Annals of DAAAM for 2010 & Proceedings of the 21st International DAAAM Symposium, Volume 21, No. 1, ISSN 1726-9679
ISBN 978-3-901509-73-5, Editor B. Katalinic, Published by DAAAM International, Vienna, Austria, EU, 2010
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Annals of DAAAM International

EXPERIMENTAL RESERCHES ON THE YARN TENSION VARIATION INFLUENCED BY THE RING POSITION AGAINST TEXTILE SPINDLE SPECIFIC TO RING FRAMES

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Abstract: *The paper presents some experimental research data concerning the yarn tensions specific for ring frames. There are mentioned aspects both on the test rig constructive components and the parameters which have a main influence towards the values of yarn tension. This study it is necessary to clarify how the technological parameters are directly involved in spinning process affecting the final yarn quality. Startly from these results it is possible to take decisions towards better constructive solutions for spinning systems of ring frames.*
Key words: *yarn, tension, ring frame, textile spindle*

1. INTRODUCTION

The ring frame represents the main spinning equipment for yarn production and it is the last machinery of the spinning process with its roll to transform the fibres band on yarn by specific subassemblies such as: draft system, wrap and twist mechanism, drive system for textile spindles (Hanganu, 2009). These are dedicated to realize the whole technological process for which the machine was designed. To obtain high quality yarn it is required to consider the interdependence not only between the constructive solutions for ring frame components and their functional parameters but also, the both nature and physics-chemicals properties of the processed fibres as is shown in figure 1 (Hanganu & Loghin, 2010).

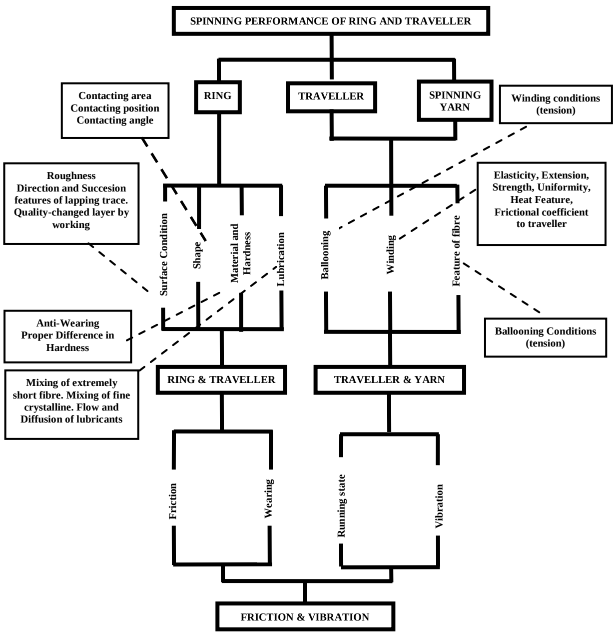

Fig. 1. The interdependence diagram between the constructive solutions for ring frame components and their functional parameters

The paper study is focused onto the aspects of yarn tension which are specific for the spinning area of the ring frame. This means mainly a deep analysis of everything that happens with the yarn in correlation with its driver, ring and traveller. The results of this experimental research study offer a database for designers involved in obtaining better constructive solutions for the components mentioned above.

2. TEST RIG

A general schema for the test rig is shown in figure 2.

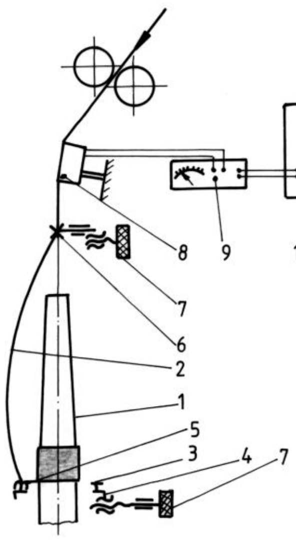

Fig. 2. Test rig components

There are three main components of the test rig: the drive system for textile spindle, measuring yarn tension equipment and digital oscilloscope. The drive system for textile spindle is basical structured from a textile spindle 1, the ring 3, the traveller 5 and yarn driver 6; this system offers the possibility to rotate the textile spindle between 6000 and 22000 rpm.

Attachment of bank ring and yarn driver has been modified so as to carry out those positions to the time requirements imposed by experimental determinations through micrometer screws 7.

The tension from yarn 2 is detected by the transducer 8 connected with the power amplifier 9 and the final result is displayed on oscilloscope 10.

Component parts 8, 9 and 10 create the possibility of detecting both static and dynamic yarn tensions.

There were created conditions for overcoming the negative influences on yarn tension, of which stated:

- ensuring squareness of the spindle rod towards both spindle bank and ring bank;
- using a ring with minimum deviation from circularity (under 0.01 mm);
- faience yarn driver without slot;
- using a filamentar and uniform yarn;
- rigid assemblage of ring bank;
- yarn winding directly onto the spindle rod to eliminate the

influence of tube defects;

- controlled central position between the textile spindle and yarn driver.

With this equipment can be measured both average and maximum yarn tension and allows highlighting the influence of each constructive factor.

