarded a bronze medal. It was in Moirans, near Grenoble, that they naturalized the manufacture of Italian straw hats. Those they exhibited at the Louvre received no finishing; they come from the hands of the worker, and can stand comparison with the most beautiful that Italy sends us.

Far from it, all straws are not suitable for making hats; those which are the finest, the most supple, the longest, that is to say, the knots most spaced apart from each other, and which are neither stained nor rusty, are the most suitable for this manufacture; those of rye, at least the finest of this cereal, are used for the manufacture of certain qualities of hats. For the beautiful hats of Italy, a quality of wheat is used which is a variety of spelt, triticum spelta, called March wheat, marzola or marzolo, the fruiting of which is made to abort. MM. Guy and Harrison obtained a patent in London for a related process, which consists of pulling up the wheat by the root, as soon as the ears are formed, gathering it into sheaves of about one hundred and fifty strands, and drying these with great care, in the sun, avoiding dew and rain by shelters. The straw thus acquires a beautiful yellow color and is very suitable for the manufacture of braided hats. Hats are also made with the prepared straw of tares, rice and rye. Independently of what we have just explained, there is still other care to be given to the straw: the wheat which is to produce them must be sown in soils which are not exposed to fogs or spring rains, because the straws of these localities are dotted with indelible stains. This cereal can be cultivated in mountainous terrain; one must therefore visit the field and choose only the finest straws. After separating the leaves, in several factories, the straws are cut above and below each node; these nodes are discarded along with the ends of the straws. These stems are then sorted according to their length in compartmented boxes; the finest are 15 to 20 centimeters long; the most highly valued are those that are thin, unblemished, and about the size of an ordinary writing quill. There are some stems that are only 5 to 6 centimeters long: they are used. Before this operation, the straws are usually bleached in the following manner.

Bleaching the straw.

If all straws offered the same shade of color, this operation would become unnecessary; but since this is not the case, it is necessary to resort to it, especially when one wishes to dye them and give them delicate colors. To give them a beautiful white, they are immersed in liquid chloride of lime. But since this white is not sought for the manufacture of hats, we resort to sulphurization, which is practiced in the following manner: We take a barrel about 4 to 5 feet high and hollowed out at both ends, on the internal walls of which we stick paper, in order to carefully block all the exits which could give passage to the sulphurous acid gas; we stand it on one of its ends, and 15 or 16 centimeters from the upper part we fix four cleats intended to support a circle on which is stretched a wire net whose meshes have a dimension of 3 centimeters, and on which we arrange the straws in small handfuls by crossing the layers; we close this barrel hermetically by means of a lid surrounded by selvedges; finally we cover with a wool blanket. Everything being thus arranged, we introduce into the barrel a stove filled with lit coals on which we place a sheet metal vase containing powdered sulphur, spread in this vase in a very thin layer to prevent it from agglomerating; because in this case the sulfur burns with too much flame and blackens the straw. The sulfurous acid gas, which is the product of the combustion of the sulfur under the barrel and fills the entire capacity, acts on the coloring part of the straw, which is largely destroyed in about ten to twelve hours. The bleached straw is then arranged between wet cloths to make it more supple, and is removed after three or four hours. It is usually after the straw is bleached that the knots are cut and the strands are divided lengthwise. We will return to this later.

Dyeing the straw.

Preliminary preparation.

Experience has shown that one cannot give certain colors to straw unless it has first been opened. To achieve this, it must not be in a state of perfect dryness, because then it breaks; it must therefore be left overnight in a low and slightly damp place; it is then easy to incise, flatten and straighten it.

For this, a kind of wooden spindle A, fig. 47, was formerly used; the straw tube was held in the left hand, the spindle was inserted into one of the ends, and by tilting and pushing it in the direction of the slit, the latter was extended to the other end: after this, the straw was spread over the spindle, rubbing it with the polisher, fig. 48. To finish flattening it, it was also rubbed on its polish with a thick, very smooth board of walnut or apple wood. The polisher is seen in profile at B and from the front at C. This operation, which was all the longer as it had to be repeated for each pipe, was shortened and perfected by Mr. L. Here is the process that he invented and described in the Technological Dictionary; we will borrow this description from him.

Fig. 49 represents the rolling mill for splitting, opening and smoothing straw. On a rectangular board of apple wood A, 20 by 15 centimeters, two strong twin beams B B are assembled with mortises and tenons, covered by an upper crosspiece C, fitted with a fork on the end of the twin beams; it is between the twin beams that the two cylinders D, E are placed, which can be clearly seen in Fig. 50 which shows the rolling mill from behind. Fig. 51 shows one of the twin beams in profile, so that the projection a can be seen, on which rests the crosspiece b, on which is fixed, by two screws, the important part which serves to open the straw and to direct it between the cylinders of the rolling mill. This crosspiece is placed by its two ends on the projections of the two twin beams, and is fixed there by two wooden screws, as can be seen in B, Fig. 49. In the twin beams, Fig. In Fig. 51, a longitudinal notch c receives the two roller journals, the lower one of which rests on a rounded notch and is surmounted by a bearing d, which is pressed by screw f so that the upper roller compresses the straw sufficiently to spread it. These two screws are seen in Fig. 49.

Crosspiece b carries a piece g in its middle, which is attached to it by two wood screws and which carries the projecting woodcock beak h, which can be seen on both sides, Figs. 52 and 53. Fig. 52 shows it from above, as shown in Fig. 49; Fig. 53 shows it from below, so that its construction can be understood. The projecting beak h is sharp on top, rounded underneath, and constantly widens, in order to direct the straw as it flattens, in order to engage it, fully extended, between the cylinders. Here is the procedure. Take the moist straw in your left hand, insert the woodcock beak into the tube, and push; the straw splits, and continue pushing until, by turning the crank G, you feel it being caught between the cylinders: you then release the straw; continue turning the crank until it is completely through; it then falls completely open and flat behind the rolling mill. Ten thousand straws are thus prepared in a day, whereas with the old method, only one hundred were prepared. These straws are thus arranged for dyeing.

Dyeing the straw blue.

First-quality powdered Guatemalan indigo.	*30 grams. (1 ounce).*
66% sulfuric acid (oil of vitriol).	*60 grams (2 ounces).*
First-quality potash.	*15 grams (1/2 ounce).*

Place the indigo and sulfuric acid in a small flask or medicine bottle and heat it in a sand bath. As soon as it is noticed that there is no longer any effervescence, add the potash and let it digest for a day and a night. Once the indigo solution is thus prepared, boil enough water in a basin for the straws to bathe in; then gradually add indigo sulfate with a very long-handled wooden spoon until the desired color is obtained. Then remove the basin from the heat, immerse the unopened straws in the liquor, and when they have acquired the desired color, wash them in fresh, pure water and dry them away from dust.

For sky blue or azure, much less indigo sulfate is used, and the straws must be open.

Yellow color.
Turmeric powder (terra merita) is boiled in greater or lesser quantities, depending on the desired shade of yellow; it is strained through a cloth, the liquor is returned to the heat, the unopened straws are immersed in it, and boiled until they have acquired the desired color; then they are removed, washed, and dried. The turmeric tincture is not exhausted after this operation; it is used to obtain weaker yellow colors.

Black color.
To dye straw black, they are first engalled, that is, immersed in a decoction of gall nuts; from there they are immersed in a bath of iron pyrolignite, and finally in a decoction or bath of logwood. They are washed and dried.

We will not mention the colors red, pink, green, brown, etc., since hats of these colors have not yet been used.

It is worth noting that the straws, although immersed in the same bath, do not all have the same shade of color; they must therefore be sorted and matched. After this, whether they are natural, sulfur-treated, bleached, or dyed, they must be trimmed, smoothed, and pressed into paper placed between two boards, so that the strands are reduced to ribbons of varying fineness.

We have already mentioned that after cutting the knots of the straw, the stems are cut lengthwise into two or four ribbons, depending on the degree of finesse of the hat. This is done with a small scalpel or penknife with a curved tip. All these strands are then gathered and placed in layers between wet cloths for about three hours, to make them more supple and suitable for braiding: without this operation, they would break at any moment.

Straw braiding.
The straws intended for hat making must be braided, and the thickness of these braids is relative to the thickness of the straw strands, depending on the quality of the hats, which are divided into two classes:
1. Fine hats are those made with braids or plaitings of which fourteen or more, sewn together, are only one decimeter (47 lines) in length.
2. Coarse or common hats are those whose plaitings, within a width of one decimeter, are composed of fewer than fourteen braids; of this number are those made of rice straw, chaff, or whole wheat.

As for those made of esparto or bark, this same width is composed of less than ten braids; otherwise, the method of manufacture is the same.

It is worth noting that for very fine straw hats, dividing the stem into two or four strands using a penknife is insufficient, and that, since this division must be much greater, it cannot be achieved using a penknife; therefore, a more suitable method is used. It consists of setting muslin embroidery needles at equal distances from each other and on the same line; to do this, the heads are implanted in resin. These needles, thus arranged, form a kind of comb on which the end of the straw strand, damp and previously split lengthwise, is placed. It is obvious that by then pulling this strip of straw to the other end, it is divided into as many small ribbons as there are pins. These strands of straw are matched according to their length and width, and used according to the varying degrees of beauty of the hats.

Women then make the braids with the straw, thus prepared and damp. Notwithstanding this, their fingers must always be slightly wet to maintain the straw's flexibility and prevent it from drying out. It is obvious that intelligent workers are required to properly rewound the straw strands and, above all, to braid them evenly and tightly so that the braids are smooth and not bumpy at the sides. Once a sufficient quantity of these braids has been produced and given the width and length appropriate for the quality of the hats for which they are intended, they are moved to another workshop. There, other women sew them in an almost imperceptible manner by rolling them flat in a spiral, either edge to edge in the same plane or overlapping. But for the beauty of the work, it is essential that this stitching not be visible. It is in this state, or even in the braided state, that straw hats are delivered to the merchants who shape them, or better, give them the fashionable shape [49] and the appropriate finishing.

Note 49: In this work, we have only intended to describe the primary manufacture of hats; for their secondary preparation, we refer to the Manuals for Young Ladies, Ladies, etc.

Preparing Straw Hats.
No matter how skilled the workers, no matter how beautiful and uniform the straw strands, no matter how carefully and skillfully the braids are made, for this straw fabric to be well-knit, consistent, and shiny, it must be prepared by pressing or ironing. Here's how these two methods are performed.

1. Preparing by pressure. The hats are first thoroughly moistened with rice water, starch, or gum arabic. Once dry, they are stacked on top of each other, placing well-heated wooden boards between each. In this state, they are subjected to strong pressure for twenty-four hours, first on the edges, then on the edges and tops of the crowns.

2. Preparing by ironing. This method has largely caused the previous one to be abandoned, since Mr. Mégnié has imagined and built two machines which significantly facilitate this ironing. These are, says Mr. E. M. [50], a kind of air tower, one of which is intended for ironing the edges, and the other for the outline and top of the caps. In these two towers, the hat, soaked in the same dressing as for the press process, is placed in a wooden form which fills it exactly, and which, turning slowly on itself, with the help of an angle gear which the hat maker himself sets in motion, drives it in its rotational movement, and makes it successively present all the points of its external surface to the action of the hot and immobile iron, strongly pressed on top by a lever suitably arranged for this purpose. This process, which leaves nothing to be desired for the perfection of the work, has shortened it so much that a worker irons 120 hats in a day, instead of the 24 he had difficulty ironing by moving the iron by hand on the stationary hat. We should add to this that the polish and shine obtained by hats smoothed in this way are far superior to those obtained by pressure. We have shown, in Fig. 54, the press used, and in Figs. 55, 56, and 57, other instruments for splitting straws.

