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EFFECT OF THE SHAPE OF BALLOON BREAKER ON
YARN TENSION DURING UNWINDING FROM COPS

Part (I)

تأثير شكل كاسر البالون على الشد في الخيط أثناء الفك
من السويجة

By
Shahin, A.

هلامة - في هذا البحث تم سحب الخيط من سويجة الغزل أثناء عملية التدوير وقياس الشد في الخيط وذلك تحت تأثير العوامل التالية :-
- المسافة بين السويجة ودليل الخيط في حالة عدم استخدام كاسر البالون .
- استخدام أنواع مختلفة من كاسر البالون .
- الكثافة الخطية لخيط قطن .
ووجد أنه يمكن تقليل قيمة الشد في الحظ وذلك بتغيير المسافة بين سويجة الغزل ودليل الخيط وذلك في حالة عدم استخدام كاسر البالون ووجد أن قسمه الشد تغل مع تقدم السداة بين سويجة الغزل ودليل الخيط . وكذلك تم سحب الخيط خلال أشكال مختلفة لكاسر البالون وتم تحديد أحسن شكل لكاسر البالون وهو ذو المقطع المثلثي .

ABSTRACT

In this work the yarn tension was measured during withdrawing the yarn from stationary cops. The value of yarn tension was measured under the effect of the following parameters :

- distance between cops and yarn guide (without using balloon breaker)
- type of balloon breaker
- linear density of yarn

The value of yarn tension during direct unwinding from cops can be reduced by varying the distance between cops and yarn guide. It was found that the small distance between cops and yarn guide is suitable, since the level of yarn tension is low. In case of using balloon breaker the value of yarn tension can be reduced by using a balloon breaker with triangular cross section.

INTRODUCTION

Through the winding process the yarn must be withdrawn from cops to wind a package on the winding machine. To form a full package the yarn must be unwound from several cops. And to increase the productivity of winding machine the yarn withdrawing speed must be increased. By increasing the yarn withdrawing speed the value of yarn tension will be increased and leads to an increase in percent of yarn breaks, which affect machine efficiency.

For the increase of yarn withdrawing speed and keeping yarn tension within accept value a balloon breaker must be used or positioning the cops (without using balloon breaker) suitable distance from yarn guide .

According to ref. /1/ , /2/ , /3/ and /4/ the yarn tension during unwinding increases as the amount of yarn on cops decreases . It was found also that the of formed balloons during unwinding from cops increases with increasing the distance cops and yarn guide. From the results in ref. /1/ it was found that the balloon with rectangular cross sections act to decrease the value of yarn tension more than balloon breakers with circular cross sections .

As stated in ref. /2/ the yarn tension increases with increasing yarn withdrawing speed (range from 500 to 1100 in/min). The yarn tension decreases as the distance between cops and yarn guide (range from 150 to 450 mm) increases.

According to ref. /3/ the number of formed yarn balloon during unwinding from cops decreases with decreasing the amount of yarn on the cops. This is due to increasing the friction between yarn and cops surface.

Ref. /2/ , /4/ and /5/ shows the reduction in yarn tension during unwinding from cops due to using balloon breaker.

In ref. /6/ it was found that the radius of yarn balloon decreases with decreasing the amount of yarn on the cops for different yarn material and balloon r.p.m.

As shown in ref. /7 / the yarn length in the rotating yarn balloon decreases with increasing the value of yarn tension, and also it was found that the balloon shape varied according to the value of yarn tension. As shown in all references the value of yarn tension during unwinding from cops is considered from the important parameters, because any increase in yarn withdrawing speed means an increase in the productivity of the winding machine.

According to ref. /8/ the radial force which act on package layers is function from yarn tension. Any variation in radial force leads to a variation in package density.

EXPERIMENTAL

Fig. (1) shows the arrangement of the apparatus used, the yarn is withdrawn from cops by means of take-up drum with a withdrawing speed 900 mt/min. The yarn passes through the balloon breaker to reduce the value of yarn tension. After balloon breaker the yarn passes on a measuring head (Rotschild) to measure yarn tension. The electric signal from the measuring head was amplified using an amplifier and then this signal was calibrated in force units and recorded on a chart recorder.