3. EXPERIMENTAL DATA

Experimental tests were performed on a textile spindle Texparts - HF 3 type, verified in terms of dynamic response (vibrations) (Hanganu et. al., 2009). Experimental determinations were performed for:

- ring diameter of 42 mm and traveller 11/0 (0,019 g);
- ring diameter of 48 mm and traveller 11/0 (0,019 g);
- ring diameter of 48 mm and traveller 6/0 (0,030 g);

n_f	e (mm)					
(rpm)	0	0,2	0,4	0,6	0,8	1,0
6000	0	0,316	0,635	0,952	1,271	1,590
7000	0	0,428	0,859	1,287	1,718	2,146
8000	0	0,563	1,128	1,693	2,258	2,821
9000	0	0,712	1,424	2,136	2,848	3,561
10000	0	0,867	1,734	2,604	3,472	4,341
11000	0	1,043	2,086	3,130	4,173	5,217
12000	0	1,265	2,530	3,795	5,060	6,325
13000	0	1,484	2,968	4,454	5,939	7,426
14000	0	1,724	3,448	5,172	6,897	8,621
15000	0	1,978	3,957	5,936	7,915	9,894
16000	0	2,250	4,502	6,752	9,004	11,254
17000	0	2,541	5,083	7,625	10,167	12,709
18000	0	2,850	5,700	8,551	11,401	14,251
19000	0	3,173	6,348	9,524	12,699	15,872
20000	0	3,516	7,035	10,554	14,073	17,592

Tab. 1. Valorile lui ΔF (x10^{-2} N) pentru inel Ø42 şi cursor 11/0

n_f	e (mm)					
(rpm)	0	0,2	0,4	0,6	0,8	1,0
6000	0	0,338	0,679	1,017	1,359	1,699
7000	0	0,457	0,918	1,376	1,836	2,294
8000	0	0,601	1,205	1,809	2,413	3,015
9000	0	0,761	1,522	2,188	3,044	3,805
10000	0	0,926	1,853	2,783	3,710	4,639
11000	0	1,115	2,230	3,345	4,460	5,575
12000	0	1,351	2,703	4,055	5,407	6,75o
13000	0	1,586	3,172	4,761	6,347	7,935
14000	0	1,842	3,685	5,528	7,370	9,212
15000	0	2,114	4,229	6,345	8,458	10,573
16000	0	2,404	4,811	7,216	9,622	12,026
17000	0	2,716	5,432	8,150	10,865	13,581
18000	0	3,045	6,091	9,139	12,183	15,229
19000	0	3,390	6,784	10,179	13,570	16,961
20000	0	3,758	7,518	11,280	15,039	18,799

Tab. 2. Valorile lui ΔF (x10^{-2} N) pentru inel Ø48 şi cursor 11/0

n_f	e (mm)					
(rpm)	0	0,2	0,4	0,6	0,8	1,0
6000	0	0,533	1,068	1,600	2,137	2,670
7000	0	0,721	1,442	2,165	2,887	3,609
8000	0	0,946	1,396	2,845	3,794	4,743
9000	0	1,136	2,393	3,590	4,787	5,984
10000	0	1,457	2,915	4,376	5,834	7,294
11000	0	1,752	3,504	5,258	7,011	8,763
12000	0	2,123	4,250	6,276	8,502	10,626
13000	0	2,493	4,988	7,480	9,980	12,475
14000	0	2,896	5,794	8,692	11,588	14,486
15000	0	3,326	6,650	9,975	13,300	16,627
16000	0	3,783	7,564	11,347	15,130	18,913
17000	0	4,271	8,542	12,811	17,084	21,356
18000	0	4,787	9,577	14,367	19,157	23,946
19000	0	5,335	10,668	16,002	21,338	26,676
20000	0	5,912	11,823	17,736	23,648	29,561

Tab. 3. Valorile lui ΔF (x10^{-2} N) pentru inel Ø48 şi cursor 6/0

To see the influence of the ring eccentricity towards the textile spindle onto the traveller speed and acceleration, and thereby the variation of yarn tension ΔF, should be carefully considered the traveller movement during a rotation on the ring.

There were imposed restrictions to reveal only the settlement influences of ring eccentric to the spindle, eliminating all factors that could distort the measurement accuracy.

For even more accurate measurements were taken into account and the variation of yarn tension due to vibration of the traveller.

4. CONCLUSION

For a ring seated correctly, without eccentricity, perfectly round, with spindle speed, constant winding radius and delivery speed, it follows for traveler, of course theoretically, constant normal acceleration, constant speed and “zero” tangential acceleration.

In the same conditions as mentioned above, but with eccentric placement of the ring over the textile spindle, the traveller speed and normal acceleration have variations and tangential acceleration can take significant amounts. Consequently yarn tension variations occur, the maximum values of these changes having adverse influence on the frequency of breakage.

Because these values were relatively low, in evaluating the influences of various organs involved in yarn production on the average and maximum value of these tensions, there were have been overlooked.

For this purpose the test rig was adjusted so that it can be highlighted only the tension changes due to traveller, other factors which can influence the yarn tension are eliminated by setting the installation options.

Startly from these results it is possible to take decisions towards better constructive solutions for spinning systems of ring frames.

5. ACKNOWLEDGEMENTS

The authors acknowledge The National Centre for Programme Management (CNMP) from Romania for funding this research.

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