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EFFECT OF THE DYNAMIC MOVEMENT FOR YARN BRAKE ON THE VARIATION IN YARN TENSION

تأثير الحركة الديناميكية لفرامل الخيط على التغيير في قيمة شد الخيط

BY

Shahin, A.

الخلاصة – في هذا البحث تم دراسة معدل انحراف القيمة العظمى للشد في الخيط أثناء سحبه من الكونة خلال أنواع مختلفة من فرامل الخيط كنوع A , B and C وذلك مع تأثير العوامل التالية :

- نوع الخيط (قطن – ألياف صناعية مستمرة)
- سرعة السحب للخيط (٥٠٠ ، ٨٠٠٠ متر في الدقيقة)
- مقدار ضبط فرملة الخيط (خفيفة – قوية)

ووجد أن فرملة الخيط A تعطي أحسن سلوك لشد الخيط أثناء سحبه من الكونة حيث أنه يعطي أقل انحراف لشد الخيط من القيمة المتوسطة . أما بالنسبة للنوع C فوجد أنه يعطي أعلى انحراف القيمة العظمى للخيط عن القيمة المتوسطة .

ABSTRACT- In this work the effect of dynamic movement for yarn brakes on the behavior of yarn tension is analysed.

The behavior of yarn tension befor and after yarn brake was measured under the effect of the following parameters:

- type of yarn brake
- adjustment of yarn brake
- yarn withdrawal speed through yarn brake
- type of yarn
- package diameter

It was found that the construction of yarn brake and its type has an influence on the degree of variation in output yarn tension. Yarn brake (type A) has a small effect on the fluctuation of yarn tension.

Introduction

To control the unwinding of yarn from cops or package in the textile process (winding, weaving, knitting, ...) a yarn brake must be used. According to the adjustment of brake the value of yarn output tension will be defined. To improve the quality of textile process the variation in output tension (after the brake) about its mean value must be minimum as allawable as possible. This variation in yarn tension is due to the dynamic movement of yarn brake.

The value of vibration for yarn brake is affected by the following parameters

- structure of yarn brake
- yarn withdrawal speed

Fora three different types of yarn brake the values of yarn tension (mean and maximum values) was recorded at different withdrawal speed and brake adjustment.

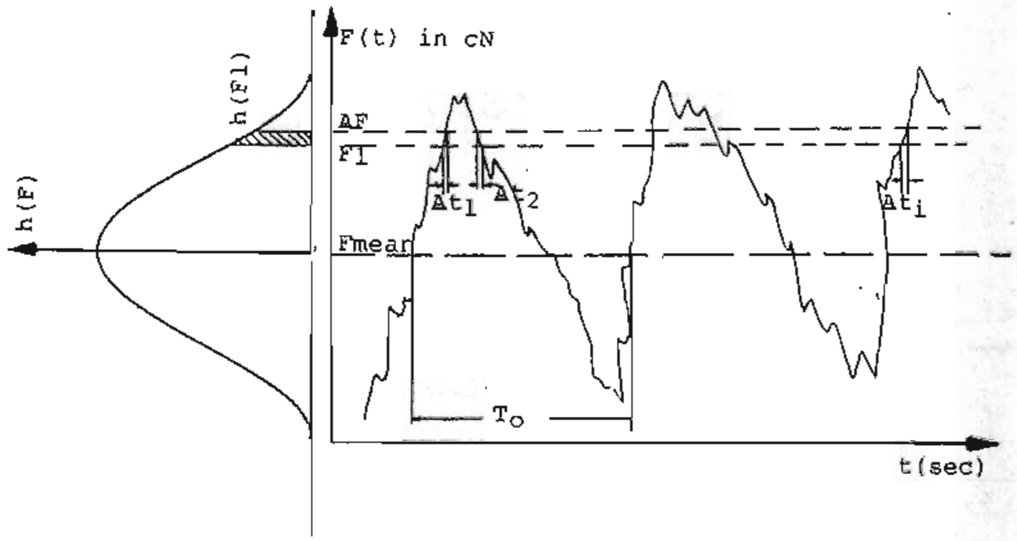


Fig. (I) Behavior of yarn tension and its frequency

Theoretical analyses:

Fig. (I)-right shows the behavior of yarn tension against time.