Note 50: Technological Dict.

We will now present some processes used by several French and foreign manufacturers; they contain certain concepts that, to avoid repetition, we felt it necessary to omit. In England, this type of manufacturing is also successfully carried out, at least judging by the following article in *Galignani's Messenger* [51].

Note 51: In England, the straw of two-row barley, called pommelle, hordeum distycum, is mainly used for this production.

The Royal Society of Dublin recently awarded four prizes for this branch of industry, each one for 20, 15, 10, and 5 pounds. A report read on this occasion contains the following provisions: The extraordinary progress that has taken place in the last three years in this type of industry, and the degree of perfection to which it has now reached, give reason to believe that this manufacture, if carried on with all the necessary perseverance and activity, will soon put Ireland fully in a position to rival Italy for this product. Merchants in Dublin, who carry on this kind of trade, being asked to give their opinion on the quality of the six straw hats which obtained the first prize, declared that if the very hats of Leghorn of the first quality, such as are imported into these countries, were mixed with these, there is no one, familiar with this item, who could make a distinction between the one and the other. These merchants declared, moreover, with regard to another hat which had obtained only the third prize, that such a hat would not yield in London, according to the current rate, not less than five guineas. The committee further observed that the cynosurus cristatus is not the best raw material suitable for this kind of manufacture, since this substance is by its nature too hard and too fibrous, and in general of an uneven color. In the opinion of the committee, rye straw (secale cereale) is much preferable; and he added that one of the hats which won first prize, a hat made of the fragrant spring grass (anthoxanthum odoratum) appeared to be of a superior quality to all the others in the same competition. (*Dublin, correspondent*.)

Italian-style straw hat making; by Mr. WEBER. (Verhandl. des Vereins zur Befoerderung des Gewerbfl. in Prussia; Jan. and Feb. 1826, p. 45[52].)

Note 52: The Berlin Promotion Society has offered a prize for this production.

The finest and most durable straw hats are made in Italy. There are two types:
1. Florentine hats, which combine the highest degree of strength with perfection of workmanship, but are also the most expensive;
2. Venetian hats, which are not quite as fine and durable as the former, but are proportionally less expensive.

The most renowned straw mats and hats are made in Italy, in the Seven Communes (*Sette Communi*). This craft is the principal industry and primary resource of this small region, which covers an area of approximately four square German leagues and has a population of ten thousand.

The annual revenue from this production, including the price of straw, amounts to three million Venetian pounds. This industry is most important in the communes of Lusiana and Giacomo; it is also there that the type of wheat suitable for this type of work grows. The straw is carefully harvested and sorted, and the straw, cut to equal lengths, is gathered and sold in bundles to the mat makers at a price of 8 francs per pound of twelve ounces. These latter sell their mats to the hat makers.

Prizes were awarded for this product by the London Incentive Society to Mr. Wells of Weatherfield and Mr. Cobbet, who successfully carried out this production.

The grass used by Mrs. Wells is poa pratensis, which grows throughout Germany in pastures and low meadows. As for Mr. Cobbet, he has experimented not only with this same poa pratensis, but also with several other grasses native to England, such as: melica caerulea, creeping bentgrass, solium perenne, avena flavescens, cynosurus cristatus, anthoxanthum odoratum, and bentgrass. All these plants have provided him with suitable mats.

Their methods for preparing the straw vary. Mrs. Wells harvests the plant from the time of flowering until the seed approaches maturity: she uses only the part between the upper node and the top; she pours boiling water over it, and then dries it in the sun; she repeats this operation once or twice, or until the leaves, which surround the stem in the form of a sheath, detach themselves. Then she bleaches it in the following manner: she begins by preparing soap water, to which she adds potash until it dominates; she moistens the plant with this solution, and places it upright in a box; she burns sulfur in it, and covers the box with cloths to contain the sulfurous vapor; she continues to burn sulfur in this way until the plant, moistened with soap water, is dry: this requires about two hours. During this operation the sulfur is renewed once or twice. The plant is then ready to be braided. This preparation is, as you can see, very simple; it does not require any special instruments, and any peasant woman can do it herself without difficulty.

Mr. Cobbet performs the bleaching process differently. He places the stems of the plant, gathered into bundles, in a small tub and submerges them in boiling water. He leaves them there for ten minutes, then removes them and spreads them on short grass. After seven days, the bleaching process is complete. The month of June is the best for harvesting and preparing the plant.

Helped by the work of foreigners, I have taken charge of this process, says Mr. Weber, and I have conducted comparative tests, the results of which are as follows:

1. Poa pratensis is very suitable for making straw hats. Its straws are at least as fine as those of Italy; but these appear to be more solid.
2. Wild grasses from Prussia can be used for the same purpose.
3. The color of the straw depends on the bleaching method; this operation should especially be carried out in fine weather and with bright sunshine. Therefore, Mr. Cobbet's method is much preferable to that of Mrs. Wells.
4. Straw thus prepared lends itself very well to braiding and sewing.

At Mr. Weber's request, the Society for the Encouragement of Gardening has undertaken to propagate native grasses suitable for making straw hats, and to bring from Italy enough seeds of the plant used there to attempt to propagate it in Prussia. This plant, according to the opinion of the most knowledgeable members of this Society, is the tricticum aestivum, which, sown in poor, unfertilized soil, produces a thin thatch. It is likely that, during the course of next summer, manufacturers who wish to make straw hats in the Italian style will have at their disposal both Italian straw and straw from native grasses, and will be able to use these two raw materials in the making of hats.

Hats made with native straw, imitating those made from Italian straw, by Mr. de BERNARDIÈRE, in Paris. (Five-year patent.)

The straws used to make these native hats are sourced from the Cotentin Peninsula and the surrounding area of Paris; the finest are found more commonly in meadows than anywhere else. Other straws, of lesser quality, are found in lightly sown rye fields rather than anywhere else.

Both of these straws require preparation to become the color of Italian straw. This preparation consists of placing the unripe straws as quickly as possible after harvesting them in cold water, which is gradually brought to a boil. After this, they are removed and exposed to the heat of the sun to dry, taking care to water them until the straw becomes a suitable yellow and very firm, otherwise it breaks and is of no use for braiding, much less for sewing.

The braid is made with thirteen strands of straw; to sew it, the braids are arranged one inside the other with a thread passed through the inside of the mesh, in such a way that, to make a complete hat, it must pass through all the meshes from one end to the other.

Straw hats from the Black Forest.
In the past, only very coarse straw braids were made in the Black Forest; the hats made from them were worn only by country people, and almost all were sold in France. The French government, wanting to encourage this branch of industry in the Vosges, doubled the import duties on straw hats, setting them at 8 francs per dozen. [53] This tax increase put an end to this lucrative trade with France. Mr. Huber, bailiff of Triberg, having learned of the processes used by the Italians for the manufacture of fine straw hats, urged his fellow citizens to give more finesse to their fabrics, which were still very coarse. In 1804, he had instruments made by means of which the finest straw could be divided into ten parts; he had the straw cut before it was perfectly ripe, had it bleached and distributed among the most skilled workers. So much so that in 1813, straw hats had already been given such a degree of finesse and perfection, and such a beautiful finish, that they are generally sought after not only in the country, but also in France, Holland, Belgium, and even Russia, where large shipments are made. In the bailiwick of Triberg alone, fifteen hundred people are involved in this branch of industry and annually manufacture one hundred and twenty thousand straw fabrics.

Note 53: Bulletin of the Encouragement Society, 1819.

Double straw hats, fabrics inside out on wicker, whalebone, reed, and other similar flexible materials, by Mr. BLOUET, straw hat maker at the central headquarters of Mont Saint-Michel, Manche department. (Patent of invention.)

Manufacturing processes.
Before splitting the straw, it is flattened on a wooden ruler, scraping it on both sides with a knife. This operation removes some of the spongy tissue that lines the inside of the tube, making it much more flexible and less brittle. It is then split with a new tool called a spinneret, consisting simply of several needles attached to a handle and spaced apart according to the width that the straw blades are to be made. By pressing these needles thus arranged on one of the ends of the flattened straw, and by pulling this end towards itself, the point of each needle splits this straw and reduces it into as many equal pieces as there are intervals.

New hats are made with straw thus prepared; it is wrapped around extremely thin wicker rods, to which a few thin strips of whalebone are added to increase its strength.

The straw, stripped of its spongy supports by the scraping process just mentioned, is then very thinned and doubled for processing. This is the way to obtain a very tight yet very even fabric, since the work then does not present the small roughness and imperfections that are inevitable when using only a single straw to form the stitch of the fabric. The two straws make it easy to imperceptibly adjust those that break. Hats thus prepared are dyed using ordinary processes.

Men's and women's hats made of straw, wicker, and whalebone mats, seamless, by Mr. Michon, the elder son. (Five-year patent.)
These hats are made of a fabric with a whalebone warp, thinned using a kind of plane, consisting of a piece of wood three inches long and two inches wide, into which a sharp iron is housed.

The weft or filling is made of wicker or straw; the wicker is split according to the desired shape of the fabric and is prepared in the same way as the whalebone. As for the straw, it is split using an ivory or steel tool or knife.
The hats are shaped by hand on wooden lasts, and when finished, those intended for men are dyed black or gray, and those for women remain unbleached. Women's hats are most commonly filled with straw or ends of wheat.
The same process can be used to make shakos for use by the troops.

Patent of Improvement and Addition issued on December 28, 1822, to Mr. ACHILLE DE BERNARDIÈRE, assignee of Mr. MICHON's patent.
These improvements consist of introducing into the previous manufacturing method the means of weaving wicker into flat splints, of making hats with a weft of poplar, willow, and generally any kind of green or dry wood; finally, in the application of these various fabrics to the making of shakos and other headgear for both civilian and military use.

As for the preparation of the various raw materials, it is exactly the same as that indicated in Mr. Michon's patent.

Sewn Straw Hats, etc.
These hats are inferior in quality to those we have described; the braids are sewn one slightly over the other's edges, so that when the straw is cut with scissors, they easily come unstuck. They are also made with flat straws of varying width glued to a base or sewn together in strips; sometimes these are interwoven with braids of varying thickness. All these hats, which vary infinitely, are cheaper than those with fine braids.

Sewn straw hats are made with small straw mats sewn together; they begin in the middle of the crown; a knob is formed, and the straw is twisted around itself until a circle large enough to make a standard crown is formed. The sizes vary according to the heads to be made.

When the worker reaches this point, she folds two rows of this straw to begin what is called the lowering of the crown; then she sews her straw always turning, taking care to guide it equally, that is to say not to make it drink more in one place than in the other, which would form bumps which are difficult to erase when rolling and reappear at the slightest humidity.