The force-time diagram was recorded during unwinding the total amount of yarn on the cops. This experiment was repeated for different types of balloon breakers and different yarn counts. In case of direct withdrawing of the yarn from cops without using balloon breaker, the yarn tension was measured under the effect of the distance between cops and its yarn guide. (distance = 5 , 10 and 15 cm).

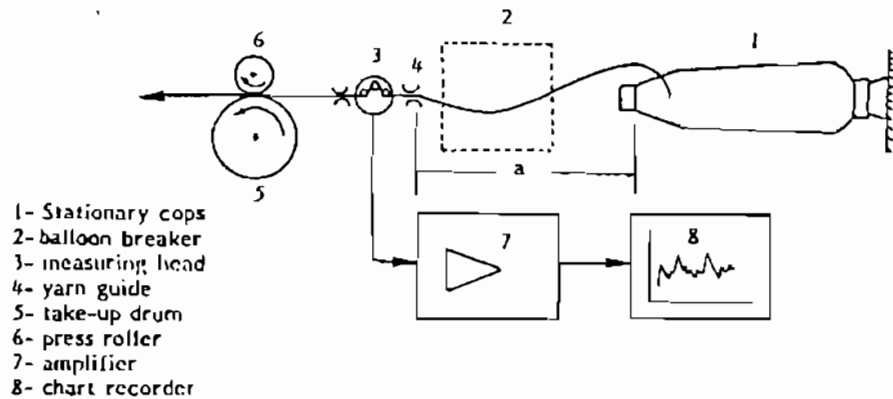
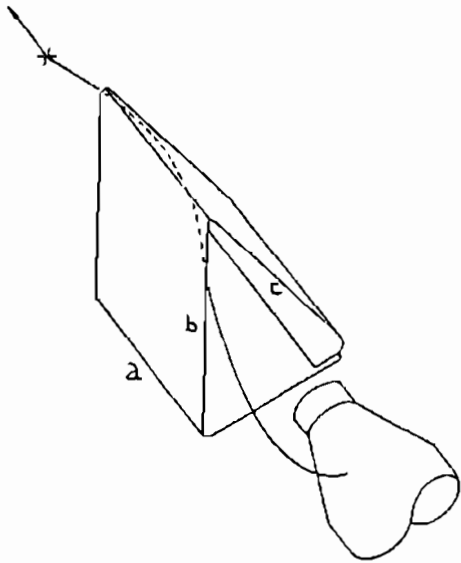
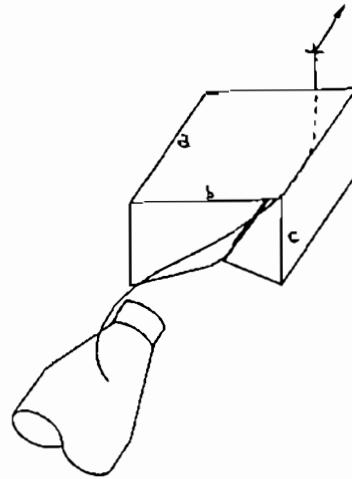


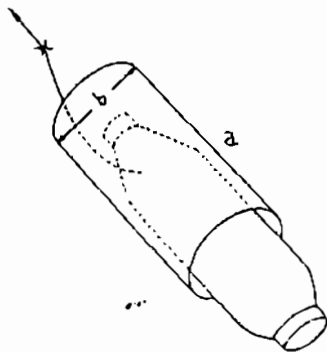
Fig. (1): Arrangement of the apparatus



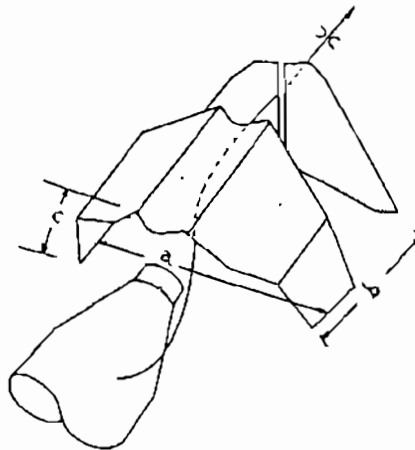
$a \times b \times c = 7 \times 3,5 \times 3,5$ cm
type (A)



