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A study on wool scouring machines
Исследование по шерстомоечным машинам

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Abstract: *shorn wool contains mineral, vegetable impurities and suints. Mineral and vegetable impurities can be removed in burring process. The suints are removed in bowls of scouring machine filled with hot water containing soda-soap. This paper presents the results of the comparison of different types of wool-washing machines and their operating principles.*

Аннотация: *стриженая шерсть содержит минеральные, растительные примеси и жиропот. Минеральные и растительные примеси могут быть удалены в процессе трепания. Жиропот удаляется в процессе мойки сырья с использование содового мыла в горячей воде. В статье приведены результаты сравнения различных типов шерстомоечных машин и их принципы работы.*

Keywords: *wool fiber, mineral impurities, vegetable impurities, wool burring machine, wool scouring machine, harrow type, rake type, paddle type.*

Ключевые слова: *шерстяное волокно, минеральные примеси, растительные примеси, трепальная машина, шерстомоечная машина, боронный тип, грабельный тип, колесный тип.*

Wool is a natural fibre, directly sheared from sheep and widely used in textile industry as a raw material. Scouring is considered to be one of the main stages in wool processing, accuracy of which is important for achieving high quality product. Sheared wool contains sand, soil, vegetable matters and suints. Sand, soil, and vegetable matters can be removed in thrashing process, whereas suints are removed in bowls of scouring machine filled with hot water containing soda-soap [1, 2, 3, 4]. Conventional scouring machines consist of 5 bowls, 3 of which is filled with hot water and remaining 2 with cold water for rinsing purposes [1 2, 3, 4]. Each bowl has a wool transportation mechanism and in between the bowls there are squeeze rollers. They are the main mechanisms of scouring machine. Raw wool is scoured, moved, squeezed, and transferred to the next bowl by these mechanisms.

The wool transportation mechanism is one of the main and important mechanisms of wool scouring (washing) machine. It plays a crucial role in increasing the productivity of the machine and the scouring quality. There are 3 types of wool transportation mechanisms widely used in wool processing [5]. These are:

1) Swing rake machine

2) Harrow machine

3) Paddle machine

First two types of scouring machines are also denoted English methods. Because the initial rake and harrow type wool scouring machines has been patented and produced by the English inventors.

The swing rake machine is shown in Figure 1, in the figure, ***1*** represents the bowl or tank, forming the body or frame of the machine, contains the scouring or washing liquid, ***2***, which is the soda-soap mixture for cleaning the wool, the greasy wool may be fed into it by feeding conveyor ***3***, driven by belts or gearing in any ordinary ways. As the greasy wool drops from the feeding conveyor into the bowl, the prongs ***b***, of the first rake ***6*** catches and immerses in the scouring liquor and carrying it forward within the reach of the next rake. There are may be from 2 to 6 rakes in the rake machine. The rakes move the wool in the liquid to the clean it and pass it forward toward the squeeze rollers ***8***.

The rake ***6*** (Fig.1 and Fig.2.) has a motion given to it near the middle of the its handle ***j***, which is placed in joint ***c***, by a crank ***a***. Near the top of the rake there is a swivel joint ***e***, which allows the rake handle to pass up and down through it and back and forth through the liquid, to suit the motion of the crank, and to properly guide and steady it. By this arrangement the rake prongs ***b***, at their points will pass forward, and at the same time scour it by moving it through the liquid. At the end of the sweep they rise vertically out of the liquid and return to the original position.

The output conveyor *7* receives the washed wool and carries it up to the squeeze rollers ***8***, which squeeze out the liquid from the wool, and liquid runs back into the bowl. Squeeze rollers deliver the wool to the next scouring bowl. And scouring process continues in the next bowls.

Near the bottom of the bowl ***1***, there is a perforated false bottom ***5***, through which the liquid may pass, but not the wool, and below this bottom there should be a draw-off opening, ***9***, for the sediment or emptying the bowl of the washing liquid.