Once the cap is finished, that is to say, having reached the height you want it to be, you fold it in four: the front, the back, and each side of the ears, where you have to start the pass; you take the straw, you give it a slight arch, and you start from the fold indicating the right ear, turning the shape to the fold indicating the left ear where you stop, and you cut your straw, taking care when sewing it to make it drink slightly in order to force the pass to rise. The worker must take care to radiate her straw at the ears, that is to say, cover it almost entirely in such a way as to let only a very small part pass through in order to give space to all the pieces of straw that must make up her pass; she must also observe when starting what is the length she wants to give to the pass of her hat, because, if she wants to make an almost round hat, then it will not radiate much or not at all. If her pass must be ten inches in front and four inches behind, then she will cut her straws and circle until she has a six-inch lead; then, instead of cutting her straw P as she has done up to this point, she will continue sewing it by turning all the way around the crown so that it has reached a ten-inch lead; the back must necessarily have four inches.

Children's hats are made completely round, that is to say, once the shape is completed, without leaving the straw, it is made to drink strongly, which forces it to rise and thus begin the advance, which is then continued, always turning until the hat is judged to be large enough. When the first six turns of the pass are completed, the worker must frequently place her hat on a table to see if its advance is flat, because if the straw is pushed too far, the advance will bulge, something which must be avoided. If, on the contrary, it is not thick enough, it will fall over the eyes like a lampshade. Since each piece of straw is only twelve ells long, frequent tucking is required. Many people cut the straw diagonally, leaving a strand of braid at each end, which, forming the hook, tucks into each other. This method is very neat, but not very sturdy. I would rather advise crossing the straw over each other, only the length of a line, taking care to hold the two ends together with a stitch, one at the top and the other at the bottom. The small bump formed by this junction flattens onto the cylinder and is never at risk of coming undone when the cylinder maker forces the shape of the hat to give it a larger dimension than it was made for.

On the enuenchage.
Straw, however finely selected, sometimes retains browner parts that are only visible when the hat is finished; The worker must then cut away all the shades and replace them with other straw whose color blends perfectly with the hat; she manages to hide this type of mending by crossing her straw as I just indicated above.

Straw hats are made from small braids made in Switzerland, bundled in bundles of twelve ells, the price of which varies according to the fineness or whiteness.

The most highly valued are those that come to us from Fribourg. The bundles, folded a quarter of the way down, are tightly wound and tied at both ends: this straw has a rounded, strong grain, and bleaches very well.

Aargau, on the other hand, is sold in bundles folded half an ell long, tied at one end only; its grain is loose and flat, and the straw, although white when new, yellows in the sun and bleaches poorly; it can be sewn indiscriminately on both sides. The Fribourg, on the other hand, has a reverse side. This is recognizable by the small spikes formed by the strands of straw when braided. On the right side, they are all placed from top to bottom, and on the wrong side, from bottom to top. If the hat is made backwards, it bristles with a multitude of small pieces that the cylinder itself cannot lower, forming a kind of fluff that detracts from the effect and completely ruins the hat.

I have indicated above how to roll these hats. Smooth straw, called French straw, is also used; the hat is made in the same way; fashion varies the shapes, as do the straws used for sewn hats.

This note was communicated to us by a lady whose modesty prevents us from naming her.

WOODEN HATS.
Wooden hats are made in two ways: the first is made with braids made from more or less fine strands of wood, similar to straw hats: one type of these hats is known as rice straw; the second is made using a very fine weave, similar to baskets and coarse esparto hats. For this purpose, white wood, free of knots, is used, very loose and very supple, just after it has been cut. Osier, poplar, willow, linden, etc., are preferred. The process involves dividing them into very thin strips, like the willow brooms brought to us annually by the Alsatian women.

Several methods are known; the one that seemed the simplest and best to us involves a kind of plane with two blades, one of which has vertically sharp teeth; This is followed by the other blade, which is ordinary: by this arrangement, the shavings it removes are divided into as many blades or threads, plus one, as the first has teeth. It is worth adding that so that each tooth always passes over the same place, the plane must constantly slide between two guides.
These wooden strands can be dyed like straw; the process is no different. If you want to make them white, you soak these strands or the caps made in cold soapy water containing a little indigo solution and spread them out for a few days in a meadow, taking care to water them with pure water as soon as they begin to dry.

Osier hats.
Three main species of wicker are grown in France:
1. Red wicker, Salix purpurea. FLAX.
2. Yellow wicker, Salix vitellina. 3. White osier, Salix viminalis.

Red osier has twigs that are more wiry than the other two, but it is less long and thick; yellow osier is a little less wiry, but its twigs are a little longer and thicker; finally, white osier is even thicker, longer, and less wiry. It would seem from this that red osier deserves preference for making hats.

Wooden hats by BERNARDIÈRE.
Mr. Achille de Bernardière, as a result of his special studies, has succeeded in making very beautiful hats and shakos from dyed osier. To divide the osier strands, he uses the same machine that the English use for straw strands, which they call bric-à-brac. This machine or instrument [54] is a cylinder made of ivory, iron, or steel, 5 to 6 millimeters in diameter and 55 to 60 millimeters long, topped with a cone 5 millimeters high. When one intends to draw twelve strands from a straw, one divides the base of the cone into twelve equal parts, and using a triangular file, one pushes the division until one reaches the tip of the cone, but without going beyond it. It is obvious that the cone must have twelve equal and sharp edges. When one wants to divide the straw, one places the tip of the cone in its tube, and one pushes the instrument, which cuts the straw into twelve equal strands. The bric-a-brac tools have from three to forty divisions, depending on the desired fineness of the straw and its thickness.

Note 54: See Technological Dictionary.

Mr. de Bernardière, by means of an instrument which differs little from bric-a-brac, reduces the wicker into very thin strips, which he makes much thinner and narrower still by passing them through a kind of sharp and tightly wound spinnerets that these strips of wicker are barely half a millimeter wide; this is what constitutes, so to speak, the weft of the fabric. The warp or framework, adds Mr. L., is partly wicker, partly whalebone; that is to say, alternately two strands of wicker and one strand of whalebone, suitable for this purpose like wicker.

These hats are then dyed, like the straw hats; they should not be confused with the following ones. We will attach here the report prepared on this subject by Mr. Bouriat to the Society for the Encouragement of National Industry.

Report prepared by Mr. BOURIAT, on behalf of the Economic Arts Committee, on Mr. de BERNARDIÈRE's wicker hats.

The council instructed its Economic Arts Committee to visit Mr. de Bernardière's wicker hat factory, located in the Poissy correctional facility, and to report back on the products of this factory. Since the committee could not travel en masse to this distance, it asked me to gather all the information it desired and to share it with it before submitting its opinion to you on this new type of industry. I visited this workshop and several others located in the same facility. I will have the honor of giving you a glimpse of it, after discussing that of M. de Bernardière, which is the main subject of this report.

I have followed the work carried out there in minute detail; I have seen that even the most unskilled hands can prepare the wicker used to make hats. First, this wicker, split into five or six sections, depending on the thickness of the strand, is thinned by a kind of sharp spinnerets through which it is passed, and which are graduated so that the opening of the last one can only allow a very thin and narrow strip to pass through. It is these strips which, depending on their thickness, form the weft or the warp, since it is possible to dispense with the use of slender whalebone to support the body of the hat, the fabric of which is made by hands more skilled than the first. These hats, once made, are taken to the dyeing process to receive various colors, according to the taste of the merchant who buys them. Fixing the color on wicker is not without difficulty; therefore, this aspect of the process merits some further research on the part of Mr. de Bernardière and the dyers.

The strength of these hats is far superior to those made with straw; therefore, Mr. de Bernardière intended to manufacture wicker shakos for light troops, in peacetime, much lighter than those made of felt. I am placing on the table a sample of these shakos, dyed black, and bearing a plaque to designate the regiment.

The price of these hats, although lower than those made of felt, did not appear to your committee to be within the desired proportions; therefore, it advised Mr. de Bernardière to use mechanical means to thin the wicker. If, as we have no doubt, he can manage to do without labor for this most time-consuming and expensive preparation, he will be able to significantly reduce the price of his hats.

Your committee has seen a rather interesting objective in this type of industry, since it tends to considerably reduce the use of hare hair, which is obtained from abroad, to make the light felt hats that wealthy people wear during the summer. Mr. de Bernardière has already produced a large quantity of wicker hats this year; but despite his zeal, he has only been able to supply a portion of the orders placed. He will work tirelessly this winter to be able to satisfy all the demands next summer.

After introducing you to Mr. de Bernardière's factory, you will perhaps find it interesting to learn about the activity taking place in the Poissy reformatory and the benefits derived from it by both the house and the workers. Each inmate finds a type of occupation according to their moral and physical abilities: children and old people alike engage in gentle and easy work. For this purpose, various types of workshops have been established; these include those for weavers, jewelers, trimmers, cabinetmakers, carders, shoemakers, tailors, and finally a colonial spinning mill and the hat factory I just mentioned. It is through such occupations that the inclinations of several criminals have often been changed or modified, who might have spent their time in prison pondering the most sinister plans had they remained idle.

These results are due to the zeal and ability of Mr. Poizel, director of the institution, who found an excellent assistant in Mr. Picard, contractor for the house's renovations.

The rate of wages to be paid to prisoners is set each year by the Prefect of the Seine-et-Oise department. This wage is divided into three parts: one for the upkeep of the house, another distributed to the workers every Saturday, and the third is set aside to be given to them upon their release. Many have already received 300 francs upon their release, despite the short time this system has been in place, as it was only introduced in March 1821. The product of the work produced during the first twelve months was 48,000 francs, and this year, as the number of prisoners has increased, the director believes it will not fall below 80,000 francs.

I now return to Mr. de Bernardière's factory, about which your committee has gathered all the necessary information. I propose, through my voice, that you thank this manufacturer for the information he has provided you with regarding his new type of industry and all the processes he employs in his manufacture, worthy of public knowledge through the Bulletin.

Adopted at the meeting on August 21, 1822.

Signed BOURIAT, rapporteur.

To this report, we will attach the one prepared on the hats of Madame Reyne, widow.

Report prepared by Mr. SILVESTRE, on behalf of the joint committees of agriculture and mechanical arts, on the manufacture of straw hats and the model of those in Italy, prepared by Madame Reyne, widow, in Valence, department of Drôme.

Gentlemen, on November 28th, your joint committees of mechanical arts and agriculture obtained your approval for a provisional report they had the honor of presenting to you, concerning the requests that Madame Reyne, widow of the widow, had addressed to you regarding her Italian straw hat factory, currently established in Valence, department of Drôme.

Your commissioners then acknowledged the zeal of Madame Reyne, who, after carefully studying the production processes of raw materials and their manufacturing in Italy, had imported into France a type of industry that had not yet been naturalized there before her; they also expressed regret that the lack of several essential documents prevented them from expressing a definitive opinion on the success of such an undertaking; they hoped to obtain new and important information, both from the long-standing correspondence at the Ministry of the Interior on this subject, and from that which could subsequently be maintained with Madame Reyne herself.

The Minister has kindly entrusted you with the file concerning this matter. Madame Reyne has responded to several of your requests; she especially expresses the desire that the report be submitted to you promptly; consequently, we will present to you the results of the main documents we have collected.
But before addressing this presentation, and so as not to divert your attention from what specifically concerns Madame Reyne, we believe it is necessary to offer here some general considerations on the importance and difficulty of such an undertaking; on its novelty and the likelihood of success.

The importance of a straw hat factory in Italy is quite significant for our trade; its purpose would be to free us from the annual export of approximately one and a half million francs, which we give to Italy alone for the acquisition of items of this type: it is true that this payment is not made in cash.

