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# Fulling

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Fulling

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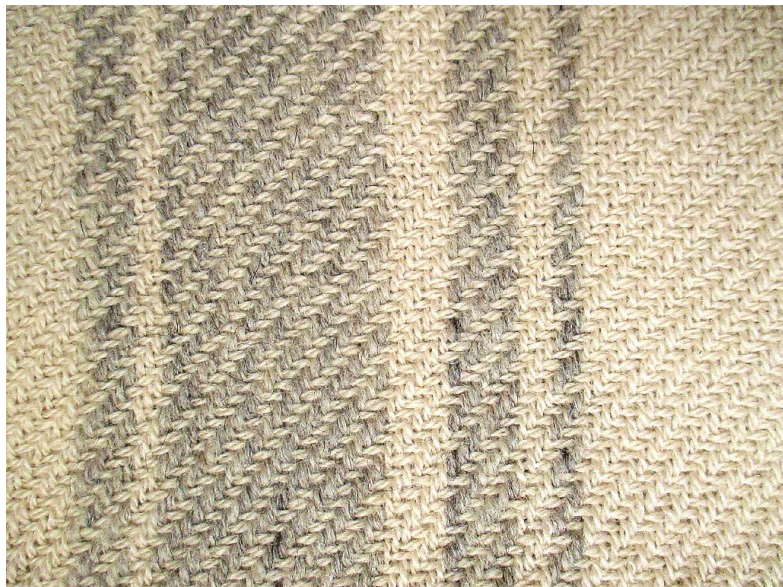
# Fulling ( Aesthetic Finish )

**Fulling** is a permanent finish used on wool fabrics; it is also known as **milling** or **felting**.

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# Fabric Examples



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# Process

**Fulling** involves two processes



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graph LR; A[Fulling involves two processes] --> B[Scouring]; A --> C["Milling (thickening)"]
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**Scouring**