The value of tension fluctuate between a maximum and minimum value. Fig.(I)-left shows the frequency distribution for the values of yarn tension.

The frequency for the values between F_I and $F_I + \Delta F$ is :

$$h(F_I) = \lim_{\Delta F \to 0} \frac{1}{\Delta F \cdot T_o} \sum_{i=1}^{i=n} \Delta t_i$$

and the mean value

$$F_{mean} = \lim_{T_o \to \infty} \frac{1}{T_o} \int_{-T_o/2}^{T_o/2} F(t)\, dt$$

and the variance

$$\sigma^2 = \lim_{T_o \to \infty} \frac{1}{T_o} \int_{-T_o/2}^{T_o/2} (F(t) - F_{mean})^2\, dt$$

Types of yarn brakes:

1-Disk yarn brake (Fig 2-A)

As shown in Fig.(1-A) the yarn passes through two brakes and every brake consists of two disks, the first disk brake is unloaded and the second disk brake is loaded with a suitable load according to yarn characteristic and textile processing. The lower disk for every brake has a rotating motion to avoid the accumulation of impurities on the disk surface.

2- Roller brake (Fig 2-B)

As shown in Fig (2-B) the yarn passes throght two rollers coated with rubber, these rollers rotates by withdrawing the yarn through it. The right roller has an additional pendulum motion to balance the pressure between the two rollers according to the value of yarn tension. By increasing the value of output tension the pressure between two rollers will be decreased due to the pendulum motion (outside motion) of the right roller. The initial pressure between the two rollers can be adjusted according to yarn characteristic and operation conditions with a loaded spring.

3- Finger brake (Fig 2-C)

As shown in Fig (2-C) the yarn passes through two groups of fingers (each group consists of three fingers) and pro group two fingers (autside fingers) were fixed on a horizontal frame. The finger frame is loaded with a coil spring to rotate the fingers in anticlockwise direction. Due to this movement of the frame the wrapping angels between yarn and fingers will be increased. By increasing the value of output tension the finger frame will be rotate in clockwise direction and leads to decrease the wrapping angles between yarn and fingers and result a balacing in the value of output tension. The initial value of yarn tension can be adjusted by means of the coil spring. To avoide the high vibration of finger frame a damping oilbrake must be used.

EXPERIMENTAL- (Fig. 3)

Fig 3 shows the arrangement of the apparatus used, the yarn is withdrawn from package 1 by means of take up drum 6 with a withdrawing speed ranged between 500 and 800 m/min. The yarn passes through yarn brake 4.

The input and output yarn tension were measured by means of two measuring heads 3 and 5 (RES-Measuring heads, 21 KHZ). The electrical signal from measuring heads were amplified by means of amplifiers 7 and calibrated in force units using a chart recorders the value of input and output tension were recorded. For a statistical evaluation for the output tension a analog-digital calculators 9 was used.

Table 1 shows the used yarn material and yarn brakes in the measuring.

DISCUSSION AND CONCLUSION. (Figs. 4,5 and 6)

- Type of yarn brake has the main effect on the ratio (F_{max} (10%) / F_{mean}) and the effect of yarn material, package dimension and yarn withdrawal speed is neglegable
- By using yarn brake (type A) the ratio (F_{max} (10%) / F_{mean}) is minimum (ranged between 1,17 and 1,51) and by using yarn brake (type c) the ratio (F_{max} (10%) / F_{mean}) is maximum (ranged between 2,12 and 3,37).
- The unloaded disk brake in yarn brake (type A) act as a damper for the formed wave in yarn tension and result a damped wave with a small amplitude

