THE THEORY OF TWISTING THE ROVING IN THE SPEED FRAME

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ABSTRACT

An analysis was carried out only on the qualitative aspects of the phenomena of twisting the roving in the speed frame. The results of this simple analysis modified the conclusions reached earlier that the twist in the roving portion between the drafting system and the flyer head consists of two components, named real twist and false twist. This work furnished grounds for the statement that the twist in the zone referred to consists of four components namely, real twist $t_a$, false twist $t_f$, pushed-back twist $t_c$, and additional false twist $t_p$ arising as a result of the roving assuming the shape of space curve as it pass through the flyer hole, each of different source of origin. Furthermore, it was found that the methods of threading the roving through the flyer head will either increase or decrease the number of turns of twist before or after the flyer head. Also it was shown that the false twist $t_p$ that created in the roving portion between the drafting system and the flyer head when using right-hand threading can be utilized to strengthen the fibre assembly in that zone to meet technological requirements during production processes.

Keywords: speed frame, real twist, false twist, push back twist, flyer head, roving.

1. INTRODUCTION

It was long thought that the twist on the portion of the roving between the flyer head and the drafting system of the speed frame is created solely as a result of the rotation of the spindle. In an earlier contribution [1], an attempt was made to elucidate the physical
essence of the phenomena occurring in the roving assembly during its passage through the flyer head.

A further study of the problem brought to light a number of additional factors, made possible the arrival at a more thought of the nature of the phenomena observed and modified conclusions reached earlier [2]. The outcome of those studies showed that the twist in that zone consists of two components, real twist $t_r$, and false twist $t_f$, the latter being a temporary one and it is caused by the rolling of the fibre assembly along the inner channel of the flyer head.

The author of this article with most recent experiments showed that, the twist in the zone referred to, consists of four components namely, $t_a$, $t_r$, $t_c$ and $t_p$ each of different source of origin.

The sources of the first two have already been named, i.e. the spindle rotation which produces the real twist $t_a$, and the rolling of the roving along the flyer head channel which gives rise to the false twist $t_f$. The physical essence of those two types of twist is quite clear and has been described in details in the literature.

In a previous publication [3], it was shown that, the third source of twist $t_c$ is mainly created by the accumulation or pushing-back of the turns of twist when the twisted roving assembly is forced to bend round the flyer holes in its path. This phenomenon of turns being pushed-back results in the so called twist blockage. The phenomena of this twist blockage have been investigated in details and a theory to explain the mechanism of twist blockage in the thread line of the spinning machines has been established [4].

A necessary condition for the production of this effect of turns being pushed together is, of course, the presence of twist in the first place. This is precisely the pattern in the passage of the roving through the flyer head and the result is that, the number of turns in the section between the flyer and the drafting system increases [5].

Of maximum interest in the sense of the resultant effect is the fourth source of twist which gives rise to twist $t_p$. This source exists only where the roving is pulled through a hole or slot in a component, in the present case is the flyer head, in which event the roving assumes the shape of a space curve.

This point will be discussed in more details since it represents a new phenomenon and the elucidation of its nature is of theoretical and practical interest.

2.0 METHOD

A simple technique was used to verify the fourth source type of twist $t_p$. In this technique, rovings produced from two slivers having different colors were threaded through the vertical hole drilled in the flyer head.

![Figure 1: Methods of roving threading](image-url)
As shown in Figure 1 the flyer head has a vertical axial hole and two horizontal holes. When looking to the flyer head, viewed from the side of the hollow arm of the flyer, it will be seen that one of these horizontal holes is on the left-hand side and the other hole on the right-hand side of the flyer head.

Therefore, when the roving is threaded through the axial vertical hole it can be pulled horizontally through the left or right-hand side hole. This means that two different methods of threading the roving through the flyer head can be used, named left-hand threading and right-hand threading.

3.0 ANALYSIS AND DISCUSSION

As shown in Figure (2), the roving is threaded through the flyer head from left to right. When threading is done in this manner the roving forms a space curve. The roving was then pulled in the direction of the arrow (X), it was found that the portion (AB) above the flyer hole rotates in one direction and the portion (BC) below the hole rotates in the opposite direction. The result will be that on the portion (AB), where the newly formed turns coincide in direction with the Z-twist turns present on that portion, the total number of turns will increase whilst on section (BC) it will decrease or the turns will disappear altogether. When the roving is threaded from right to left i.e. it emerges through the left, and again being pulled in the direction of the arrow (X) as shown in Figure (3), it was found that the direction of rotation of the roving sections (AB) and (BC) were reversed. Now the portion (AB) will lose its twist and the number of turns of twist in section (BC) below the flyer hole will increase.