The harrow type machines are used for more than 100 years. One of the initial harrow machines was invented by English inventor William McNaught in 1900, and still using its improved versions in many scouring plants. The main inventors of improving of the harrow type machines are William McNaught, Thomas Hawkins, Frederic G.Sargent, Allan C.Sargent, Friedrich Bernhard, Joseph Tillinghast, Walter Oscar Milne and etc.

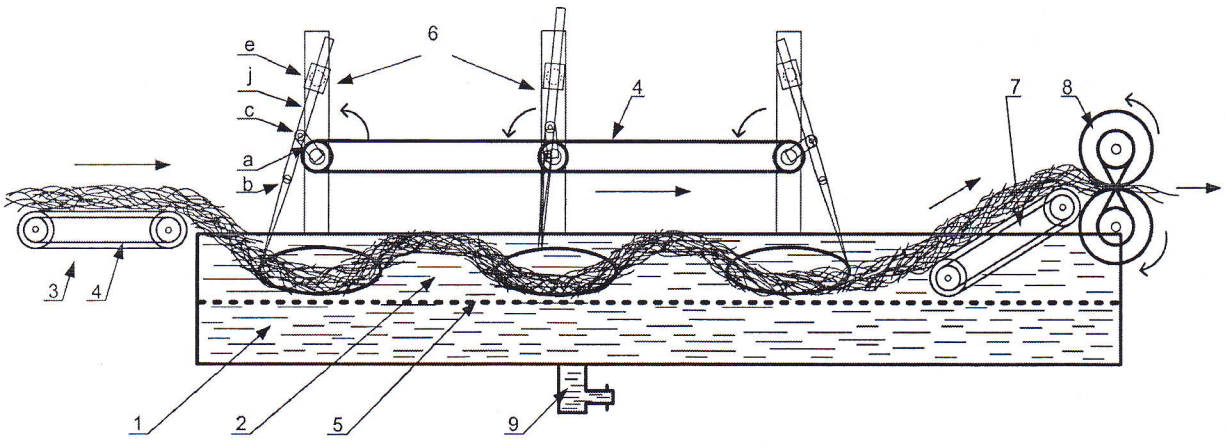

Fig. 1. Swing rake type machine

In the harrow type machine (Fig.2), as the swing rake machine in Fig.1., ***1*** represents th bowl or tank, forming the body or frame of the machine, contains the scouring or washing liquid, ***2***, raw or greasy wool may be fed into it by feeding conveyor ***3***, driven by belts or gearing in any ordinary ways. As the greasy wool drops from the feeding conveyor into the bowl, the prongs ***p***, which are all mounted on longitudinal girths ***h***, of harrow, **H**, catch and immerse in the scouring liquor and carrying it forward toward the output conveyor. On the wall of the bowl ***1***, secured standards or columns ***jj'***, provided at their upper ends with bearings for cross shafts O_2O_3, respectively. To each of said cross shafts are secured two

levers ***LM***, respectively. ***L*** and ***M*** levers are being three armed levers. The arms ***l*** and ***m*** carry each weights ***ii'***, said weights counterbalancing the weight of the harrow **H**. And the arms ***l1*** and ***m1*** are connected by rods ***ff'***, with the cross bars ***B*** and ***B'***. While the ***l'*** and ***m'*** of the three armed levers ***L*** and ***M*** are connected together by a rod ***g***.