In exchange for the straw hats and other items that Italy provides us with, we supply linens, wines, haberdashery, jewelry, porcelain, books, fashions, etc., etc., etc.; and it is noteworthy that the tables officially drawn up for the balance of trade establish, in our favor, an annual profit of more than eight million on reciprocal exchanges. However that may be; these bases are not immutable, foreign industry always seeks to make them more favorable to itself, and we must undoubtedly welcome with interest everything that can tend either to consolidate our advantages, or to find at home what our soil and our industry can provide (at a price equal to those abroad) to consumers.

This last consideration brings us back to Madame Reyne's factory and the circumstances that preceded her undertaking; the correspondence of the Minister of the Interior provides us with useful documents in this regard. It appears that attempts similar to hers have been made; that patents for inventions similar to hers have been issued. You know too well, gentlemen, the principle of these patents to be surprised by our assertion: the patent in no way proves that the owner invented or imported, but it only proves that at a specific time he declared that he had invented or imported, except for him to prove, if necessary, and before the appropriate authority, the reality of his assertions or the anteriority of his application.
A few attempts were therefore made before Madame Reyne to manufacture Italian straw hats in France; it is known to Parisian dealers in such items that many of these attempts were unsuccessful. In 1814, an import patent was issued free of charge to Mr. Bastier, who intended to build a factory similar to Madame Reyne's.

Around 1815, Mr. Pierre Couyère established a straw hat factory in Sainte-Melaine, in the Calvados department, similar to those of Italy, using native grass stems. It appears that he used phleum pratense for this purpose. In 1819, he obtained a ten-year patent; he corresponded with a sewing and finishing factory established in Paris by his brother, which supplied the trade with over 40,000 francs per year. As early as 1808, Mr. de Bernardière had also obtained a five-year patent for the manufacture of hats similar to those of Italy, using the stems of native cereals; it appears that he also most commonly used phleum pratense.

But an enterprise even more similar to Madame Reyne's has been underway for three years in the department of Haute-Garonne, under the care of the directors of the Toulouse hospices; it uses the straw of the same wheat used for this purpose in Tuscany, and which is successfully cultivated around Toulouse. The factory has an even greater advantage there, since His Excellency the Minister of the Interior has kindly sent to the hospices one of the dressing machines invented by Mr. Meigné and mentioned in issue CXCIX, page 6, of your 1821 Bulletins. This machine is used to provide, without inconvenience to the workers' health, the proper dressing for 126 hats per day, whereas the men who performed this arduous work by hand could only dress eighteen.

It may be added that all the details of the wheat cultivation that provides the straw suitable for this work and the processes relating to the art of preparing this straw and making the hats have been described in detail in Italian verse by Mr. Lastri, a Tuscan. Finally, as early as 1805, Count de Lasteyrie had brought back from Italy the wheat seed used to make straw hats there: this seed has since been cultivated every year in the King's Garden by the care of Mr. Thouin. Mr. Yvart had also, in 1812, brought back seeds of this cereal from Italy, and had cultivated them successfully. The raw material and all the means of using it had therefore been known for a long time; but an obstacle, which is due to the nature of this work, has always stood in the way of great successes. This obstacle arises in the same way for all work which is not susceptible to the use of machines, and which must be done by hand in countries where the labor force is higher than in the places where the factory originated.

It is on the means of equalizing this price of the first manual labor that we would have liked to have more positive information to be able to assess the probability of the successes which Madame Reyne hopes for. It was towards the end of 1817 that Madame Reyne returned from Florence. During her three-year stay in that city, she had formed the plan to establish a factory in France for making Italian straw hats. She had carefully studied all the processes for growing wheat, which provides the straw suitable for this work, and for its preparation and use in this production.

She first settled in the town of Bourg Saint-Andéol, in the department of Ardèche; at that time she still had her husband who assisted her in her work: they first approached the Minister of the Interior in February 1818; they announced that they had thirty young people in their workshops who were busy making straw hats, equal in quality to those from Italy. They explained that they had sown in France grains of wheat called marzole, which they had brought back from Italy; that these grains had succeeded well there, and that moreover they had found in France itself cereals whose stalks had the same property. They hoped to be able to supply, in a short time, the quantity of hats necessary for the consumption of the kingdom, and they requested the free issue of an import patent: the prefect of Ardèche supported their petition. The minister requested information and samples which were sent to him; then he consulted the advisory committee of arts and manufactures, this committee was of the opinion that Mr. and Mrs. Reyne would deserve to be encouraged, when it had been established that their factory supplied the trade with straw hats of the same quality and finesse as those of Italy. He deferred at that time the judgment to be made on the degree of interest that the government should take in their work. Consequently the minister refused to grant the requested patent free of charge; but he left the hope that he could encourage the efforts of these manufacturers, when it was certain that they had supplied the trade with straw hats of the same quality as those of Italy.

About fifteen months passed between this decision and the new requests that were made. In February 1820, Madame Reyne wrote to the minister that she had lost her husband, and moved her factory to Valence, department of Drôme; she then announced that her factory supplied the trade, and in fairly large quantities, straw hats of the same quality and finesse as those that come from Italy. This petition was supported by the mayor of Valence, who regretted having been able to give only weak encouragement, and by the prefect of Drôme, who requested assistance for Madame Reyne. The minister granted 600 francs, and asked the prefect for information on the activity of the establishment, the number of workers employed, the quantity of hats delivered annually to the trade, and their price compared with that of similar hats coming from Italy; finally, what sum would be necessary to give the work all the appropriate extension. The prefect replied to these questions that the factory employed seventy workers, that it could produce eight hundred to one thousand hats annually, that the price of these hats was roughly the same as those from Italy, and that they were equal in quality. He also announced that these prices would drop by one-sixth if Madame Reyne had sufficient funds to establish her establishment; he requested a sum of 12,000 francs for her. On April 12, 1820, the minister agreed to grant 2,400 francs to be used to expand Madame Reyne's work. It appears that part of this sum was indeed used to purchase a press for preparing straw hats.

But soon after, Madame Reyne experienced new needs; She addressed herself to you, gentlemen, in a letter supported by the Prefect of Drôme and the Mayor of Valence, and which, referred to your committees for mechanical arts and agriculture for review, was the subject of the provisional report presented to you on November 28th. According to this report, in accordance with your intentions, your committees were required to undertake further research and verification.

Two main types of information have reached us since that time. Some were drawn from a voluminous file relating to this affair, which was communicated to you by His Excellency the Minister of the Interior and whose analysis we have just presented to you; the others come from the direct correspondence we maintained with Madame Reyne or with her principal in Paris. We can only present these as simple assertions, the main report that forms part of it having been seen only by the mayor of Valence, as certifying that the manufacture of the hats sent had taken place in the said city, and seen by the prefect for the legalization of the mayor's signature.

In any case, it follows from this correspondence, 1° that the hat whose manufacture you have distinguished is indeed from the factory of Madame Reyne; 2° that this lady and her principal declare that she continues to use the straw of the type of wheat that she brought back from Italy, and whose cultivation is perfectly successful in the area around Valence; that the profit of the workers she employs depends on their skill; that it is usually children who weave; that No. 30, taken as an example, costs 15 centimes per ell to sew and weave; that a braider makes seven to eight ells per day, and a seamstress always sews twice that. The labor for a hat of this size costs 8 francs; namely, 6 francs 75 centimes for braiding and sewing, 75 centimes for the straw, and 50 centimes for the finishing. Higher sizes become more expensive, namely: size 40 at 16 francs 70 cents; size 50 at 27 francs 50 cents; and finally, size 60, which is roughly the same as the one displayed before you, costs 52 francs.

As for the number of hats produced annually, Madame Reyne points out that this production is limited only by the limited capital she can devote to it: she cites several towns in the south, and especially the Baucaire fair, as her main outlets.

She was unable to meet the request for more straw hats than she had previously sent to the company; She has only sent a few men's hats, the quality of which is insignificant to prove the superiority of her manufacturing; she points out that her current situation, in a sparsely populated town which provides too few workers at low prices, is not very favorable; she intends to change her address again; she would like that, failing the Encouragement Society itself, the government or capitalists would enable her to give all the desirable boost to her manufacturing.

After having explained to you the current state of affairs, your commission must not let you ignore that it found itself embarrassed to present to you conclusions in the case of Madame Reyne. Her manufacturing is good and interesting; her products are very remarkable in the most important and most difficult parts of this type of work; she will find the improvements to be made to her handling here, where they know, as well and even better than in Italy, how to join braids end to end, bleach straw and prepare hats; thus there is no doubt that she will be able to achieve perfection in this area in the future. We also have no doubt that more considerable capital than that which she has been able to obtain up to now, will be very necessary to give a suitable boost to her factory; but your regulations do not allow you to devote funds to revitalizing particular manufactures. On the other hand, the Minister of the Interior, by giving 3,000 fr. to Madame Reyne, wisely expressed that he did not intend to establish her own factory, but only to provide her with some encouragement.

Ruined, as she explains, by various circumstances beyond her control, she can only expect sufficient resources for action from capitalists who might take an interest in her work.

You can only offer Madame Reyne advice and expressions of esteem.

In the first regard, you can recommend that she pay particular attention to the joining of her braids end to end, the bleaching and finishing of her hats; you can invite her to place her business, if possible, in an orphanage or a detention center, in a place where labor is as cheap as possible.

In the second regard, and considering that Madame Reyne appears to be the first to have introduced, on a large scale, the cultivation of the plant used to make straw hats in Italy; Considering that what is lacking in his work is executed here with great perfection and can easily be introduced into his own factory, we have the honor to propose that you award him a silver medal at your next public session.

Signed SILVESTRE, rapporteur.

Adopted at the session on February 20, 1822.

This proposal was adopted, and at his public session, Mr. Charbonnel, this lady's attorney, received the silver medal intended for him.

Wooden hats by Mr. BERNARD.
These hats differ from the previous ones in that only the frame is formed from light wood, cut into thin, narrow strips using mechanical processes he invented. These strips are glued side by side onto a fabric that combines strength with lightness; the top and brim of the hat are prepared in the same way. And when he has given these three pieces the proper shape and joined them together, he covers the whole thing with a waterproof varnish. When it is dry, the hat is covered with a plush silk fabric, which very well imitates the hairs called gilding in ordinary felt hats. Finally, the author applies a type of varnish to the plush that surrounds each strand of silk, does not retain dust, and prevents water from penetrating. These hats have the advantage of always retaining their shine and never losing their shape. For more details, we refer to the Annals of National and Foreign Industry, August 1825.

Esparto Hats.
All types of broom can be used to make common hats, called esparto hats; but it is mainly the Spanish broom, Spartium junceum, that is used for this purpose. For this purpose, the finest rushes are used to make fabrics, not in separate braids. There are three types of these hats: white, straw-colored, and mixed with various colors. The esparto fabric is sold in square pieces, each of which is enough to make a hat. Their price ranges from 2 francs to 10 francs per piece, depending on their beauty.

Woodchip Hats.
This patented invention of summer hats, made of woodchip fabric, painted black and varnished, is due to Joseph Lantenhammer of Vienna. (Archiv. fur gesch, stat, liter, und kunst, July 1824, nos. 89 and 90.)

These hats, says the editor of the aforementioned journal, are recommended by their shape, their great lightness, and even by the longevity that can be expected from their service. Above all, he adds, they deserve preference over straw hats, to which the public has had the good sense to grant only reserved favor until now.