$a \times b \times c = 6 \times 4 \times 2,8$ cm
type (B)



$a \times b = 19 \times 6,2$ cm
type (C)



$a \times b \times c = 11,3 \times 9 \times 8$ cm
type (D)

Fig. (2): Different types of balloon breakers

Specification of used Cops:

Cotton Ne 50:

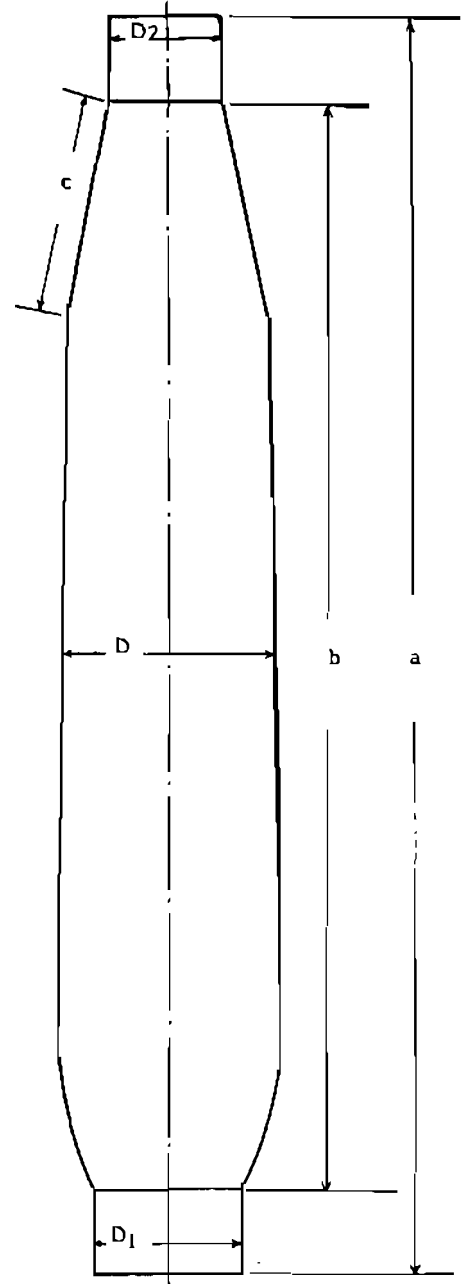
Weight of cops 86 gm
yarn length per double stroke 6,3 mt
twist factor $\alpha_e = 3,6$
a = 22 cm b = 19 cm
c = 4 cm D = 3,7 cm
D₁ = 2,6 cm D₂ = 2,1 cm

Colton Ne 30 :

Weight of cops 130 gm
yarn length per double stroke 8.5 mt
twist factor $\alpha_e = 3,33$
a = 25,3 cm b = 21,3 cm
c = 5,2 cm D = 4,45 cm
D₁ = 2,8 cm D₂ = 2,1 cm

Colton Ne 20 :

Weight of cops 142 gm
yarn length per double stroke 9,5 mt
twist factor $\alpha_e = 3,2$
a = 25,8 cm b = 22 cm
c = 5 cm D = 4,36 cm
D₁ = 2,8 cm D₂ = 2,1 cm



Specification of Yarn Material and Balloon Breakers :

- a) The material which is used in the experiment work is cotton materials in cops form with yarn counts Ne 20, Ne 30 and Ne 50. (see the specification of used cops)
- b) As shown in Fig. (2) the different shapes of balloon breakers are:
 - type (A) with triangular cross section
 - type (B) with rectangular cross section
 - type (C) with circular cross section
 - type (D) with U-form cross section

Evaluation of Results:

At five points with equal distances along cops length the maximum value of yarn tension was recorded and drawn as shown in Figs. (3-10).

