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Features of the friendship processing the cotton washing machine vertical spindles

M Shaumarova^{1*}, T Abdillayev¹, B Sarimsakov¹ and Sh Yusupov¹

¹Tashkent Institute of Irrigation and Agricultural Mechanization Engineers, Uzbekistan, Tashkent

mshaumarova@mail.ru

Abstract. The benefits of the vertical spindle picker and its main disadvantage are the facts that the frictional rotation of spindles around their axes is largely due to the decline in cotton picking. It is explained that the absolute velocity of the tooth is to be within certain limits so that the spindle tooth can be trapped, and that the tooth has sufficient velocity for the tooth to pull out the cotton fibers. The absolute speed of the tooth depends on the geometric sum of V_m , the velocity of the drum, the velocity of the drum V_b , and the spin speed of the spindle. V_m and V_b are not changed, but V_s vary for different reasons. As a result, the direction and extent of the tooth's absolute speed changes, and the dialing rate decreases. The authors believe that friction ribbons should be at their intended level to prevent the fall in cotton harvesting.

1. Introduction

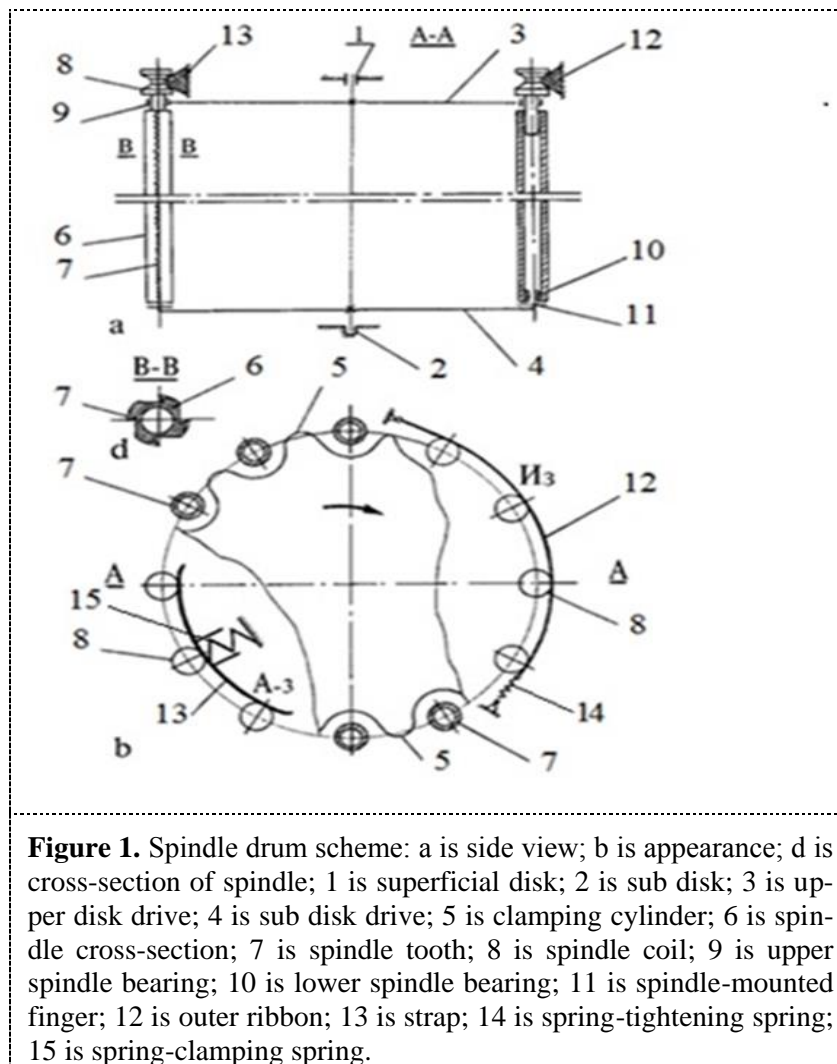
It is known that cotton varieties grown in Uzbekistan's climate are not fully harvested, and they often encounter unripe cotton bushes during the harvest. For this reason, it is preferable to use vertical spindle machines because the vertical spindle machines do not mix the ripe fiber with the blue sponge [1, 2, 3, 4, 5, 6]. Besides, its structure is simpler and makes it cheaper to manufacture and use [7]. Therefore, it is important to eliminate some of the disadvantages that impede the wider use of vertical spindle cotton pickers.

The biggest disadvantage of a vertical spindle machine is that the cotton-picking rate is slightly lower [8]. However, previous studies have shown that if such machines and cotton growers are made based on scientifically sound recommendations, the level of dialing can be at least 90% in one move [9]. But, unfortunately, such a high rate is not always observed; as there are some factors that adversely affect the dialing rate. These factors include frictional rotation of spindles [10, 11, 12]. The frictional drive does not always turn spindles at a speed that meets the requirements. It is observed that the spindle velocity during the dialing varies depending on the situation. This situation has led to volatility in cotton harvesting [13, 14, 15].