Hats made from braids other than straw.
We will devote this article to the manufacture of hats made from braids of silk, cotton, linen, and horsehair. The former have reached such a degree of superiority that they seem to compete with the finest straw hats in Italy.

Silk Braided Hats.
The first silk braided hats were made in Florence; since then, Mesdames Manceau of Paris have succeeded in bringing this type of manufacturing to such a degree of perfection that their silk braided hats imitate the finest Italian straw hats, creating a complete illusion through the shade, as well as the fineness and workmanship of the fabric. As early as 1823, Mesdames Manceau had won a silver medal at the French Industrial Products Exhibition, which was confirmed at the 1827 exhibition. For this production, they use the finest quality silk, woven and braided to the desired degree of fineness. The regularity of the braids requires the greatest care; they are made using machines that set the materials in motion; they are then prepared, assembled into hat shapes, and subjected to the cylinder. These hats combine lightness with strength and are very easy to clean. Add to this the fact that they are half the price of those made of Italian straw, as we shall see below.

1. Those of number 70, bearing seventy straws on the brim, can be sold for 200 francs, while those from Florence would cost more than 2,000 francs.
2. Ordinary qualities from number 34 to number 50 vary between 28 and 56 francs.

In order to better understand the manufacturing method used by the Manceau ladies, we will report the patent that one of them took out on this subject.

Process for making hats imitating Italian straw hats with unbleached silk, by Mademoiselle Julie Manceau, in Paris. (Five-year patent.)
First, fabrics are made from unbleached silk of the finest quality and best possible choice, which are then placed in the dye; The dyer prepares these fabrics so that they retain a certain stiffness that approximates the consistency of straw or bark; then, using a braiding machine, the silks are converted into braids of varying fineness and tightness, depending on the fineness of the hats to be made. The braided strips are carefully checked along their entire length to remove any defective parts that would detract from the fabric's identity.

These prepared braids are ellished, balled into the appropriate quantity, and given to the workers responsible for assembly; this operation is performed with a needle using three-strand silk cord twisted in the same shade as the fabric. The lost seam is obtained by joining the left side of the braid with the right side of the braid to which it is to be joined, so that the seam, zigzagging equally on both sides, is hidden at all points of contact. These hats are constructed in two pieces, the crown and the front.

The first piece is started at its center, and the joining stitches are combined so that as the circumferences increase, the spiral formed by the seam can easily expand and join without seizing; the crown must be made from a single strip.

The front of the hat is executed according to the same procedures; the eye and experience of sewing determine the shapes and grace of the contours in this work. This piece, also made from a single piece, is joined to the crown and then finished to form the entire hat.

This dressing consists of ten parts of gum tragacanth, one part of alum, and nineteen parts of water. Once these materials have been mixed by the action of heat, the fabric is immersed in them until saturated, and then allowed to dry completely, but to lose its excess moisture, so that it can be pressed and ironed while hot.

For this purpose, depending on the shape desired for the cap, a cylinder or other solid piece of wood is used, composed of several pieces pierced together in the center with a hole intended to receive a conical piece of wood. With this cylinder placed inside the cap, the pressure on the conical piece, passing through the center of the form, determines the tension of the fabric, which is then ironed with a hot iron, the size and shape of which are those of the object over which it is to be pressed.

If, instead of using unbleached silk, one wanted to use human hair, the hats would be made in the same way.
These new hats are lighter than those made of Italian straw, and can be washed and redyed, as desired, in various colors.

Certificate of additions.
The raw materials, which were ordinary unbleached silk, are replaced by Alès hair, which has the advantage of making the fabric finer, of not producing unevenness, and of giving the shades more pleasing hues.

The hats, which were previously made of two pieces, are now made of a single piece through the continuity of a single braid.
The first finishing had the disadvantage of leaving stains when dry, which is avoided by using prepared gum tragacanth, and, for the second finishing, a varnish composed of tear-shaped mastic, to make them waterproof.
They are rolled using a mechanical press, which, while simultaneously pressing the hats, gives them a freshness they could not achieve with iron.
Men's hats are made using the same process.

In 1823, Madame Milcent-Scherckenbick received an honorable mention for her so-called waterproof hats, woven from silk and linen in various colors. The same distinction was awarded to her at the 1827 exhibition. These hats are made of very fine fabric, lightweight, elastic, and can easily be restored when they have become deformed or stained. We will present the patent that Madame Milcent took out for this production, and it will show the recipe for the waterproof varnish she uses for this purpose.

Manufacture of hats made from cotton, thread, and silk braids by Madame Milcent-Scherckenbick in Rouen. (Five-year patent.)
Cotton, thread, and silk braids are made using machines composed of nine to thirteen spindles or bobbins of four to eight threads each, or even more, depending on the fineness. These braids are added together with the needle like knitting; they are shaped like hats on a wooden form as they are knitted.

The formed hats are primed with the following composition, sufficient for a dozen hats:
Four ounces, fish glue;
Two ounces, gum arabic;
Four ounces of potato starch;
Half a pint of spirits of wine and about a jug of water.

To make these hats waterproof, Venetian varnish is applied with a brush for white hats, and gum copal varnish for colored ones.
The varnish applied to the hats is then passed through a hot cylinder.

Madame Milcent also took out another patent for the making of various kinds of hats from braids of different fabrics: here it is.

Various kinds of hats for men and women, made from braids of different fabrics. (Five-year patent granted on August 26, 1820, to Madame Milcent-Scherckenbick, in Paris.)
Women's hats are made from braids and even cashmere knits, from braids or knits of merino wool, from braids or knits of wool, and finally from braids or knits of camel or goat hair.

All hats made from braid are knitted with a needle like Italian straw hats; knitted hats, being made as usual, are pulled with hair using a thistle and a card. They are then prepared with fish glue dissolved in spirits of wine, which is mixed with a solution of gum arabic, gum Senegal, and starch: after this operation, they are rolled with a hot iron.
All these hats, which are very durable, can be cleaned and dyed in all sorts of colors.

Other hats are made of embossed or pressed white satin, or of all kinds of silk, wool, cotton, etc., in all colors and with various designs.
The design is engraved on a copper or wooden plate; the fabric is glued with the above composition, and this plate is subjected to the action of a strong press to obtain the design.
There are also hats made of esparto weave made of unbleached straw-colored silk, silk and cotton, white cotton, white thread, and thread and cotton.

To make this wickerwork, the spun materials are soaked in the solution described above; these threads are allowed to dry, and then woven on a loom, as with any other fabric, then hot-rolled.

The Le Mans ladies also make hats from cotton braids, which, with their whiteness, perfectly imitate rice straw.
Hats are also made from horsehair braids. We will describe the processes, based on the patents obtained by their authors.

Manufacture of horsehair hats, by J. Reins. (Five-year patent for invention and improvement.)
This process consists of braiding the horsehair into three or five strands and sewing them together, increasing or decreasing the length, depending on the various shapes or sizes desired for the hats. A finish is then applied that resists humidity and rain, and which gives the hats the proper shape while giving them greater consistency.
This method of manufacturing has also been applied to caps for use by the troops; here is Mr. Cavillon's process, according to his patent.

Manufacture of woven horsehair caps for use by the troops, intended to replace those made of bearskins, by Mr. CAVILLON, furrier in Paris. (Five-year patent.)
Until now, these caps have been made with bearskins from Louisiana, the Newfoundland Banks, Virginia, and Canada, and not from Russia, as many people believe. Russian bearskins are not suitable for this purpose, as their leather and hair are too fine, which would be of poor use and would become four times more expensive than those from Canada; it is therefore the latter that are used for the troops' headgear.

It can be estimated that the English smuggle twenty thousand bearskins into France each year, which, at forty-five francs, amount to nine hundred thousand francs; if we add to this figure those that pass through the continent, this will amount to approximately four million, for which we are dependent. My new methods will provide France with the means to free itself from this tribute.

These methods consist of shaping a cow carcass, reinforced to its shape, arched and recast at the back, to accommodate a two-pronged buckle, held in place by a black sheepskin cap, and its girth strap, also made of sheepskin, to tighten the cap as desired.
This frame is covered with a strong black Laval thread canvas, laid very tightly, forming, so to speak, a single body.

How to make the fabric.
Take the finest strands of collar or tail hair, start by combing and curlying it well to remove the grease. If it is too greasy, boil it in water, remove it, and let it dry. After that, cut it four and a half inches high, then braid it with three strong silk threads, three inches high: the remaining eighteen lines are to fill the braid. You then place your first braid at the bottom, turning and keeping three lines apart from each other. In this way, you cover the entire canvas, leaving uncovered the parts of the cap intended to receive plaques or other ornaments.

Once the bonnet is assembled, it is rinsed with linseed water to clean it thoroughly; then the sheepskin cap, topped with its cloth, is placed on top, and the drawstring is inserted.

Madame Celnart, in her interesting work [55], devoted an article to the manufacture of hats with cotton or silk braid, imitating Italian straw. We will transcribe it.

Note 55: Manuel des demoiselles, part of the encyclopedic collection of M. Roret, 3rd ed.

Following the procedure for making flat braid, small pieces of cotton and silk are prepared and assembled into the shape of a hat as follows:

Take a slightly large hat pattern, because the braid tightens through bleaching and processing. This pattern or model consists of the pass and the shape of the hat; it must be made of straw or cotton. Start at the center of the base; attach the end of the braid to the center, and twist it around itself, successively describing a larger circle. These circles are built one on top of the other as a certain quantity is obtained, and after they have been attached with pins. But as soon as these circles have grown a little larger, it is better to build them immediately, not only one on top of the other, but also to ring them after the pattern. This circular pattern surrounds the entire shape of the model. Then, threading a fine white cotton needle if the braid is cotton, and a straw-colored silk needle if the braid is silk [56] , you will sew the braids together with couching overlock stitches, taking these stitches in the small stitches at the edge of the braid. Once this operation is completed, remove the work from the last, turn it over, and assemble the front or the loop in roughly the same way, except for the difference dictated by the model: measure the loop at half length, and it is from this half that the braid is started to the right and left on the edge of the loop, in order to see where it must be cut on the side to obtain the roundness of the loop. Before banding, measure each row of braid on the loop, so as not to lose too much by trimming the edges, or to have to start again if, by chance, a piece is too short.

Note 56: The color of the silk used to sew the braids must match that of the braids, so that the eye cannot discover this seam.

Approximately twenty rows are laid in this way, ringing them well after the pass, and then basting them one after the other.
At this point, it is necessary to make narrowings, that is, to cut the braid before the end of the row, and to lose the end of this braid between the braid of the previous row and that of the following row, so that it does not form a fold. This is achieved by biting down on both selvedges a little tightly. Since the work is done inside out, the excess parts do not appear when the hats are turned inside out. It is impossible to indicate the number of these narrowings; they depend on the shape of the hat. The pass must be sewn like the shape, and then joined together. When the cotton hat thus made is bleached and dressed, it has the appearance of a white wooden hat, called rice straw; if the braid is silk, the hat has the appearance of Italian straw. It is worth noting that the braids must be overlocked closely afterward, to prevent them from separating and becoming unstitched during bleaching. These cotton or silk braids can be given various colors to obtain, in addition to white and straw-colored hats, black, gray, etc.

It is obvious that similar hats can be made using the same process, that is, with braids made from linen, hemp, and other filamentary materials; since the method is the same, we do not believe it is necessary to repeat it.