It is obvious that, when one of the cross shafts O_2 or O_3 is oscillated the other will likewise be oscillated through the connecting rod ***g***, to impart to the harrow ***H*** the required rising and falling motion. This movement of the harrow required to and fro motion or sweep is imparted to said harrow through the following mechanism, supported from the standards or columns ***jj'*** at the feed end of the bowl: there is a rod ***e***, near the middle of which is pivoted to the arm ***l*** of lever ***L***, the other end of said rod ***e*** being pivoted to a lever ***c***, that is fulcrum at ***O4*** to an arm projecting rearwardly from the standard or column ***j'***. The lever ***c*** carries near its right end a roller ***d***, which rides on a cam ***b***, secured to a shaft O_1. On the shaft ***O1*** also secured a crank ***a***. The end of the crank is pivoted one end of a connecting rod ***k***, opposite end of the connecting rod ***k*** is pivoted to a cross bar ***B'***, secured to the longitudinal girths ***h*** of the harrow ***H***.

In the position of harrow operating mechanism the connecting rod ***k***, under the action crank ***a***, is slowly moving the harrow ***H,*** toward the delivery end until said crank is about to travel from its lower to its upper half circle, and which time the cam ***b***, acting on rod ***e***, moves the arm of the lever ***L*** upward, thereby revolving shaft O_2 toward the left, which movement is communicated to lever ***M***, thereon, whereby the harrow ***H*** is lifted out of the liquid ***5***. As said crank revolves through the upper half of its circle and in the upper portion of the slot in lever ***l'*** the harrow will be moved backward at an increased speed and then downward back into the liquid, as will be readily understood.

As the swing rake machine in Fig.1, the output conveyor ***7*** receives the washed wool and carries it up to the squeeze rollers ***8***, which squeeze out the liquid from the wool, and liquid runs back into the bowl. Squeeze rollers deliver the wool to the next scouring bowl. And scouring process continues in the next bowls. Near the bottom of the bowl ***1***, there is a perforated false bottom ***2***, through which the liquid may pass, but not the wool, and below this bottom there should be a draw-off opening, ***9***, for the sediment or emptying the bowl of the washing liquid.

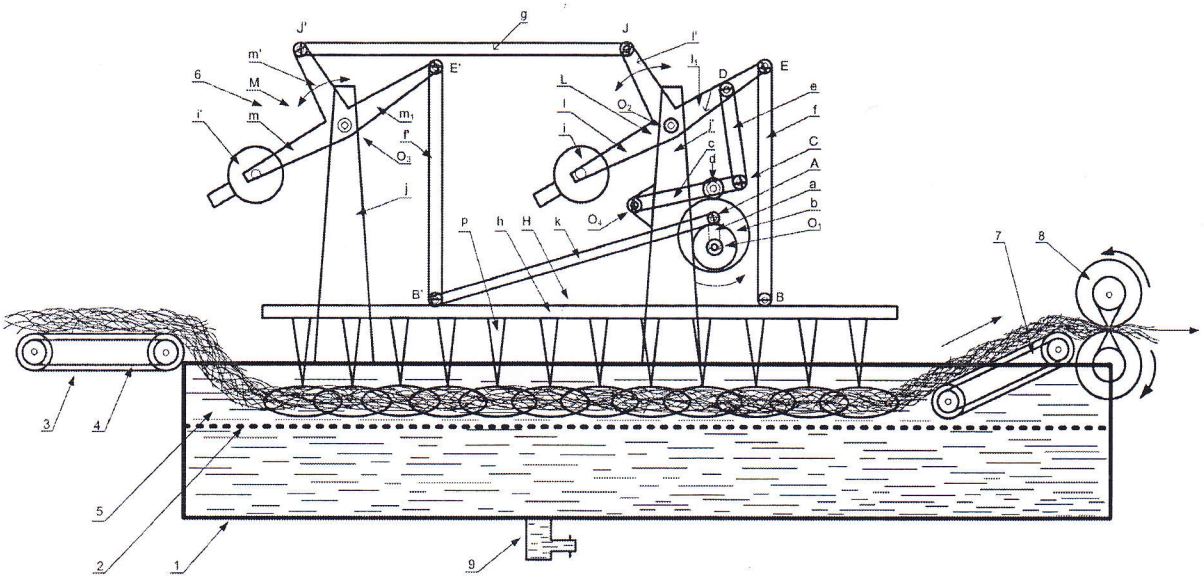

Fig. 2. Harrow type wool scouring machine

The paddle machines are also used for more than 100 years. The main inventors of improving of the paddle machines are William Lund, Luther A Peckham, Edward A O'Brien, Winfred Windle and etc.