Table 1 : Difference in yarn tension along cops length

cotton yarn count	difference in yarn tension (CN)						
	without balloon breaker			using balloon breaker			
	a = 5 cm	a=10 cm	a=15 cm	type (A)	type (B)	type (C)	type (D)
Ne 20	18	22	49	17	17	30	31
Ne 30	20	25	38	18	21	17	24
Ne 50	8	12	21	14	17	13	22

(difference in yarn tension along cops length = maximum value of yarn tension at the base of cops - maximum value of yarn tension at the top of cops).

Tabl 2 : Comparison between maximum value of yarn tension at the base of cops

cotton yarn count	maximum value of yarn tension at the base of cops (cN)						
	without balloon breaker			using balloon breaker			
	a = 5 cm	a=10 cm	a=15 cm	type (A)	type (B)	type (C)	type (D)
Ne 20	36	45	61	28	35	41	46
Ne 30	32	36	44	27	28	26	30
Ne 50	13	19	25	17	21	20	26

a = distance between cops and yarn guide.

DISCUSSION

a) Effect of the distance between cops and yarn guide without using balloon breaker:

- By withdrawing the yarn directly from cops the value of yarn tension for all yarn counts increases with increasing the distance between cops and yarn guide (range from 5 cm up to 15 cm) , see Fig. (3, 4 and 5) . And the level of yarn tension along cops length decreases with decreasing the linear density of yarn, see Fig. (10).

Cotton Ne 20 :
(without using balloon breaker)

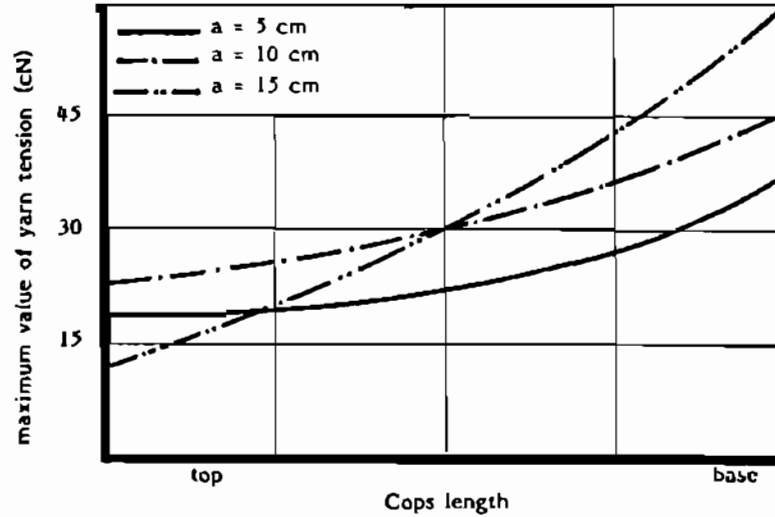


Fig.(3): Maximum value of yarn tension versus cops length

Cotton Ne 30 :
(without using balloon breaker)

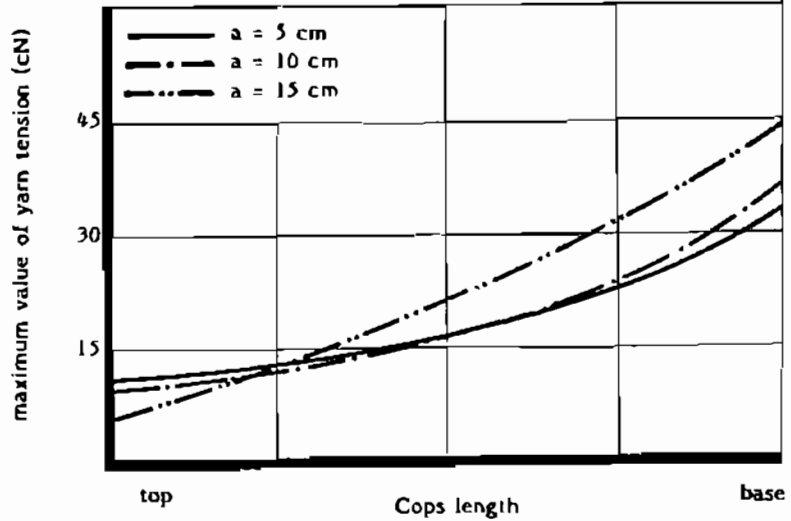


Fig. (4): Maximum value of yarn tension versus cops length

Cotton Ne 50 :

