COLD MILLING: INNOVATIVE TEMPERATURE/HUMIDITY CONTROL ON MILLING OPERATION

A. Galiotto and A. Peruzzi

1 Erretre spa - Italy

a)Corresponding author: adriano@erretre.com

Abstract. Air temperature and humidity are fundamental in the milling operation. There is a complicated correlation between air conditions and leather moisture that is practically impossible to predict in industrial process. Many important characteristics like softness, grain, pebble, yield depend on leather moisture. This patented system is the latest improvement in milling drums technology that keeps the leather cooler and allows a precise and optimal humidity control. Designed for soft, tight-grained leathers, especially from organic tannages and opened to a wide range of new operating conditions impossible with traditional machinery. The original new design makes the milling drum completely independent from the outside environment with many advantages: consistency over seasons, shorter transition time, energy savings.

1 Introduction

In the leather industry “milling” is meant a mechanical processing in which leathers are subjected to mechanical action due to its rolling/falling inside the cylindrical body which constitutes the main part of the milling drum.

Simultaneously with the mechanical action, it is possibile to have a conditioning of the material present inside the cylindrical drum by means of air subjected to predetermined temperature and humidity. Temperature and humidity controls and dust filtration are demanded to external unit identified with name “deduster”.

The application of a dedusting unit on wood milling drum starts between 1920-1930 [2], stainless steal milling drum starts mid-seventy. This new generation of drums were improved for dust removal and air conditions control [3]. New heating and humidifing unit were designed and milling became a key operation in many articles to enhance leathers’ features. Thanks to the success of this first generation of controlled milling drums a large number of innovations were introduced in the period 1990-2010 like filter performance and air quality control [4], chemicals injection [6]. As result of those innovations consistent mass production and an automatic and easy to use machine is what the market know nowadays.

2 Result and discussion

Physics behind milling drums can be briefly summarized as follow: leather are treated by centrifugal force in a rotating drum; the amount of energy generated inside the drum by this movement depend on many variables: hides' number and size, thickness, drum size and construction, outside temperature, leather moisture, finishing/tanning chemicals.

This energy (potential and friction) raise internal temperature but the increasing rate is not predictable. Part of this energy will be absorbed by the structure, part lost, part remain on hides. The result of this energy, continuously generated during the whole process, impact on the

temperature and humidity control. Production data show this energy is able to increase inside air temperature from 5 to 15°C.

This temperature growth could affect milling operation in some critical situation and caused undesired results. This can be analyzed on a batch process, like milling, only trough a production data registration and comparison with quality inspection.

Some different design were tried [1] in order to improve temperature control but no one of this consider this “self generated” energy before the Erretre Cold Milling patent [5]. Standard milling drum exchanges air with outside to keep the temperature down, this air is normally dryer than inside air and as a results of that there are two negative impacts. Leathers dry out and drum sprays water inside to counteract this effect but never reach an equilibrium. Static energy is generated reducing de-dusting efficiency.

Work experience of those conditions is leathers' shrinkage with yield and grain quality loss. Temperature is the key parameter, air humidity and moisture depend on it.

The tannage and retan/fatliquor determines the drying out rate, all organic tannages loose water faster than chromium leathers so are very susceptible to low RH and high temperatures condition. Water is coming into the drum from the humidity control or from hides, changes on initial moisture cause variable milling results if perfect control is not realised.

The original Cold Milling design, recognized by international patent, is a new temperature control based on two separated circuits. Milling drum became a completely closed system, independent from the external ambient. No air exchange is needed during the process finding a solution of all limitations described previously.

Moreover, VOC contaminations are prevented, hides are always in contact with their own air and the emissions generated inside the drum during the process.

From the original idea tests started in 2018, several batches of different articles for a total of more than ten thousand hides from different customers and articles (mainly automotive seat and nappa shoes upper) were analyzed. Quality and appearance were checked by independent technician, a quality improvement and a reduced grain loss were detected as a results of this new technology.

For all batch tested initial temperature is constant thanks to energy absorbed by Cold Milling circuit.

3 Conclusion

Air temperature and humidity are fundamental in the milling operation. There is a complicated correlation between air conditions and leather moisture that is practically impossible to predict in industrial process.

Many important characteristics like softness, grain, pebble, yield depend on leather moisture. Cold Milling is the latest improvement in milling drums technology that keeps the leather cooler and allows a precise and optimal humidity control.

Production data show this original designed made for soft, tight-grained leathers, especially from organic-tannages can be opened to a wide range of new unattainable operating conditions with traditional machinery.

Cold Milling makes the milling drum completely independent from the outside environment with many advantages: consistency over seasons and locations, leather quality, energy savings. Comparison with the standard productions show the process can be extended without risk of looseness or yield lost.

References

1. *CN 203 247 270 U 23 october 2013*
2. *US 1 623 943 A 5 April 1927*
3. *EO 0 960 948 A1 1 December 1999*
4. *EP 1 690 950 A2 15 August 2006*
5. *WO 2018/172837 A1*
6. *EP 0 990 707 B1 11 February 2004*