

UNITED STATES PATENT OFFICE

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FELTING AND SHRINKING PROCESS

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This invention relates to the manufacture of felt bodies such as, and particularly, hat bodies, and to a felting and shrinking process for use therein.

Felt bodies, such as hat bodies, are ordinarily formed from much larger bats of loosely meshed fibres, these bats being hardened and treated to cause felting together of the fibres and shrinking of the bat. The felting and shrinking are produced by subjecting the bat while advancing to working or kneading action in the presence of hot water.

The felting and shrinking operation is usually performed by a machine called a "multiroller," having superposed beds of rotating rollers between which the bat is advanced under pressure while repeatedly wet with hot water. The rollers of one or both beds are reciprocated transversely or longitudinally of the bed, or in both directions, to produce opposite reciprocatory working or kneading of the upper and lower surfaces or plies of the bat.

A typical multiroller of the type in which the rollers directly engage the bat is shown and described in United States patent of Wheeler, No. 1,716,401, dated June 11, 1929. The machine may have only two beds of superposed rollers, as shown in this patent, or it may have three such beds, forming in effect two sets of superposed beds between which the bats are successively passed. Although the machine shown in this patent has only an endwise reciprocation of the rollers, one or more of the beds of such machines may also be given a longitudinal reciprocation. In some machines, the bats are advanced on or between flexible belts which are interposed between the bats and one or both of the beds of rollers.

In the felting and shrinking process as performed with such machines in the past, the bats are advanced at a uniform rate and are subjected to uniform conditions of oscillatory working action until the desired degree of felting and shrinking has been obtained. This may entail passing the bat several or numerous times through a single machine, or one or more times through several machines arranged in series.

I have discovered that optimum conditions of heat, pressure, oscillatory working and rate of advance vary markedly as the felting of the bat progresses. Thus, in the initial stages of the process, the optimum working action is produced by a short oscillatory stroke of the rollers at a high rate under low pressure and with low water temperature and a high rate of advance of the bat, but that, as the felting of the bat progresses

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and the bat becomes tighter, the optimum stroke length, pressure and water temperature increase, whereas the optimum rate of oscillation and of advance of the bat decrease.

In the process of my invention, in its preferred form, all of these elements of the felting operation are subjected to controlled variation so that close to optimum felting conditions are maintained throughout the felting and shrinking operation. Thus, according to the preferred practice of the invention, the pressure, length of stroke and water temperature are initially low and are thereafter raised so that they are relatively high at the end of the process, whereas the rate of oscillation and of advance of the bat are high at the outset and are reduced so that they are relatively low at the end of the process. Preferably, these correlated changes are made in unison and progressively, that is, in successive steps or increments, throughout the processing cycle.

For example, in a preferred practice of the invention applied to the production of wool felt hat bodies, I start the operation with a working oscillatory stroke of the rollers of about $\frac{1}{8}$ inch, a rate of oscillation of 700–1000 strokes per minute and a pressure on the bats of about $\frac{1}{2}$ to 5 lbs. per inch of length of the rollers. The temperature of the water with which the bats are sprayed is about 90° F. and the bats are advanced at a rate of about 16 feet per minute. During the treatment, the length of stroke, the pressure and the water temperature are progressively raised to respective maxima of about $\frac{1}{4}$ inch stroke, 25–50 lbs. pressure per inch length and 180° F. water temperature. Also, the rate of oscillation is reduced to about 300–500 strokes per minute and the rate of advance of the bat is reduced to about 6 feet per minute. A better quality of felted hat body is thereby obtained and the operating time required is substantially less than in the prior practice of maintaining the operating conditions uniform throughout the process.

While best results are obtained by increasing stroke length, water temperature, and pressure, and by decreasing rate of advance and rate of oscillation, as is preferred, improved results are also obtained by increasing the pressure, the length of stroke and water temperature, leaving constant the rate of advance or the rate of oscillation or both. Thus, in the preceding example, the rate of advance may be maintained at about 8–12 feet per minute and the rate of oscillation may be maintained at about 500 to 700 strokes per minute.

The process may be performed by passing the

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bats one or more times through each of a series of multirollers, in which case, according to the preferred practice, successive machines are so adjusted that the pressure, length of stroke, and water temperature are higher and the rate of stroke and rate of advance are lower than in the preceding machine. The process may also be performed with a single multiroller machine, which will normally require many passes of each bat through the machine in order to complete the felting and shrinking process. In such case, the operational changes above indicated may be made progressively, as at intervals of one or two passes of the bat through the machine, by the use of variable controls in the oscillating and rotating drives to the rollers and in the pressure-applying mechanism and water heating system.