In the paddle machine, the paddle action (Fig.3) gently swishes the wool along the bowl in which it has a longer period of immersion at a much lower temperature than in the swing

rake and harrow machines. As the swing rake and harrow machine in Fig.4., *1* represents the bowl or tank, forming the body or frame of the machine, contains the scouring or washing liquid, *2*, which may be fed into it by feeding conveyor *3*, driven by belts or gearing in any ordinary ways. As the wool drops from the feeding conveyor into the bowl, the blades or paddles ***a***, which are all mounted on longitudinal cylinder ***b*** (Fig.3.) of the first paddle cylinder *6*, catch and immerse in the scouring liquor and carrying it forward the output conveyor. The blades or paddles of the next paddle cylinders receive the wool and continue carrying forward the output conveyor. The paddle cylinders secured in standards or columns, driven by belts or gearing in any ordinary ways.

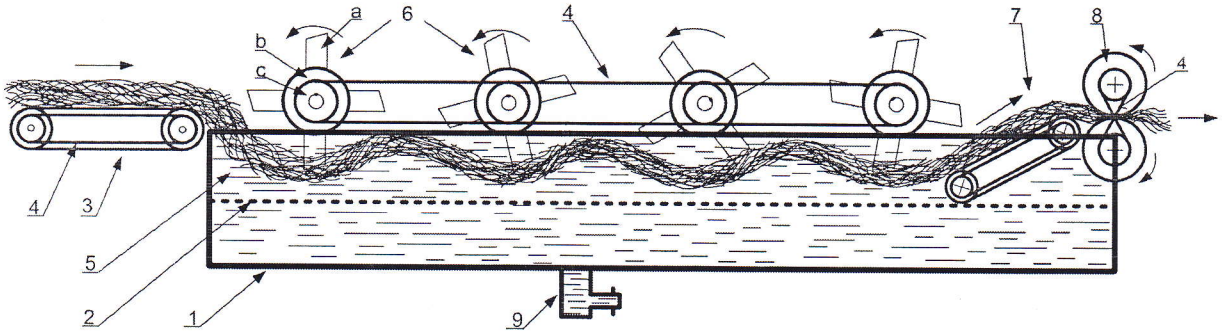

Fig. 3. Paddle type wool scouring machine

As the swing rake machine (Fig.1), and harrow machine (Fig.2) the output conveyor *7* receives the washed wool and carries it up to the squeeze rollers *8*, which squeeze out the liquid from the wool, and liquid runs back into the bowl. Squeeze rollers deliver the wool to the next scouring bowl. And scouring process continues in the next bowls.

Near the bottom of the bowl *1*, there is a perforated false bottom *2*, through which the liquid may pass, but not the wool, and below this bottom there should be a draw-off opening, *9*, for the sediment or emptying the bowl of the washing liquid.

In all three systems, the wool is scoured in bowls with perforated false bottoms, which permit the heavy impurities and sediments to escape, by setting into the compartment at the bottom of the bowl. Side compartments are provided at the end of the bowl, to receive the liquor from the squeezing rollers. As the dirt settles and the fats rise, the intermediate pure liquid may be fed back into the bowl for reuse.

In order to reduce fiber entanglement and fiber damage, the wool transportation mechanism of the harrow type wool scouring machine has been improved by the authors of this paper. The new harrow type mechanism has been designed by principle of four bar linkage [6].

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УЧАСТНИКА НАУЧНО-ПРАКТИЧЕСКОЙ КОНФЕРЕНЦИИ

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СТАТЬЯ

A study on wool scouring machines

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