Men's and women's hats, with a warp made of whalebone and a weft made of silk, cotton, or any other twisted filamentary material. (Five-year patent granted on September 27, 1822, to Mr. de BERNARDIÈRE (Achille), in Paris.
These hats are made using a wooden last; the warp is made of whalebone and the weft of silk, cotton, or any other twisted filamentary material; the weft is twisted around the warp, which is attached to the last simply by the fingers of the hand.
The hat, upon leaving the worker's hands, is bleached, dyed, and finished.

Although fowl feather hats are not hats with braids or braids, however, since they are neither felted nor covered with any fabric, we felt it necessary to classify them after them.

Awards awarded from 1798 to 1827, during exhibitions of French industrial products, for hat making.

The exhibition of the products of French industry is one of the most beautiful human conceptions; it can be considered as a vivifying genius of the sciences and the chemical and industrial arts, over whose perfection it presides, and as a certain means of knowing all our resources and all the progress of national industry. In browsing the magnificent products which are exhibited in the galleries of the Louvre, one believes to be transported into those enchanted palaces due to the imagination of poets, and of which one finds such brilliant descriptions in oriental tales: at the sight of so many masterpieces, the observer, his mind filled with admiration, remains plunged into a sort of ecstasy from which he emerges only to pay a cult of esteem and gratitude to these hardworking men, who, by their talents, honor both their country and the century which saw them born; It is in this sanctuary of science and industry that one is truly proud to be French, and in the eyes of learned Europe, the ignorant gentleman is forced to respectfully bow his humble brow before the genius of the arts.

We must not forget that this institution is due to one of the most illustrious men of our time, Count François de Neufchâteau, then Minister of the Interior.

What is remarkable is that he put it into effect in the year VI (1798), at the very moment when the English were closing the seas to us. Through this exhibition, Mr. François de Neufchâteau made known to all of Europe all the resources of our beautiful France and rekindled the flame of our industry that England sought to extinguish. Moreover, this is not the only service that this famous man rendered to science and the arts; His ministry, like those of Count Chaptal and Lucien Bonaparte, will always be remembered.

The first exhibition took place on the Champ-de-Mars; it lasted only three days.

The second, under the Consulate, in the year 9 (1801), was held in the courtyard of the Louvre, where, beneath one hundred and four porticoes erected there, two hundred and twenty-nine exhibitors were placed; it lasted eight days.

The third took place in the year X (1802), under the ministry of Count Chaptal; there were five hundred and forty exhibitors.

The fourth, in 1806, under the ministry of Mr. de Champagny: three thousand four hundred and twenty-two exhibitors were erected on the Place des Invalides and in eleven halls of the Ponts-et-Chaussées. Twenty-seven gold medals, sixty-three silver medals, and fifty-three bronze medals were awarded.

The fifth took place in 1819; it was the most brilliant: people were amazed at the immense improvements that chemistry had produced in almost every branch of industry; and the flattering testimony that Count Berthollet, of illustrious memory, and Count Chaptal, received from Louis XVIII for their contribution to this progress has not been forgotten. At this exhibition, the number of exhibitors increased further, and fifty-six gold medals were awarded, as well as one hundred and forty-eight silver medals, and one hundred and fourteen bronze medals.

The sixth took place in 1823, and was remarkable both for the variety of products and the large number of exhibitors. It must be admitted, however, that the ease with which so many trivialities, these pretty nothings, fruits of charlatanism and greed, had been admitted, had converted this beautiful institution into a kind of bazaar or the meeting place of merchants who came to distribute their addresses. It is an abuse that the jury of 1827 had the courage to attack; let us hope that we will end up completely uprooting it. The exhibition of 1823 was famous for the products of our cotton spinning mills. It was also at this exhibition that the chemical arts, which placed France at the head of all nations, shone.

Finally, the seventh exhibition has been held since August 1st, in wooden rooms located in the courtyard of the Louvre and in part of those of this superb building. An immense concourse of foreigners hastened to come and admire the ever-increasing progress that has taken place, not only in the quantity of products, but also in the improvement of processes and the numerous applications that have been made to the arts of a large number of discoveries; thus one sees with transport works that seem to have exceeded the limits of the human mind. One must witness the beauty of those who are subjected to this learned test, to be able to judge their merit. However, we are forced to admit that this exhibition was neither as numerous nor as varied as that of 1823, since it counted only about one thousand six hundred and fifty exhibitors, including more than eight hundred from Paris. Should we attribute this discouragement to the misfortunes of the times, or should the provincial manufacturers believe that the jury is not judging them impartially?

Let them rest assured: the talent and loyalty of Messrs. Arago, Darcet, Gay-Lussac, Biot, Thénard, Malard, Brongniart, Héron de Villefosse, Oberkampf, Gérard, Camille, Beauvais, etc., whose reputation is European, should fully reassure them.

We have said that the 1798 exhibition lasted only three days; no paper manufacturer appeared there; instead of the medals awarded at other exhibitions, this one was given only first, second, and third-class distinctions.

In 1801, gold, silver, and bronze medals were awarded, as well as honorable mentions. The jury declared at the same time that the first and second-class distinctions of 1798 were equivalent to gold and silver medals; it awarded these prizes to the exhibitors of the first exhibition, who re-exhibited their improved products in 1801.

In 1802, the awards were the same. It was also decided that manufacturers who, at this exhibition, presented products from previous exhibitions, in the same state of perfection, would not receive a new medal, but would instead be awarded a reminder of the last one.

In 1806, a fifth was added to these four awards, called a citation; this comes after the mention. A noteworthy fact is that, through a very ill-conceived stinginess, only one medal was awarded to several manufacturers who were forced to draw lots for it; but all the others were considered to have received it, since it was recognized that they had deserved it.

In 1819, in addition to the 1806 distinction, decorations, titles of baron, and monetary rewards were awarded.

The awards are graded as follows:
Citation: this is the lowest;
Honorable Mention;
Bronze Medal;
Silver Medal;
Gold Medal;
Decorations;
Honorary Titles.

Monetary rewards are also sometimes awarded. Manufacturers whose progress has continued, without increasing, are awarded the same medal, under the title of Return of the Medal Obtained.

We will now list the manufacturers who have received awards from 1798 to the present day. A glance at the table below will make it easy to judge the influence that the exhibitions have had on this branch of French industry.

Exhibitors from 1798 until the 1827 exhibition.

Exhibition of 1798.
No hat makers exhibited at this exhibition.
Exhibition of 1801.
The same was true at this one.

Exhibition of 1802.
It was from this exhibition that hatmaking began to be recognized as a product of French industry. The manufacturers who were the first to respond to this noble call were:

Messrs. Bardinel, from Limoges, for hats;
Bellegarde (Joseph), from Gaillac, id.;
Brouilland fils, id.;
Viot, from Marseille, id.;
Desaint-Riquier jeune, from Quevavilliers, for hat trim.

No awards were given to hatmaking.

Exhibition of 1806.
A large number of manufacturers followed the momentum already given this year, and this exhibition, while not the most brilliant for hats, was at least the most numerous. It featured:

Messrs. Bellegarde (Joseph), for hats;
Bernard senior, from Moulins, id.;
Berthier (François), from Issoudun, id.;
Beylard senior, from Marmande, id.;
Boulanger, from Rennes, id.;
Bourdachon, from Issoudun, id.;
Dulerys (Pierre), from Bourganeuf, id.
Florentin, Couyère et Cie, for straw hats;
Guiffray et Cie, from Lyon, id.;
Juhel, from Sens, id.;
Lamaique, from Oleron, id.;
Messrs. Lamorte, for hats; Meissonnier, id.;
Monnereau, from Niort, id.;
Pascal (Pierre), from Marseille, id.;
Patoors, id.;
Ribolet, from Lyon, id.;
Rouliés, from Agen, id.;
Sade, from Anduze, id.;
Sandrot (widow), from Grenoble, id.

Of all these exhibitors, only Messrs. Guiffray received an honorable mention. This failure so dampened the zeal of these manufacturers that only two reappeared at subsequent exhibitions.

Exhibition of 1819.
This exhibition was smaller than the previous one; only Messrs. Allemand, from Paris, for hats:
Brouilland fils, id.;
Chenard aîné, père et fils, id.
Couyère, willow hats;
Delouchant, id.; Dormois et Cie, ibid.; Guichardière, of Paris, ibid.; Lamorte, ibid.; Lauche (Antoine), ibid.; Lantier aîné, ibid.; Masclet, ibid.; Maurisier, ibid.; Poujal, ibid.
Thibault, for straw hats; Vian-de-Mourche, of Marseille, ibid.

The latter received an honorable mention; the same was true of Mr. Guichardière, who has since published some very good memoirs on hat making. It is regrettable that greater encouragement[57] was not given to the factory of Madame Veuve Reyne, in Valence, department of Drôme, which, in 1822, received a silver medal from the Society for the Encouragement of National Industry. Finding herself ruined, this woman was forced to abandon this business. We have made known the report made by Mr. Sylvestre on this subject.

Note 57: Madame Reyne had requested a sum of 12,000 francs from the government; the sum of 2,400 francs was granted to her by the Minister of the Interior on April 12, 1820.

1823 Exhibition.
We were unable to obtain exact information on the number of exhibitors that year; we were only able to identify those who received some awards. These were:

Ms. Manceaux, who received a silver medal for silk hats imitating Italian straw; and for other hats made of cotton braids imitating rice straw.
Mr. Dupré, from Lagnieux, received an honorable mention for his Italian-style straw hats.
Ms. Milcent-Scherckenbick received an honorable mention for her so-called waterproof hats, braided from silk and linen of various colors.

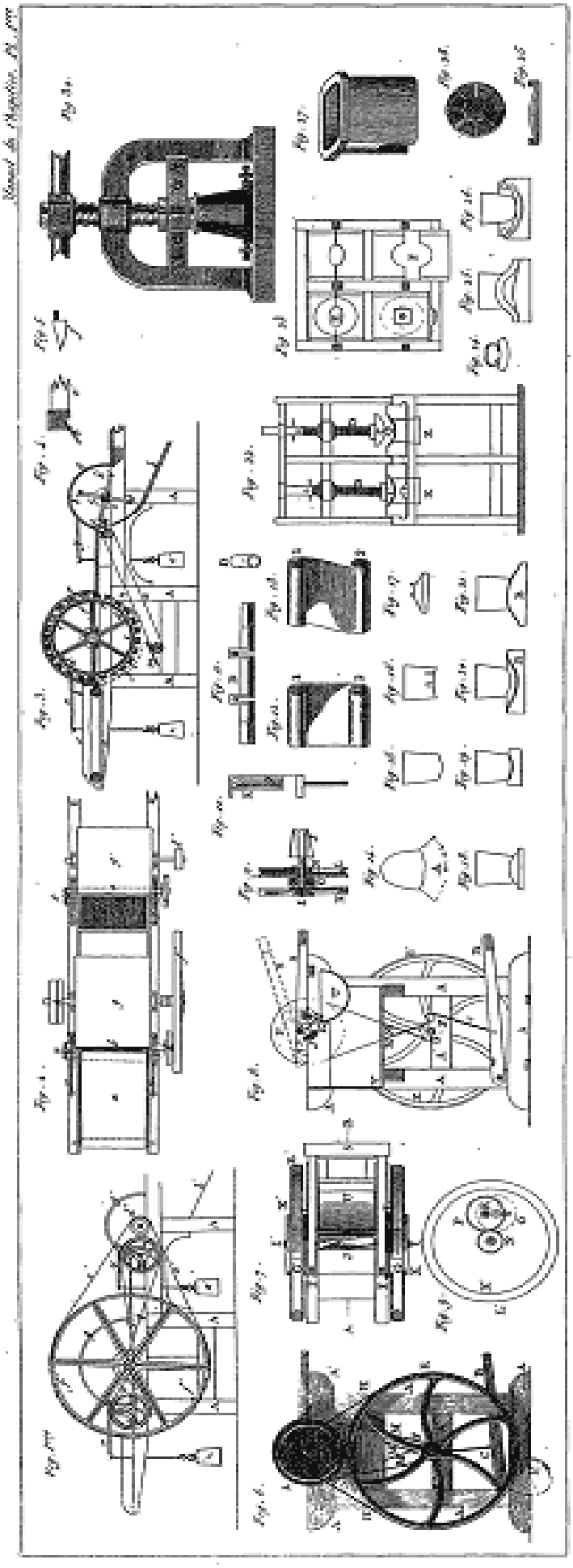
1827 Exhibition.
The silver medal awarded to the Manceaux ladies appears to have been a powerful incentive for other manufacturers; thus, since the 1827 exhibition was the most brilliant for millinery, the jury had a much larger number of awards to award. We will present them starting with the highest, and gradually descending to the lowest.