This article is dedicated to the analysis of the underlying causes of such situations. Therefore, the article begins with an overview of the structure of the cotton harvesting apparatus.

It is well-known that the degree to which a spindle is rotated around its axis is the most important factor of the agrotechnical operation of a cotton picker. The diagram of a vertical spindle rotating around its axis is [16].





The drums are rotated in opposite directions to force a large cotton bush into the narrow, narrow (28 - 36 mm) working hole between the drums located side by side. To transfer the drum rotational movement to the spindle, there is a steady band 12 and 13 that cover the coils both inside and out. If the center of the spin progresses due to the drum rotation, the spindle rolls around the axis at the expense of the friction force between the surface of the reel and the ribbon[17]. As a result, the cotton bush, pressed into the worker's hole, soaks the cotton tooth that is pressed against the branches and pulls it out of the pocket in the form of a long sled. The cotton blade is wrapped around the spindle surface. The spindle wraps around the cotton, drumming along with the drum as it drops from the outer ribbon and continues to spin. The reel is then leaked onto the inner ribbon and brake, trying to reverse it under the force of friction - stops for a very short time and changes the direction of rotation. During braking, the cotton spindle wrapped in a spindle is removed by the force of inertia and detached from the tooth. This means that about 80% of the cotton spindle that has not yet reached the separator brush will be separated from the spindle due to the inverse rotation of cotton [18]. The spindle tooth is rotated in the reverse direction and the tip of the spindle blades off with a piece of the sticky brush as it passes through the tooth [19].

2. Methods

In any case, the friction force F is known to depend on the coefficient of friction N with the pressure on which the friction particles are pressed together. For this reason, the tape is tightened using a special spring 14 so that the tape can always be pressed into the coil with the required amount of pressure. When the tensile spring force decreases, the pressure on the reel will decrease. As a result, when the working teeth are exposed to the cotton branches and the resistance of the teeth to be raised increases dramatically with P , the spindle angular velocity decreases, the direction and amount of tooth absolute speed changes, and the tooth becomes unpredictable. If $P > F$ becomes, the spindle will not rotate at all, no dialing [20].

Therefore, the tape must be pressed with a certain pressure N to rotate the spindle at the required speed.

The pressure of the tape on the reel depends on the bandwidth N . N affects the amount of friction force that occurs between the spindle coil and the ribbon. Therefore, it is necessary to pay attention to the position of the spring which tightens the tape.

The spindle drum rotates with the drum, constantly changing its position. Besides, because of a large number of obstructions on the upper disk, it is not possible to measure the speed of the spindle with a contact method (such as a simple tachometer).

Field velocity V_M and spindle drum angular ω_β velocity [13], [21]. The fan speed must be constant to prevent the work of machine components, such as the pneumatic system. For this reason, the engine is always set to run at a nominal speed. However, the angular velocity of the spindle varies with ω_s , as the friction force between the frictional belt and the coil axis, which is the spindle rotation, varies with the bandwidth. The reason for this is that the normal pressure of the tape on the reel is changed by N . The amount of N depends on the bandwidth. The amount of N does not exceed 40% of the bandwidth (with 12 spindles mounted on the drum). The tension of the ribbon depends on the hardness of the spring 14, which stretches out. Due to the speed of drum rotation and the number of spindles (1300 times per minute) the spring is shortened. Therefore, over time, its characteristics change, reducing the bandwidth, and reducing its gravity.

Also, the rolling drum changes its pressure on the reel due to the tape vibration in the horizontal plane. When a spindle tooth is pressed against the horns of a cotton bush in a very narrow working hole, the spindle angular velocity decreases and even stops in the ribbon when the tooth is raised to the thick branches.

For visual evaluation of the beneficial coefficients of tooth absolute velocities at multiple locations on the spindle surface, it is necessary to turn the $\vec{V}_{\text{та}\beta}$ projections to the radial direction AT around the tooth T . An epura is constructed by combining the ends of these twisted $\vec{V}_{\text{та}\beta}$ vectors with nonlinear curves.

The central U angle showing the edges of the diagram shows the boundaries of the active part of the spindle surface. It is believed that toothpaste with an active part of the surface can be harvested. The spindle cannot be trapped by a toothpick in the inactive part of the surface.

However, it is necessary to take into account the effect of the corrugated cylinder on the inside of the drum, which covers the drum spindles from the inside. In fact, a relatively thin corrugated cotton wire inserts a cotton spindle into it, and due to friction and other factors, the cotton coil is slightly tucked into place and prevented its spill. Not all pile of the cotton bush can penetrate the wafers' nests, meaning that even if the tooth is in an active condition, it does not meet the skin. Therefore, it is necessary to reduce the central angle of U to the portion of the wafer and to find the U_a angle, which indicates the active surface.

