

Felt. 1. (*Fabric.*) Fur and wool fibers have barbed surfaces inclined from the root towards their tips. Under the influence of friction and heat these barbs spread out from the main fiber, and, like the tendrils of a plant, catch hold of other fibers and cling to them. When a mass of such fibers are disposed in all directions, they readily interlock and consolidate into a compact fabric. As these barbs all incline in one direction, the fibers can readily work into a mass of fibers, partially felted, but end foremost. This is called *sizing*, and is produced in napping hats.

Felt probably preceded woven fabrics. In Central Asia, the home of the argali, from whence the domestic sheep has probably sprung, the clothing and tents of the people are yet, and have been since the first recorded times, felted fabrics. The latticed huts referred to by Herodotus and Æschylus are covered with felt, of which also the flapping screen which answers for a door is made. See WAGON. Marco Polo (thirteenth century) describes them fully. Klapproth describes them as of goat's hair (see HAIRCLOTH), and having a shaggy villus on the outside. The Chinese traveler, Chi-fa-hian, who visited India in the fourth century, describes the people of Chen-chen, who lived about the Lake of Lob, as wearing dresses of Chinese cut, but made of felt. Felt covered the funeral pile of Hephæstion, whose obsequies were so splendidly celebrated by Alexander; Xenophon says that felt was used to cover chairs and couches; the Medes also used felt for sacks.

The word *felt* is allied to the Greek *pilos* and Latin *pilus*, from a root word which means to *compress*. The Greek word **pilotos*—felted—comes strangely near the English *pilot-cloth* in name and meaning, not but that the latter is woven before being thickened by the act of compression (Latin, *cogo, coactus*, whence *coactilis*).

"Lanæ et per se coactæ vestem faciunt."

PLINY.

The principal use of felt among the Greeks and Romans was in the manufacture of caps and hats. (See HAT.) The art of felting no doubt passed from Central Asia into Greece. In the time of Aristotle, besides the felt hats (*petasi*), the helmets were lined with felt (*pilos*) or sponge.

The mantles of Circassia and Phrygia to this day are heavy, stiff, and rain-proof. Colonel Leake describes a postilion's dress in Phrygia as a cloak of white camel's hair half an inch thick and stiff enough to stand alone when set on the ground. It had neither sleeves nor hood, but holes for the hand and projections like wings on the shoulders to turn off the rain.

The Armenians of Schamachi lead a nomadic life in movable huts constructed of wicker-work covered with felt, and with mats made of reed-grass.

The Nogai Tartars of the Caspian have similar shelters.

The hatters attribute the art of felting to Clement. The hatters are a very modern guild, and cannot antedate their order beyond the year 1400.

Dr. Hooke lectured on felt-making before the Royal Society, 1666. — PEPYS.

The mechanical features of the operation of felting are derived from the jagged character of the edges of some animal fibers, which enables them to pass in one direction, that is, root first, but opposes their withdrawal. The most familiar illustration of this

feature is an awn of barley, a beard of wheat, or a head of grass of some kinds. These, as we all know, when introduced but first between the wrist and the sleeve, will crawl up the arm and strongly oppose withdrawal. The teeth are presented towards the point, and resist a force applied from that direction.

If we take a human hair, hold it fast by the root-end, and draw it gently between the finger and thumb, it passes smoothly and without sensible interruption; but if we reverse the direction of motion, a sensible crepitation is experienced. If we gently press a hair between the finger and thumb, and give it a rolling motion, it will advance root first, whatever may be the position of the root in respect to the two rubbing surfaces. A fiber of wool operates in the same way, moving root first; so do the hairs which are adapted for felting when similarly treated.

The jagged structure is visible in the beard of wheat and barley, and the microscope reveals it in the hair and wool referred to.

It would be interesting to introduce various other examples of hair

and wool, as seen under the microscope, but our limits forbid. *a*, in the illustration, shows the appearance under a microscope of a fiber of Saxony lamb's wool somewhat less than $\frac{1}{1000}$ of an inch in diameter.

f shows the appearance of rabbit-hair under the microscope, and *b* beaver-down, which has a diameter of about $\frac{2}{1000}$ of an inch.

c, *d*, *e* show musquash, nutria, and hare's fur. They all show the jagged edge which confers upon them the characteristic felting quality.

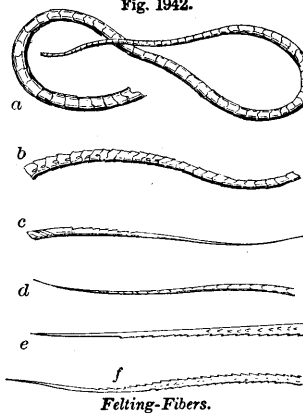
Wool in the yolk, with the natural grease (*suint*) adhering to it, will not felt, because in this state the asperities of the fiber are filled and smoothed over, just as oil destroys the action of very fine files. Fine wool that has been scoured has strong tendency to mat or felt together, and must be oiled to enable it to be carded and spun successfully.

The hair of rabbits, hares, and some other animals, is used in Russia as a felt foundation for bowls, dishes, plates, etc. It is brought to shape and then varnished; when complete, the utensil resembles papier-maché or varnished leather, and is light and durable.

English patent 1,403 of 1862 cites the use of the silky down of *typha* or bulrush. The down is separated from the seeds by a willowing process and blown over into a chamber. It is mixed with one third or half the quantity of rabbit's hair, and worked by the usual processes into hats, caps, and fabrics; or mixed with silk, wool, cotton, or flax to form a fabric for shoe-soles, paper, etc.; or mixed with caoutchouc or gutta-percha for bands, belts, carriage-fitting, accouterments, pipes; as a substitute for cork, book-covers, etc.

The uses of felt are various; among them may be cited the following:—

Fig. 1942.



Among the Asiatics: cloth, hats, carpets, tent-coverings, socks.

In the United States and Europe, for domestic purposes: cloth, clothing, socks, slippers, boot and shoe soles and insoles, hats, caps, gloves, carpets, and table-covers.

Surgeons' bandages and saddle-cloths.

Mechanical: clothing for steam-boilers and cylinders; deadening for walls and floors; non-conductors for kilns and refrigerators; roofing charged with bitumen or other water-repellant; steam-packing; lining between the planking and copper-sheathing of ships; polishing-wheels; hammers of pianos; elastic blankets for printing-presses; covers of books.