Silver medals.
The Manceaux ladies, who had also received it in 1823.
Mr. Dupré, for Italian-style straw hats.

Bronze medals.
Mr. Percherand, Dubois et Cie, for straw hats imitating those of Florence.

Honorable mentions.
The Maison Centrale de Bicêtre, Paris, for straw hats.
Mr. Gancel (Pierre), for wool and calfskin hats.
Mr. Giroux, Paris, for felt hats. Mr. Lenoir (Épiphane), for well-made, inexpensive wool hats.
Mrs. Milcent-Scherckenbick, for waterproof silk and linen hats.

Quotations.
Messrs. Davilla and Dabbé, for waterproof hats.
Mr. Dulong-Miergue, id.
Mr. Wansbroug, id.
Mr. Savornin, for elastic hats.



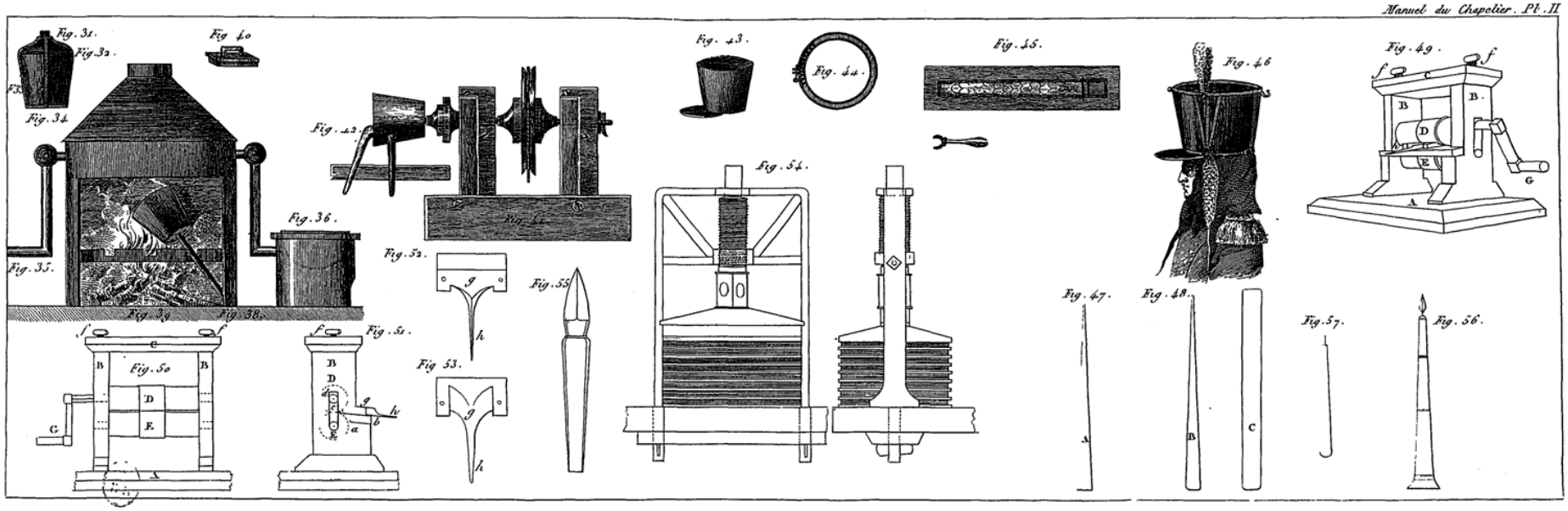


Fig. 31.
Fig. 32.
Fig. 34.
Fig. 35.
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Fig. 37.
Fig. 38.
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Fig. 44.
Fig. 45.
Fig. 46
Fig. 47.
Fig. 48.
Fig. 49.
Fig. 50.
Fig. 51.
Fig. 52.
Fig. 53.
Fig. 54.
Fig. 55
Fig. 56.
Fig. 57.

VOCABULARY OF THE PRINCIPAL OPERATIONS AND INSTRUMENTS USED IN HAT MAKING.

Acids.
Compound substances that generally have an acidic flavor, redden litmus dye and most blue vegetable colors, and form a class of substances known as salts, when combined with salifiable bases. They are the result of the union of certain substances with oxygen, in which case they are called oxyacids, or with hydrogen, in which case they are known as hydracids; finally, they can be the result of the combination of certain substances without oxygen or hydrogen, such as chlorine with boron; chloroboric acid, etc. We will now list the acids used in hat making.

Acetic acid. This is vinegar in its pure state.

Citric acid. This is the acid in lemons.

Muriatic or hydrochloric acid, formed by chlorine and hydrogen. This acid gives rise to muriatic salts or hydrochlorates.

Nitric acid or aqua fortis. Acid extracted from nitrate of potash (nitrate salt). It is composed of nitrogen and oxygen.

Sulfuric acid (oil of vitriol). Obtained by the combustion of sulfur in large lead chambers. It is composed of oxygen and sulfur.

Tartaric acid. This is the acid that, with potash, constitutes the salt known as tartrate of potash (cream of tartar).

Alkalis.

Alkali. Substances that turn most blue vegetable dyes green, have a pungent, urine-like flavor, saturate acids, and form salts with them.

Atmospheric air.
An elastic fluid which, apart from all the exhalations and vapors, etc., it contains, envelops the entire terrestrial globe, rises to an unknown height, penetrates the deepest abysses, is part of all bodies, and adheres to their surfaces. It is composed of 0.79 nitrogen and 0.21 oxygen; plus 0.01 carbonic acid.

Copper acetate (sub-). Verdigris. A salt composed of acetic acid with excess copper oxide.

Copper acetate. A salt composed of acetic acid and copper oxide in a neutralized state.

Iron acetate. A salt composed of acetic acid and iron oxide.

Hat dressing.
Introduction of a glue that, while maintaining the fabric's flexibility, binds the felted parts together, making it more consistent, firmer, and more likely to retain its shape.
Hats that have reached the proper stage of manufacture lack the shine and softness that make them beautiful. These are the qualities bestowed upon them by appropriation. As for felts intended for hairdressing, they are simply ironed or pressed to form a shaggy cloth, like woolen fabrics.

Hat tree (of the).
The hat tree is a type of large bow, suspended from the floor near its center so that it can be positioned in all possible directions. This bow is placed above a table covered with a fine wicker rack, tightly packed enough to allow only the debris to pass through. The hair is placed on this rack; the string of the hat tree is introduced into the pile, and, without letting it come out, it is set in motion using a notch, a sort of hardwood spindle, ending at each end with a mushroom-shaped knob. By hooking the rope with this bolt and pulling it hard, it ends up sliding over the button, and it begins to vibrate more quickly, the more abrupt the bowman's movement was. The worker is careful to raise or lower the bow.

Lambs.
Wool from lambs.

Plucking or pulling the hare's hair.
In this operation, the cutters pinch the down between their thumb and the blade of a knife called a tranchet, and pulling it towards them, the down is removed, and almost all of the guard hair remains on the hide. This plucking completes the trimming.

Assortment.
To match a hat is to place it in a shape similar to the one it should have, taking care to adopt a shape slightly higher than that of the shedding process, so that the string does not occupy the same point as it was in the shedding process, and thus to avoid compression of the felt, which produces a kind of constriction. This is what, in art, is called lowering the string.

Advancing by hand.
Synonymous with walking in the shedding process; this name comes from the fact that most of this work is done with the bare hands.

Attaining shedding.
This is when the felt has reached the prescribed size, and is not susceptible to any further shrinkage for further fulling.

Basin and building (of).
This operation is one of the principal in hatmaking; it must be done in a particular place, so that the worker does not continue to be exposed to the exhalations produced during the harnessing. We give the name of basin to a workbench made of hard and well-united wood; and that of felt-work, to a strong Alençon canvas. We then wet the felt-work either with a brush, or with a handful of willow, heather or with a small rice broom; when it is sufficiently wet, we place some squares of thick and flexible paper on it, we cover them with the hanging part, and we roll the whole thing so that the moisture is distributed equally. In this state, the worker unrolls the felt-work, and, after having taken the papers out, he arranges it, as we have already said, that is to say one half on the basin, and the other hanging on the front. Everything thus prepared, the worker spreads the pieces on the felt board, one on top of the other, taking great care to ensure they are evenly spread, and especially to ensure there are no folds or wrinkles on each piece. After lightly moistening it, he places a sheet of the aforementioned paper on top; finally, the last piece is covered with the remaining half of the felt board.

The pieces are worked until they are determined to be: 1. consistent and firm enough not to open or spread; 2. soft enough that, when assembled, they unite and bind together to form a single felt. This is what is called building a felt.

Preparation basin.
Approval of hats.
This operation aims to remove excess sizing from the surface of the felts, which is holding the hairs together, as is noticeable in those that have not been subjected to the vat. To do this, the edges of these hats are soaked in a weak solution of soap in boiling water; it is then drained, wiped, the hair removed, and dried in an oven to undergo appropriating.

Shedding bench.
An inclined bench, placed around the boiler, on which workers full the felts.

Bordering the skin.
This involves removing the tail, legs, etc.

Bagging the fabric.
This involves making it have pockets when the basting is not done properly.

Burning.
Synonymous with dyeing.

Cartoning (of).
This operation consists of gluing strong paper to the bottom of the hat, and a lighter one around the shape.

Plaid.
A type of small iron card used to develop the down on hats.

Half-pile hats.
The word half-pile indicates that this gilding is superior to that of ordinary gilded felt and inferior to that of bearskins. This quality therefore strikes a balance between the other two. The two gildings applied to this felt are called, in artistic terms, first and second application.

Bear hats.
These hats have a more beautiful and longer gilding. The word bearskin comes from the fact that these hats, in terms of hairiness, are compared to bearskin, although their hair is far from being as long.

Plumed hats.
Hats called plumets, as well as bordered hats, etc., differ from bearskins only in that, like the latter, they are gilded only on one side or only on the edges, etc.