The following coefficients can be found to evaluate the actual spindle activity in different parts of the drum:

$$S_a = \frac{U_a}{2\pi}$$

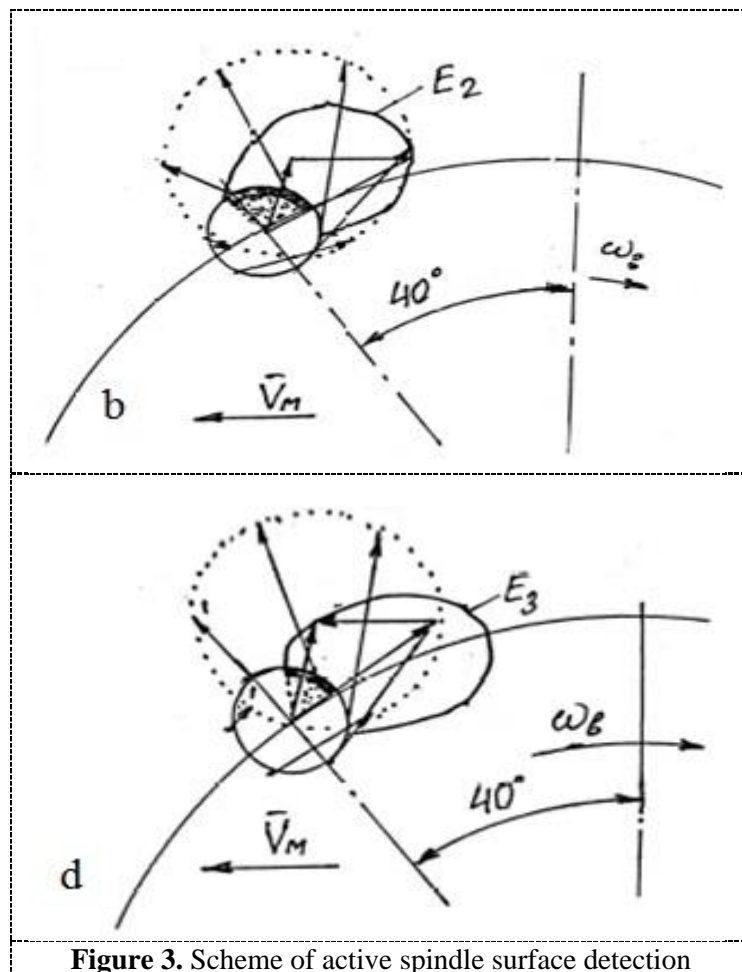


Figure 3. Scheme of active spindle surface detection

The strong influence of spindle angular velocity on the rate of cotton harvesting can be explained by the help of Figures 4-b and d. Figure 4 shows the absolute velocities of six points located on the spindle surface of Figure. 2-b, with the diagrams E_1 , E_2 and E_3 representing the useful part. Figure 4-a shows that when the spindle rotates at a nominal angular velocity, the active surface of the surface (dark dyed) is at the center angle $\tau=140^\circ$. For some reason, the spindle velocity drops to 70% of the nominal value, although the central surface of the active surface (\bar{V}_M and \bar{V}_b does not change) is active at $\tau=92^\circ$ the surface central angle is reduced to $\tau=54^\circ$ (Figure 4-d). Besides, the inactive part of the spindle surface in Figure 4-d is likely to be exposed to the cotton bush. Therefore, it is necessary to prevent the slope of the spindle from reducing its angular velocity so as not to diminish its spinning ability.

In this case, if the spindle angular velocity drops to 70 % of the nominal velocity for some reason (\bar{V}_M and \bar{V}_b are stored as in Fig. 4-a), the central angle of the epicenter E_2 is $\tau=92^\circ$. If the spindle angular velocity decreases to 40% of the nominal value ($\bar{V}_M=\text{const}$ and $\bar{V}_b=\text{const}$), E_3 is constructed to reduce the central angle of the spindle to $\tau=35^\circ$.

Besides, the absolute velocity of the spindle tooth in the cases in figure 4 a, b, and d can be seen. It is well-known that the absolute speed of the tooth also affects the ability of the tooth to pick cotton because the tooth that meets the skin in the sink can be safely pulled out of the pocket when the tooth sink deeper into the fiber. It is clear that this process depends on the amount of tooth absolute speed.

4. Conclusion

Thus, it is necessary to make the spindle rotate at a nominal angular velocity to make full use of its cotton-picking ability.

1. The spindle tooth can pull the cotton pad out of the trunk so it must sink in enough space between the fibers and retain them.
2. For a tooth that works like a two-sided ponytail, its absolute velocity direction must be as close to the bisector of the angle of tooth ache as possible.
3. Toothpaste slipped between cotton fibers is required to penetrate deep into the sink, allowing it to absorb more fibers. The absolute speed of the tooth must be as large as possible for this process to be performed in a very short time.
4. Since the speed of the machine used does not change the speed of the drum, the direction and amount of tooth absolute speed depend only on the spindle angle.
5. The spindle angular velocity depends on the gravity of the frictional drive belt that moves it. This ability depends on the strength of the friction between the ribbon and the spindle coil, hence the pressure on the tape. And the pressure depends on the bandwidth. This means that the tape tension should be kept constant at all times.

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