(without using balloon breaker)

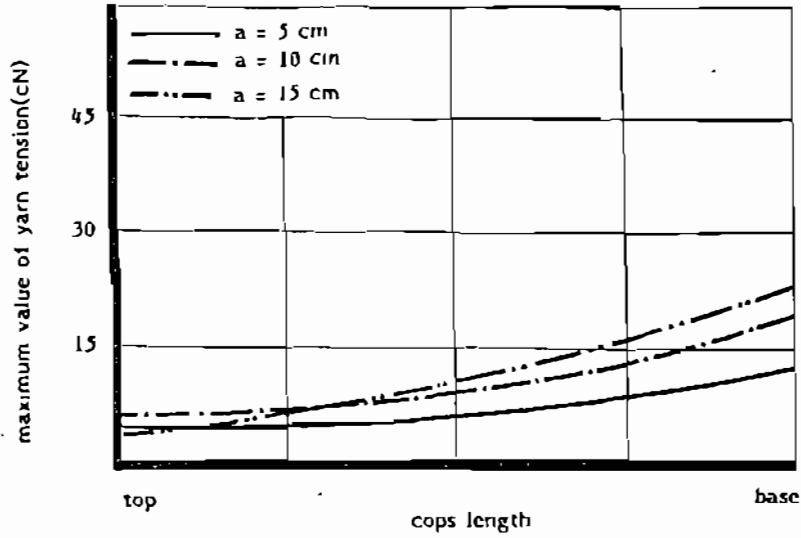


Fig. (5): Maximum value of yarn tension versus cots length

Balloon breaker type (A)

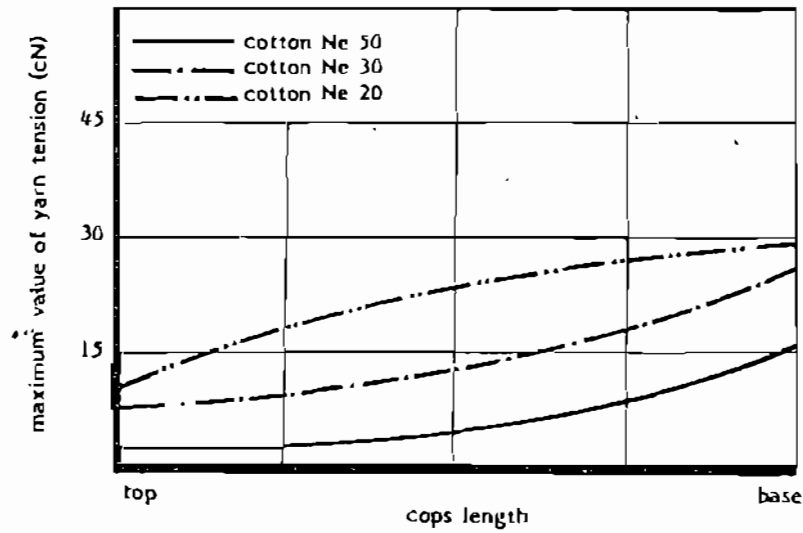


Fig. (6): Maximum value of yarn tension versus cots length

Balloon breaker type (C)

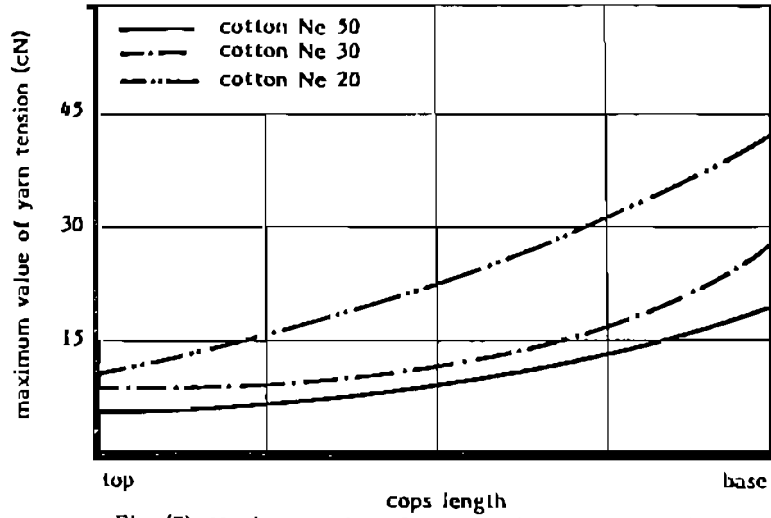


Fig. (7): Maximum value of yarn tension versus cops length

Balloon breaker type (B)