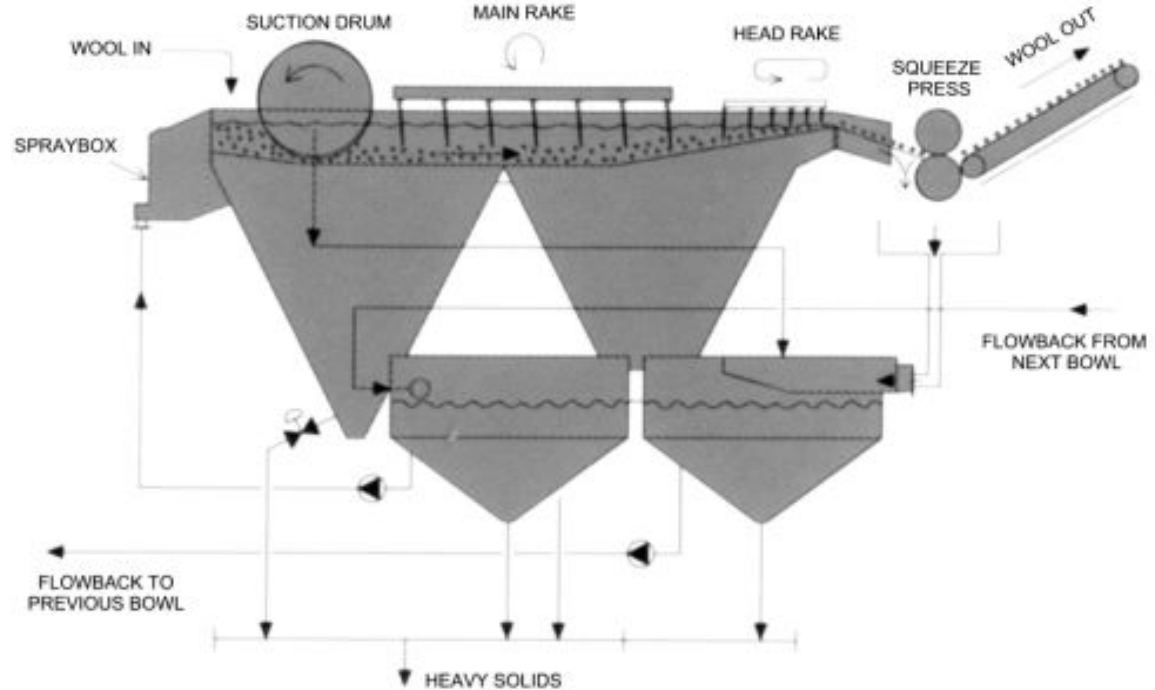
**Milling  
( thickening )**

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# Scouring

The open, blended wool is scoured in a series of bowls containing hot scouring liquor, followed by cold and hot water rinses. The scouring water is normally around 60-65°C, which is hot enough to melt the wool wax (or grease). Detergent is added to help remove the dirt from the fibres and to emulsify the wax so that it does not re-deposit on the wool.



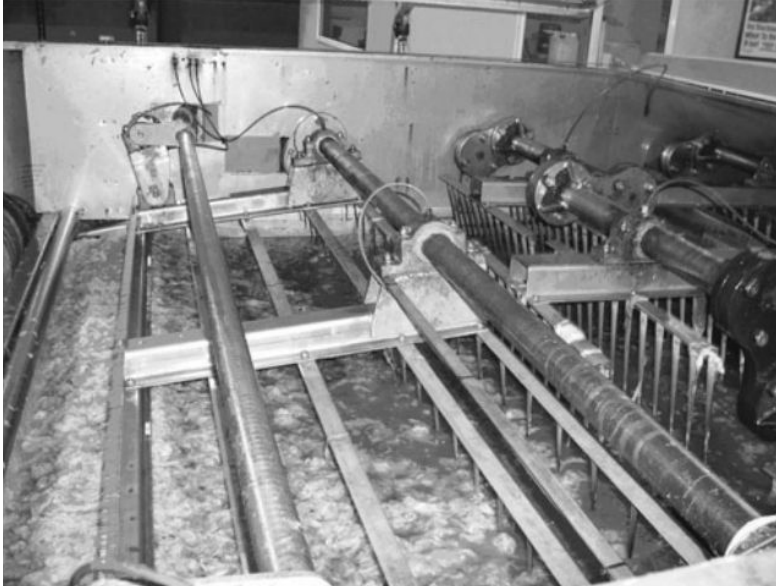
It shows the parts of a typical scouring 'mini-bowl', which is the basis of most modern scouring lines.

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# Scouring

As the wool enters each bowl, it is pushed under the surface to wet it thoroughly with the liquor in that bowl. A set of metal teeth (rakes or harrows) gently drags the wool through the liquor, as shown in the picture. When the wool reaches the other end of the bowl it is lifted up into a pair of rollers that squeeze the liquor out of it. The wool is then dropped into the next bowl where the process is repeated.



The suint dissolves quickly in the first bowl while the wax and dirt particles are steadily removed by a combination of detergent action, mechanical agitation and gravity, and by the pressure applied by the squeeze rollers. As the wool moves through the bowls it becomes cleaner, and moves into cleaner liquor. The liquor flows in the reverse direction to the wool movement and is discharged from the first bowl for treatment. Wool grease is extracted from this effluent and refined for a variety of uses. Finally, the wool is rinsed to remove the detergent and to eliminate the remaining solids.

