

FELT (cognate with Ger. *Filz*, Du. *vilt*, Swed. and Dan. *felt*; the root is unknown; the word has given Med. Lat. *filtrum*, "filter"), a fabric produced by the "matting" or "felting" together of fibrous materials such as wools, hairs, furs, &c. Most textile fibres (see FIBRES) possess the quality of matting to some extent, but wools, furs and some few hairs are the only fibres which can be felted satisfactorily. It is probable that the quality of felting must be attributed to the scale structure and waviness of the wools, furs and hairs referred to. When it is desired to incorporate non-felting fibres in felt cloths, wool must be employed to "carry" them.

There are two distinct classes of felts, viz. woven or "thread-structure" felts, and "fibre" or true felts. In the manufacture of thread-structure felts, wools possessing the quality of felting in a high degree are naturally selected, carefully scoured so that the felting quality is not seriously damaged, spun into woollen yarn possessing the necessary fibre arrangement and twist, woven into cloth of such a character that subsequently satisfactory shrinking or felting may be effected, and finally scoured, milled in the stocks of machine of both, dyed and finished on the lines of an ordinary woven fabric. The lighter styles of woven felts may be composed of a single cloth only, but for the heavier styles two or more cloths are woven, one on top of the other, at one and the same time, arrangements being made to stitch the cloths together during the weaving operation.

Fibre felts are exceedingly interesting from the historical point of view. It is now generally admitted that the art of

weaving preceded that of spinning, and it must further be conceded that the art of felting preceded that of weaving, so that the felt fabric is probably one of the oldest of the various styles of recognized fabrics. The inhabitants of the middle and northern regions of Asia seem to have employed felt from time immemorial, as clothing and also as a covering for their habitations. Most of the classical writers refer to it and some of them actually describe its manufacture. Felt was also largely employed by the ancients for their hats, outer garments, and sometimes as a species of armour.

Fibre felts may be divided into three classes, viz. ordinary felts; hat felts; and impregnated felts. As all felts are based upon the ordinary felt, the process of manufacture of this will first be described. Of the wools employed the principal are:—East Indian, German or mid-European, New Zealand cross-breeds, and Australian, Cape and Buenos Aires merinos. Vegetable fibres and silk are also employed, but wool must be used to “carry” them; thus a good felting wool may be made to carry its own weight of cotton, hemp, &c. Hairs and furs are principally used in the hat felts. The average loss upon the wool from the raw state to the finished felt is 40 to 50%. The order of the manufacturing processes is as follows:—mixing, willowing, teasing, scribbling and carding. It is interesting to note that it is not usual to scour felting wools. This is not because they are really clean—some are dirty—but because the felting property is liable to be interfered with in the scouring operation. Some wools, however, must be scoured to ensure satisfactory working in the machines. From the card the wool is delivered as a gossamer-like film from 50 to 60 in. wide on to an endless sheet from 30 to 60 yds. long, upon which the felt is built up film upon film until the required thickness—perhaps 4 in.—is obtained. To harden this somewhat tender sheet of felt it is now passed through an ironing process, effected by either steam-heated rollers—to which a rotatory and vibratory motion is given—playing upon the continually drawn-through cloth; or a huge vibrating flat-iron, to which the cloth is automatically fed, held in position and then wound up while the following length to be treated is drawn under the iron. Soaping, fulling or “felting” and the ordinary finishing operations—including dyeing and printing if desirable—now follow, so that ultimately a strong firm fabric is turned out. It must be admitted, however, that the strength is much greater lengthwise than cross-wise, owing to the parallelization of the fibres induced in the scribbling and carding operations. Of course, the true felting or contraction occurs in the fulling or felting stock, the fabric being perpetually “hammered” in the presence of fulling agents such as soap, fuller’s earth, &c., for a considerable time. The reduction in width, length and thickness is remarkable. This may be controlled within certain limits. The principal styles of ordinary fibre-felts are—linings for coats, furniture and rubber shoes; saddlery; seatings for carriages and pews; carpets, surrounds and under-felts for carpets; mantles, dresses and table-cloths; felt-slippers; mattress felts; chest-preservers, and shoulder-pads; steam-engine packing, motor-car and anti-vibration felts, shipbuilding felts; drawing-roller felts and gun-wad felts.

Hat felts may be divided into two classes, viz. those made from wool and fur respectively. Wool “bodies” used for the lower quality hats are manufactured in the same way as ordinary felts, but the “shape” upon which the film issuing from the carder is built up takes the form of a double cone and thus approximates to the shape of the two hats ultimately formed. The shape is further controlled and developed in the fulling or felting operation. In the fur hat felts an air-blast is employed to carry the finely separated fibres on to the shape required, upon which shape the fibres are held in position by suction until the required thickness is obtained. The structure is then further developed and “stiffened,” *i.e.* impregnated with certain stiffening agents according to requirements. If desirable the exterior fibres blown on to any shape may be of a different material from the body fabric.

Impregnated felts are simply felts made in the ordinary way

but subsequently impregnated with certain agents which give a special quality to the fabric. Messrs McNeill & Co., of London, were the originators of “asphalted-felt” for roofing and, among other styles, place on the market sheathing felt, inodorous felt, dry hair felt, foundation felt, &c., &c. A later development, however, is the impregnated iron-felt manufactured by Messrs Mitchells, Ashworth, Stansfield & Co., of Waterfoot, near Manchester, who not only produce from 70 to 80 % of the ordinary felts manufactured in Great Britain, but also place on the market several specialties of which this “iron-felt” is largely used in the construction of bridges, &c., and as a substitute for rubber, it being apparently more durable. (A. F. B.)