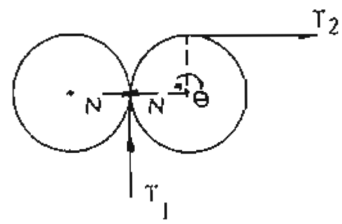
- By low adjustment of yarn brake the value of the ratio (F_{max} (10%) / F_{mean}) is higher than the ratio by high adjustment of yarn brake. The stability of yarn brake at high adjustment is more than the stability of yarn brake at low adjustment, and result by more stability for yarn brake a small variation in yarn tension during withdrawing the yarn through the brake.
- The ratio (F_{max} (10%) / F_{mean}) by using yarn brake (type B) is nearly equall to the ratio by using yarn brake (type A). Yarn brake (type B) has a heavy elements than the other two types, and result a small vibration for brake elements during withdrawing the yarn through the brake which leads to a small variation in the value of yarn tension.
- It is suitable to use a compaund yarn brake with pre and main loading because this leads to damping the formed wave in yarn tension.
- The behavior of yarn tensin in yarn brake type A is :

$$T_2 = T_1 + 2\mu(N_1 + N_2)$$

μ= coefficient of friction between yarn and disks.

The resultant tension wave after passing the yarn through disk brakes is the summaation for the two waves for first and second disk brake. The disk brakes constructed with a suitable dimensions to avoide the high resultant values of amplitude for for tension waves.

- For yarn brake (type B), assuming the contact between two rubber rollers in one point and the yarn has a relative movement to roller is:

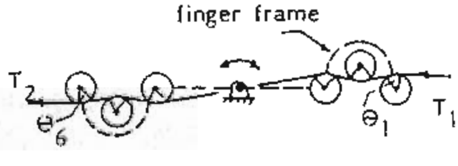


$$T_2 = (T_1 + 2\,\mu\, N).\, e^{\mu\,\theta}$$

the output tension affected by the pressure between two rollers
- the behavior of yarn tension in yarn brake (type c) is :

$$T_2 = T_1 \,.\, e^{\mu\,(\theta_1 + \ldots + \theta_6)}$$

the output tension affected by the degree of inclination of finger frame.



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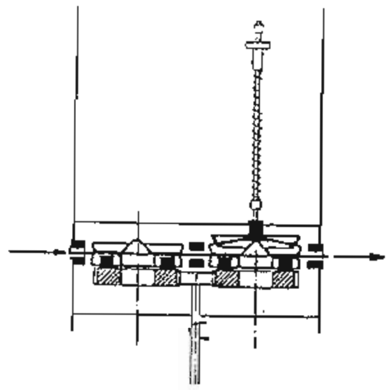
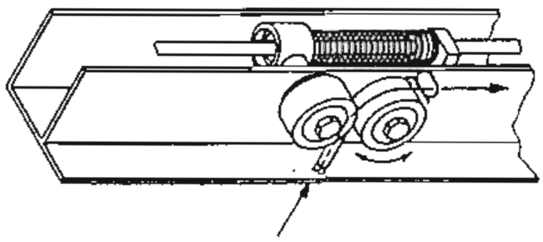
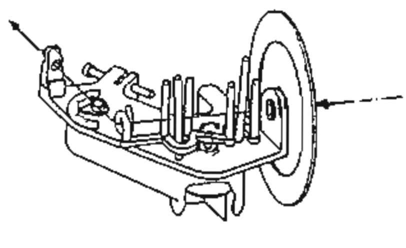


type A



type B



type C

Fig.(2) Different types of yarn brake

	Disk brake (type A)	Roller brake (type B)	Finger brake (type c)
Yarn material	Cotton, 15 tex Nylon (cf), 70 den	Cotton, 15 tex Nylon (cf), 70 den	Cotton, 15 tex Nylon (cf), 70 den
Package diameter	Cotton D = 8 cm Nylon D = and 22 cm	Cotton D = 8 cm Nylon D = 13 and 22 cm	Cotton D = 8 cm Naylon D = 13 and 22 cm
Yarn speed	500 and 800 m/min	500 and 800 m/min	500 and 800 m/min
brake adjustment	low and high	low and high	low and high