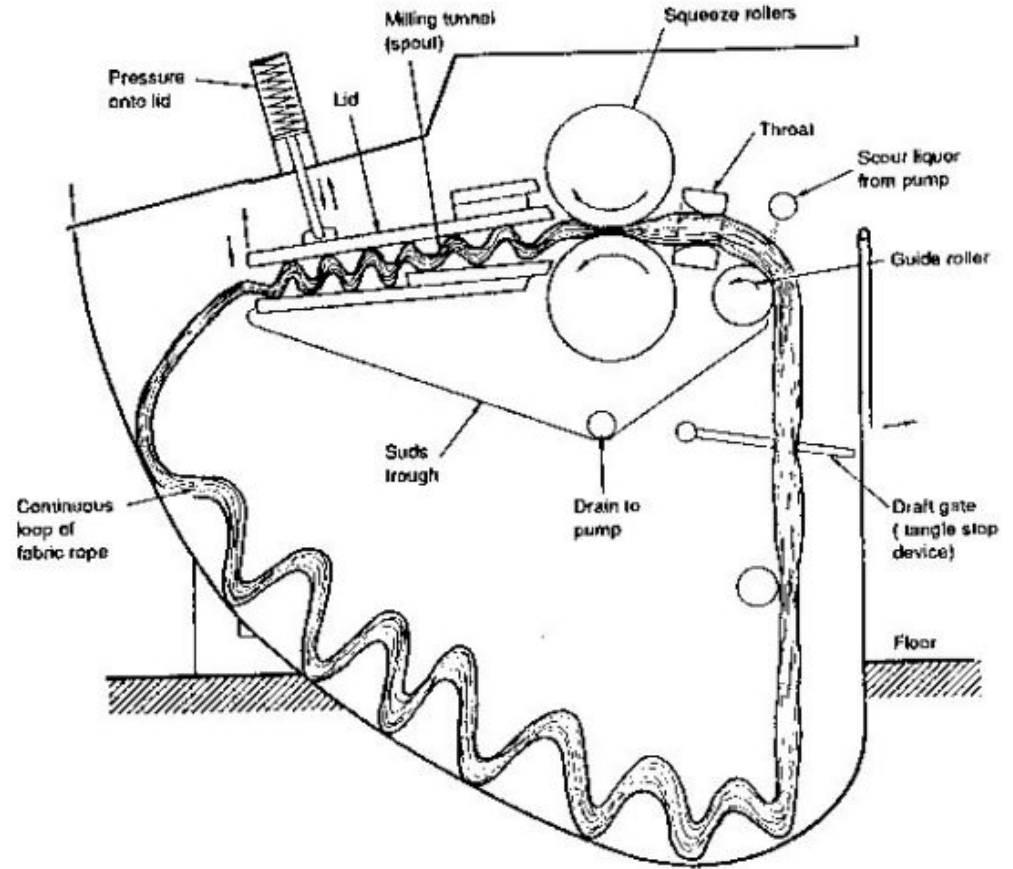
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# Milling

In piece milling the fabric is sewn into a tube, called bagging, with the fabric face protected inside the tube. Bagging allows the fabric rope to balloon, which prevents wrinkles and creases from being milled in. As shown in the picture, the fabric rope is moving in an anticlockwise direction, being lifted out of the milling liquor, through the draft gate, over the guide roller and into the throat piece.

Just before entering the throat, the fabric rope is sprayed with liquor. The fabric rope then enters the squeeze rollers and milling tunnel. The squeeze rollers and the milling tunnel, which is like a stuffer box, act mechanically on the wet cloth. The draft gate pulls lengthwise to reduce the cloth width and stops the squeeze rollers if a tangle occurs.





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# Different substrates give varying results

1. The higher the percentage of wool, and of fine wools in the blend, the faster the milling.  
Short wools mill more quickly than long wools.
  2. Fabrics made from open-structured woollen yarns mill faster than those made from worsted yarn.
  3. Low-twist yarns mill faster than high-twist yarns.
  4. Tight fabric structures are slow to mill.
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## Process variables affect the milling :

1. The number of passes the fabric makes through the squeeze rollers, which can be set on modern machines.
  2. The mechanical action of both the squeeze rollers, and the milling tunnel, which are machine controlled.
  3. The milling bath temperature. Increasing the temperature makes fibres more mobile and so the milling rate increases. However, dye-bleeding is more likely at higher temperatures.
  4. Liquor ratio. As the liquor ratio is reduced, the milling rate increases. Above a liquor ratio of 12:1, milling is slow. The draft gate and squeeze rollers control the amount of water in the cloth during mechanical action.
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# Purpose

The purpose is to make the object tougher. If it used without fulling, the object will likely pill and shed fiber until it falls apart.

Fulling refers to the use of heat, moisture and extreme agitation to make a wool fabric shrink and therefore become stronger and warmer.

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Thank you

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