It should be pointed out that the existence of this phenomenon can be verified without the use of a twisted fibre assembly. If the experiment is repeated with a twist less string, on portions (AB) and (BC) of which short pieces of thin wire has been pushed through the string in a manner of pointers, it will be readily seen that in this case, too, the string portions (AB) and (BC) rotate in opposite directions and that again the direction of rotation depends on the manner of threading the string through the flyer head. It is clear, of course, that this is also a case of false twist.

![Figure 2: Right-hand threading](image)

![Figure 3: Left-hand threading](image)
Figures (4) and (5) show that for the left and right-hand threading the turns on the relevant portions of the roving are oriented in opposite directions although the direction of the torque $m_x$ remains the same. In Fig. (4), which shows a left-hand threading, the vertical part ($a_l$) has S-twist and the horizontal part ($b_l$) emerging from the flyer head has Z-twist. In the case of right-hand threading, as shown in Fig. (5), the vertical part ($a_r$) has Z-twist while the horizontal part ($b_r$) has S-twist. From the above short analysis, the question arises what is the explanation of the differences in the twist arising from different threading methods. The answer may be as follows:

(1) In the case of right-hand threading it is clear that all four sources of twist impart the same twist type to the roving (right-hand twist i.e. Z-twist). Therefore, the total twist in the roving will be the result of adding together all four sources of twist;

$$T_{\text{right}} = t_a + t_f + t_c(\text{right}) + t_p \quad (1)$$

Therefore, it can be assumed that, with this method of threading, the number of turns of twist formed as a result of the turns being pushed back together ($t_c$) will be substantial, since in this case, the turns of the existing twist in the roving are so arranged in relation to the hole edge on the flyer head so that conditions are created in which the turns of twist are retained to a large extend behind the line of deflection at the hole edge. The result is that, the number of turns of the twist in the portion AB (Fig. 2) increases.

(2) In the case of left-hand threading while the turns in the roving have right-hand twist i.e. Z-twist, it was found that the direction of the turns created by the fourth source ($t_p$) did not coincide with the turns that have been created by the other sources of twist. The turns were therefore deduced from the existing twist and the total twist was;

$$T_{\text{left}} = t_a + t_f + t_c(\text{left}) - t_p \quad (2)$$

Therefore, the difference between the values of $T$-right and $T$-left increased from an additional causes, i.e. $t_c$ (left) is less than $t_c$ (right) since in left-hand threading the turns pass readily beyond the line of deflection and do not accumulate at the same rate as in the case of right-hand threading.
4.0 CONCLUSION

During the passage of the roving through the flyer head, its path is diverted from a straight line as it bends around the holes drilled in the flyer head. For the roving to move through these holes, it has to overcome the frictional forces of the contact regions.

When the roving bends around a curved surface it forms space curve and will be compressed and flattened under the applied forces. In the case of this deformation of the roving cross-section, the roving will tend to inhibit a rotation about its axis because of the internal friction generated over the contact surface. Therefore, it can be assumed that some induced incremental torque applies to the roving and causes the subsequent incremental twist to migrate from the deformed roving portion in contact with the flyer head to the roving portion prior to the head.

The applied tension and consequently the bending deformation induce a torque causing twist flow for a given roving length of constant twist density. The twist moves from a thick deformed section to a thinner un-deformed section of the roving to increase its twist density.

For the roving to move or slip over the contact region inside the flyer head, work of deformation would be needed. This distortion of the roving cross-section would then cause momentary untwisting, pushing some turns of the roving twist back by the contact regions, leading to twist deficiency in the roving length over the contact region.

It can be concluded that in the speed frame, the total twist in the roving between the drafting system and the flyer head has four components. These are, the actual twist created from the rotation of the spindle about its axis \( t_a \), the false twist \( t_f \), which results from the rolling of the roving along the inner channel of the flyer head, the additional twist \( t_c \) arising from the pushing back together or accumulation of twist at an obstacle, and the false twist \( t_p \) arising as a result of the roving assuming the shape of space curve in its passage through the hole in the flyer head.

The false twist \( t_p \) can be utilized for strengthening the fibre assembly to meet technological requirements, more particularly for the strengthening of the roving between the drafting systems and the flyer head and inside the hollow arm of the flyer.

REFERENCES