Having described the method of the invention in preferred form, what I desire to claim and secure by Letters Patent is:

1. The method of felting and shrinking a fibre bat after hardening to form thereof a felt body which comprises advancing the bat while subjecting a surface thereof to oscillating working motion relative to its other surface parallel to the plane of the bat and while applying pressure and water to the bat, and during the process progressively increasing the length of said oscillatory working motion, the amount of said pressure and the temperature of said water and progressively reducing the frequency of said oscillatory motion.

2. The method of felting and shrinking a fibre bat after hardening to form thereof a felt body which comprises advancing the bat while subjecting a surface thereof to oscillating working motion relative to its other surface parallel to the plane of the bat and while applying pressure and water to the bat, and during the process progressively increasing the length of said oscillatory working motion, the amount of said pressure and the temperature of said water and progressively reducing the rate of advance of the bat.

3. The method of felting and shrinking a fibre bat after hardening to form thereof a felt body which comprises advancing the bat while subjecting a surface thereof to oscillating working motion relative to its other surface parallel to the plane of the bat and while applying pressure and water to the bat, and during the process progressively increasing the length of said oscillatory working motion, the amount of said pressure and the temperature of said water and progressively reducing the frequency of said oscillatory motion and the rate of advance of the bat.

4. The method of felting and shrinking a fibre bat after hardening to form thereof a felt body which comprises advancing the bat pressed between superposed beds of rollers while oscillating the rollers of one of the beds parallel and relative to the other said bed and while applying water to the bat, and as the felting and

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shrinking action progresses, increasing the length of the oscillatory stroke of said oscillating rollers, the pressure of said rollers on the bat, and the temperature of said water, and reducing the frequency of the oscillating stroke of said oscillating rollers.

5. The method of felting and shrinking a fibre bat after hardening to form thereof a felt body which comprises advancing the bat pressed between superposed beds of rollers while oscillating the rollers of one of the beds parallel and relative to the other said bed and while applying water to the bat, and as the felting and shrinking action progresses, increasing the length of the oscillatory stroke of said oscillating rollers, the pressure of said rollers on the bat and the temperature of said water, and reducing the frequency of said oscillatory stroke of said oscillating rollers and the rate of advance of the bat.

6. The method of felting and shrinking a wool fibre bat after hardening to form thereof a hat body which comprises advancing the bat pressed between superposed beds of rollers while oscillating one of the beds parallel and relative to the other and while applying water to the bat, and as the felting and shrinking action progresses, increasing the length of the oscillatory stroke of said oscillating rollers from about $\frac{1}{8}$ to about $\frac{1}{4}$ of an inch, increasing the pressure of said rollers on the bat from about $\frac{1}{2}$ -5 lbs. per inch of roller length to about 25-50 lbs. per inch of roller length and increasing the temperature of said water from about 90° F. to about 180° F.

7. The method of felting and shrinking a wool fibre bat after hardening to form thereof a hat body which comprises advancing the bat pressed between superposed beds of rollers while oscillating one of the beds parallel and relative to the other and while applying water to the bat, and as the felting and shrinking action progresses, increasing the length of the oscillatory stroke of said oscillating rollers from about $\frac{1}{8}$ to about $\frac{1}{4}$ of an inch, increasing the pressure of said rollers on the bat from about $\frac{1}{2}$ -5 lbs. per inch of roller length to about 25-30 lbs. per inch of roller length, increasing the temperature of said water from about 90° F. to about 180° F., reducing the frequency of the oscillatory stroke of said oscillating rollers from about 700-1,000 per minute to about 300-500 per minute, and reducing the rate of advance of the bat from about 16 ft. per minute to about 6 ft. per minute.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
240,870	Wharton	May 3, 1881
1,533,345	Smith	Apr. 14, 1925
1,716,401	Wheeler	June 11, 1929
2,112,207	Genest	Mar. 22, 1938

Certificate of Correction

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February 7, 1950

MANFRED T. HOFFMAN

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows:

Column 4, line 45, for "25-30 lbs." read *25-50 lbs.*;

and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 23rd day of May, A. D. 1950.

[SEAL]

THOMAS F. MURPHY,

Assistant Commissioner of Patents.