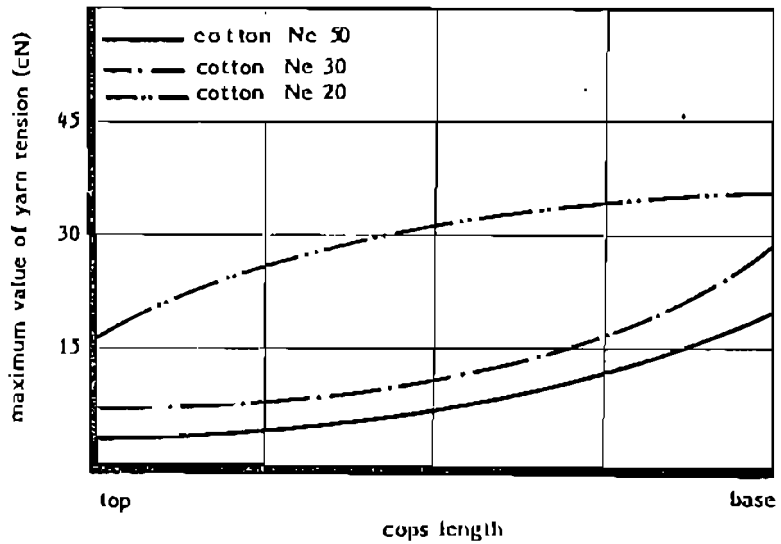


Fig. (8): Maximum value of yarn tension versus cops length

Balloon breaker type (D)

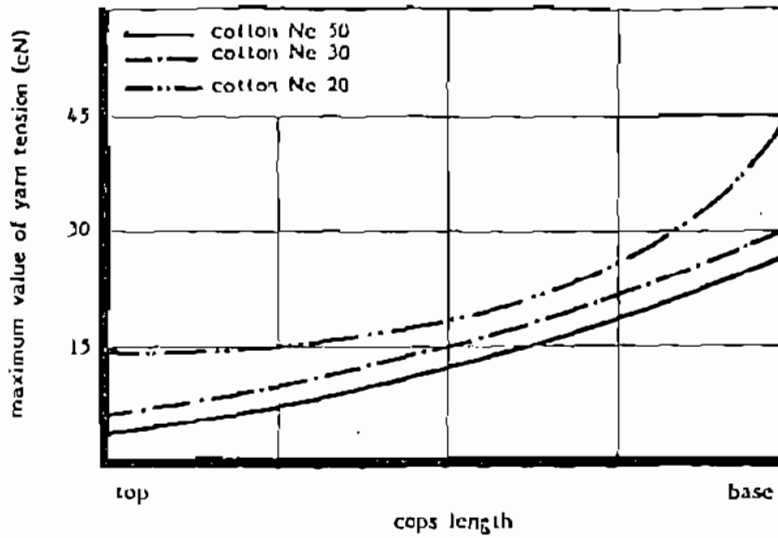


Fig. (9): Maximum value of yarn tension versus cops length

Comparison between balloon breaker (A) and direct withdraw without using balloon breaker for a distance between cops and yarn guide $a = 5$ cm:

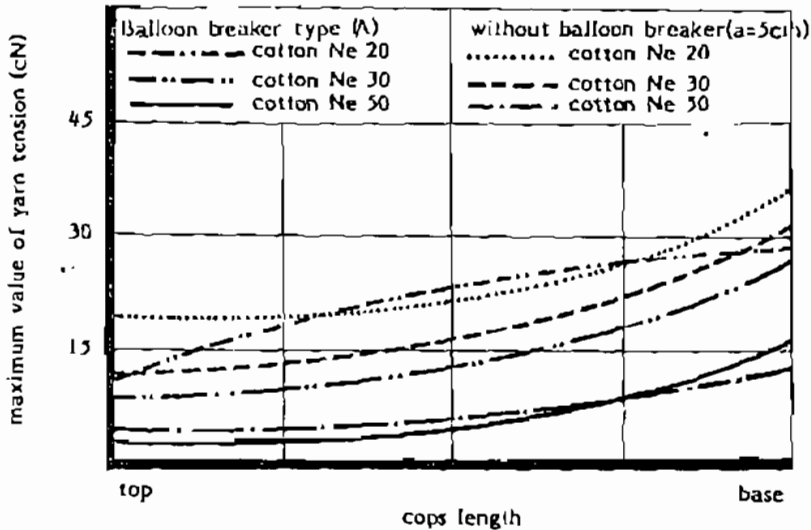


Fig. (10): Maximum value of yarn tension versus cops length

- The average difference in the value of yarn tension along cops length increases with increasing the distance between cops and yarn guide, see Tables 1. This difference affects the package density during winding process.

b) Effect of the shape of balloon breaker on the value of yarn tension

- The shape of balloon breaker affects the value of yarn tension. Balloon breaker type A was found to be the most efficient in reducing yarn tension during unwinding from cops, then came the other types respectively type B, type C and type D.

The value of yarn tension was affected by the friction between surface of balloon breaker and the rotating yarn balloon during unwinding from cops. The value of yarn tension increases with increasing the friction between yarn and balloon breaker. The friction between yarn and balloon breaker type A is at three planes only because balloon breaker type A has a triangular cross section. The friction between yarn and balloon breaker type B is in four planes because the balloon breaker type B has a rectangular cross section.

Balloon breaker type C has a circular cross section and the rotating yarn balloon slips on the inner surface of the balloon breaker. And this leads to a high value of friction between yarn and breaker than the other types (balloon breaker type A and B). Balloon breaker type D has a U-form with relatively larger dimensions. And this leads to an increase in the dimensions of the rotating yarn balloon. The value of yarn tension increases with increasing the dimensions of the rotating balloon.

c) Comparison between the maximum values of yarn tension using balloon breaker and without balloon breaker:

By using a suitable balloon breaker type A the maximum yarn tension can be reduced, the percent of reduction in yarn tension ranged between 17% and 22% for yarn counts Ne 20 and Ne 30, see Table 2. But for yarn count Ne 50 the all types of balloon breakers have higher values of yarn tension than the direct withdrawal of yarn from cops, when the cops is adjusted at a distance equal to 5 cm from yarn guide.

In case of unwinding the yarn directly from cops, the maximum value of yarn tension increases with a percent ranged between 30% and 50% when the distance between cops and guide varied from 5 cm to 15 cm, see Table 2.

Statistical Analysis :

From the measurements of yarn tension during unwinding from cops using balloon breaker and without using balloon breaker. It was found that balloon breaker type A act to reduce the value of yarn tension to a minimum level in the range of yarn count up to Ne 30 and bobbin shapes used in this study

For yarn count Ne 20 and Ne 30 the statistical analysis using T-test for the values of the maximum yarn tension at the base of the cops for yarn count Ne 20 and Ne 30 shows that the difference between balloon breaker type A and the other types is significant. Also the difference in yarn tension between balloon breaker type A and without using balloon breaker is significant.

For yarn count Ne 50 the maximum value of yarn tension at the base of cops is lower than with using any type of balloon breakers.

CONCLUSIONS

- In the case of unwinding from cops without using balloon breaker, the cops must be arranged at small distance from yarn guide.
- The contact surface between the rotating yarn balloon and balloon breaker must be small, because the value of yarn tension was affected by the degree of contact surface.
- The dimensions of balloon breaker must be suitable for the volume of cops because the dimension of the rotating yarn balloon was affected by the dimensions of balloon breaker.
- To avoid the high rate of increase in yarn tension during unwinding from cops. The cops length must not be too long. The use of balloon breaker is not necessary for unwinding the fine yarns from cops.

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