Hot.
Hot is also known as diving or fire; its duration is one and a half to two hours.

Chiquettes,
Parts removed from the skin.

Iron citrate.
Salt composed of citric acid and iron oxide.

Colcotar, English red, Prussian red (iron tritoxide).
This oxide is a beautiful red, tending slightly toward brown, more fusible than iron, indecomposable by non-magnetic heat, reducing by electric fluid, and insoluble in water. It is the coloring principle of red blood, reddish brown, etc.

Fish glue (isinglass).
These are the aerial vesicles of a sturgeon (Acipenser huso. LIN.), which are usually 24 feet long by 12 feet wide. These vesicles are cleaned, rolled up, and dried, giving them the shape of a heart or a lyre; or, instead of rolling them, they are folded like a napkin.

Strong glue, Flanders glue.
This is the name given to the gelatin extracted from the ears and feet of oxen, horses, sheep, calves, as well as from the white parts of these various animals. This glue is cast into dry, brittle, brown, yellowish, reddish, transparent, or semi-transparent tablets, depending on their degree of purity and the care taken in their preparation.

Crystals of Venus. See copper acetate.

Blue rosacea, vitriolated copper, blue vitriol, copper vitriol, Cyprus vitriol, etc. (copper deutoxide sulfate).
This salt is odorless, with a pungent, and very styptic flavor, in transparent, irregular blue crystals, and sometimes octahedrons and decahedrons, exhibiting double refraction, slightly efflorescens, and then offering a greenish-white powdery material; Soluble in four parts of cold water, and undergoing aqueous fusion. The volatile alkali precipitates the oxide, which remains suspended in the solution and gives it a beautiful blue color. This preparation is called celestial water. It is composed of sulfuric acid and copper oxide.

Courrose, green rosacea, green vitriol, martial vitriol, vitriolic mars, etc. (Iron sulfate).
Recently crystallized, this salt is in rhomboidal prisms, a beautiful emerald green, transparent, and when exposed to air, absorbing its oxygen, it is then converted into iron tritoxide sulfate, which appears as yellow spots on the aforementioned crystals. Iron sulfate is odorless, stytic, and so soluble in water that nine parts of this boiling liquid dissolve twelve parts of this salt. It is composed of sulfuric acid and iron.

Crossing the Shed
Is the set of all the movements required to roll the felt successively on all sides of its shape and to full it on each of these rolls.

Uncapping.
This is to unravel the pile using a card.

Uncapping.
The pile of hides is often filled with dust and foreign matter, which must be removed: this is what is called, in art terms, uncapping. This operation is performed using a type of small card, known as a carrelet.

The worker gently moves this tool over the pile, and then beats the hide with a stick on the opposite side; he continues these two operations until, by vigorously shaking the hides, no more dust comes out.

Gilding.
This is the finest hair that is applied to the surface of felts.

Dressing.
This involves placing the hats on the last to give them the proper shape.

Trimming or dehairing.
The hair of beaver, rabbit, hare, etc., is composed of down and guard hair. Manufacturers have used various methods to separate this guard hair from the down.
The words dehairing (*ébarbage*) and dehairing (*éjarrage*) seem roughly synonymous; however, there is a slight difference between them. We have already mentioned that in beaver and rabbit skins, the guard hair adheres less to the skin than the down; it is because of this property and given the greater length of the guard hair that we strive to remove it. This is what is called trimming, while trimming is also applied to it, but more commonly to hare skins, whose guard hair adheres more closely to the leather than the down.

Strapping.
After partially fitting the hats onto the appropriate lasts and securing them with a string, they are immersed in a bath of pure boiling water to drain them and extract the cream of tartar that the hair may contain. After holding them for a few moments in the covered kettle, they are re-trimmed and placed on trays similar to those used in the shed, with a rim at their lower end that carries the water flowing from the felts out of the shed. The felt is then pulled onto the last until it is firmly attached and has no creases. Two turns of string are then tied around the middle of the last using a slipknot that is tightened moderately.

Fraying.
This operation is also known as tearing.

Felts.
Materials used for hat making that have been converted by shaping into a type of fabric called felt.

Felts called Flemish hair.
This name comes from the fact that this method of preparation was originally imported from the factories of Flanders. This felt is most often made with pure hare hair and is brushed with a rubbing tool during the shedding process, which produces a very long and smooth pile, which constitutes its quality and principal beauty.

Gilded felts.
The name gilded felts is given to those of ordinary or inferior quality, whose outer surface is covered with a thin layer of finer material or hair.

Scribbly felts.
We have already explained what is meant by scribbly; We will add here that snagged felts are those which, after being worked and pressed between the fingers, by sliding them horizontally over each other, still exhibit the roughness and grain that constitute snaggedness. This defect is caused by:
1. the felt was too short-handled by the worker, in order to make it reach the desired size more quickly;
2. a flaw in the blending process that produced a fabric too soft to be snagged more.

Snagged felts.
These felts, after being made and pressed between the fingers as above, exhibit points where the fabric has so little consistency that it is on the verge of unfelting or, if you prefer, of losing the adhesion and interlacing of the down that is the result of basting and fulling. According to Mr. Morel, this defect arises from the fact that the felt, having been built too large, and finding itself affected by a crowd before being reduced to the required dimensions, the worker continued to full the felt in the hope of reducing it; or else, when having been built in the correct proportions, the too-loose fabric spread at the pelvis and peeled off towards the end of the shedding process. When this defect, the author adds, is carried to excess, it causes cracks and holes. We then say that the fabric has given way.

Feather felt.
So-called feather felts are a richer gilding process, using the finest hare and beaver hair. Generally, this gilding is applied only after the felt has been fulled, with the difference from the process for gilded felts, that for feather felts, several layers of hair or gilding are applied.

Fulling (of the).
The felt, after the basting process, is far from having the consistency, strength, and solidity required to ensure its durability; these qualities are given to it by means of fulling, which forces the hairs to fold in on themselves in all directions and thus tightens the fabric, making it more consistent, much stronger, or, in artistic terms, more substantial. The hairs, in this new arrangement, occupy less space than before; thus, the fabric shrinks in all directions. Also, the felt, upon leaving the frame, must be one-third or double the size it will be after shedding. This new felting is always carried out while hot, using certain agents that increase the felting quality of the materials, although this new method of action has not yet been chemically determined.

Singling.
Feathered hats, of whatever type, are singed before receiving the first application. To do this, when the worker has reduced the base to the size where it is to be applied, he drains it as much as possible using a rolling pin and passes the surfaces to which the application is to be made over a fire of straw or shavings to remove the hairs that cover them and would hinder the introduction of the hairs that make up the feather. After this singing, a light rubbing is given to thoroughly clean these surfaces.

Smoking cloth.
Wet cloth placed on the felt to soften it.

Gum arabic.
This gum is of the same nature as that which oozes from the bark of apricot, almond, cherry, plum, etc. trees. Gum arabic is solid, often in globules, odorless, with a bland flavor, transparent, colorless when pure, golden yellow, or more or less reddish when combined with foreign matter.

Grigne.
Asperities seen on felt when it is not well drawn.

Indigo.
This coloring matter is provided by the leaves of several plants, almost all of which are classified in the genus to which, because of this property, the name indigo is given. The plants from which it is most particularly extracted are:
1. Indigotifera argentea, the wild indigo tree. This species produces less than the others; but, on the other hand, it is the most beautiful.
2. Indigotifera tinctoria, the French indigo tree; this is the one that produces the most, but it is also the least attractive of all.
3. Indigotifera disperma, or Guatimala. This plant is the tallest and most woody; its indigo is better than the previous one.
4. Indigotifera anil, or anil. Its indigo is at the minimum oxidation state.

These plants are native to India and Mexico, from where they were transported to the two Americas, China, Japan, Madagascar, Egypt, etc.

Jar.
Blackish, shiny hair that is very coarse and does not felt.

Luster.
Luster brush used for polishing hats; there are also semi-luster brushes.

Handles.
A type of instrument composed of leather soles, with which the worker dips the unrolled felts into the kettle without burning themselves at each rolling, even the felts that have been finished rolling; the felt is then very hot.

Walnuts.
This name is given to a round growth produced on the buds of Linnaeus's Quercus infectoria, by the bite of an insect named by the same naturalist Cynips quercus folii, and by Geoffroy, Diplolepsis gallae tinctoria. This oak is very common throughout Asia Minor; it is found from the coasts of the Archipelago to the borders of Persia, and from the banks of the Bosphorus to Syria, etc.

Oxygen.
A gas that accounts for twenty-one percent of the composition of atmospheric air, and which, by combining with metallic substances, transforms them into oxides or rusts.

Red and black balls.
This woolly hair comes from the Orient, and takes its name from the ball-like shape it is given in the bales used for this transport; it is produced by goats of a particular species from Asiatic Turkey. There is a notable difference between red and black balls of wool. The latter felt more easily, but the red hair is much finer. Tibetan goats also have very fine down, in addition to the awn. It has been observed that our goats also have, in addition to their long hair, a type of wool excellent for hat making.

Ball.
A piece of padded panne that is passed over felts.

Piece.
A piece is a copper tool used to remove the liquid and any impurities that may be contained in the felt.

Dip.
In hat making, what ordinary dyers call a fire, is called a dip or a hot dip. Each dip or fire lasts one and a half to two hours.

Thumb.
This is the name given to a finger of leather used to protect the tool from the sharpness of the tool when the awn is pressed against the sharpness of the tool with that finger.

Trimming (the)
Flemish hats and those with plumes must first be combed; ordinary fur hats must be trimmed, that is, the surface is gently brushed with a piece of dogfish skin, to produce a short, thick, and fine hair.

Shakos.
The shako is a headdress peculiar to the troops and takes various cylindrical shapes, sometimes tapering slightly at the top, and sometimes, on the contrary, widening considerably. Shakos are made like wool felt hats; they can also be made with silk plush, cotton, horsehair, or leather, and generally in the same manner as the various hats we have listed. Strictly speaking, shakos are hats of a particular shape, without a brim, with a leather crown and often fitted with a patent leather visor.

Secreting.
Secretion is a process performed on hair to increase its felting properties. From the beginning, a decoction of marshmallow root and comfrey was used in France for this purpose, but with little success. It was around 1730 that a hatter named Mathieu brought the process of secreting hides using mercury nitrate from England.

Sunflower loaf.
This coloring substance is made in Auvergne, Dauphiné, etc., from several lichens, mainly from Varidaria orcina d'Achard. The process consists of pulverizing the leaves of these lichens, making a paste with urine and half their weight of gravelly ash, taking care to add more urine as it evaporates. After forty days of putrefaction, this mixture acquires a purple color; It is then placed in another trough, and more urine is added; this is when the blue color develops. This paste is then divided and urine and lime are added. As a final preparation, carbonate of lime is added to the resulting paste to give it consistency, and it is ground into small loaves that are then dried.

Violin.
The term violin refers to an assembly of sixteen to eighteen whip cords, about eight feet long, which are held by their ends in two cleats pierced with a sufficient number of holes spaced two to three inches apart. The cords thus arranged whip easily when, with one of the cleats fixed to the floor, the carder strikes repeatedly in front of him with the other cleat, which is equipped with a handle a foot and a half long. The worker must be careful to stir the pile from time to time with two sticks so that the mixing or working takes place evenly; he continues to whisk until the various materials are well blended, which in the art is called "erased."

END.