Table 1

Evaluation of results :
Using the analog - digital calculator the following values were calculated
- F_{mean} = mean value of yarn tension
- F_{max} (10%) = mean value of yarn tension of classified 10% for the maximum value of yarn tension

The ratio(F_{max} (10%) / F_{mean}) was recorded against type of yarn brake, see Fig. 4, 5 and 6.

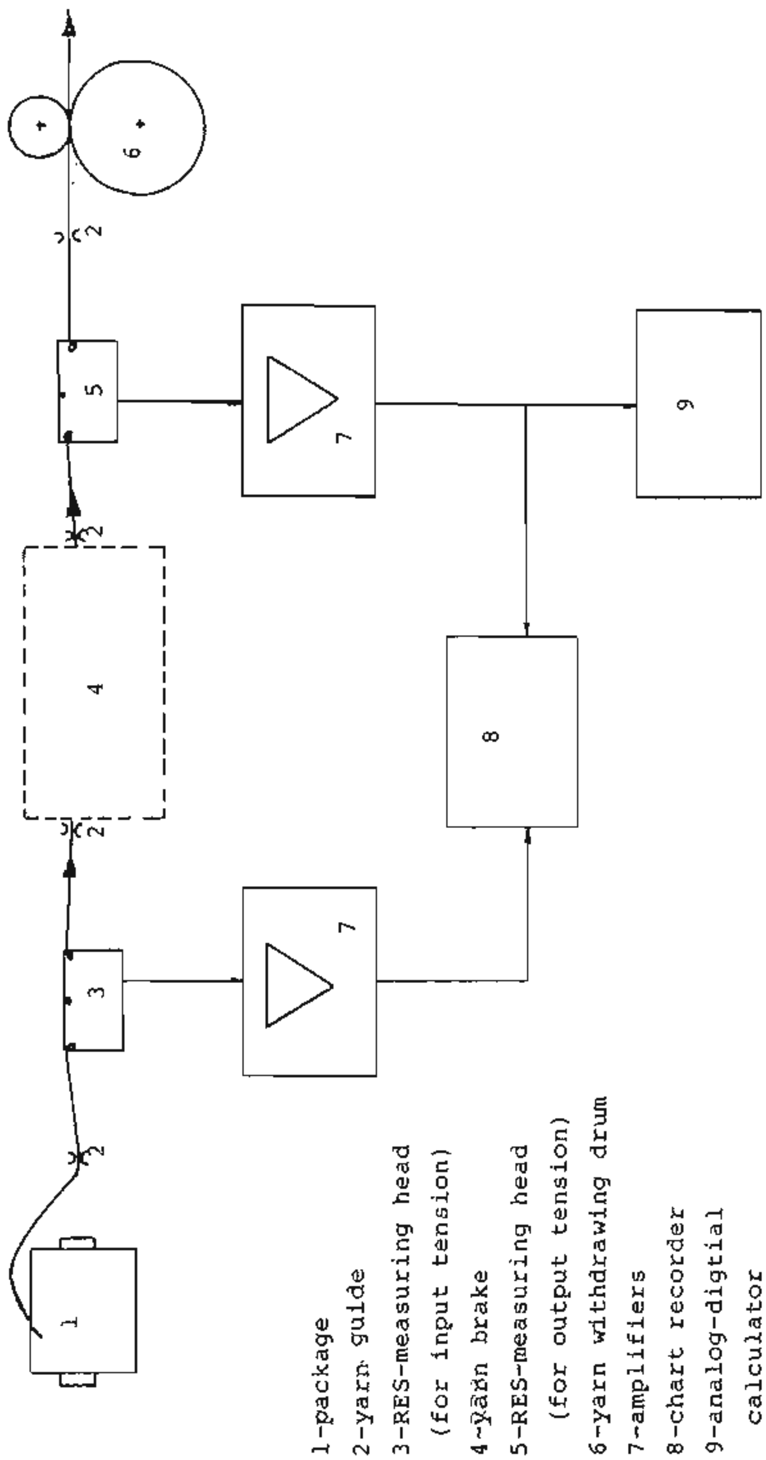


Fig.(3) Arrangement of the measuring apparatus

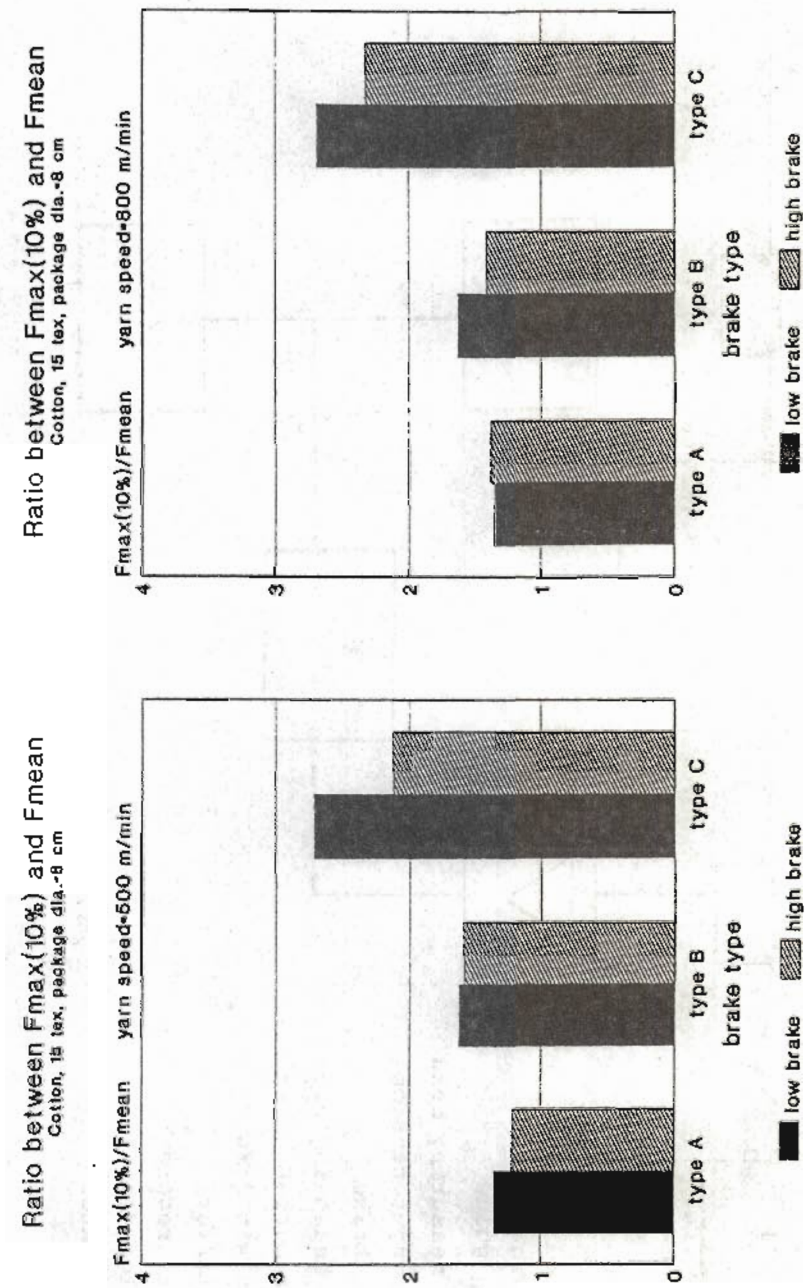

Ratio between Fmax(10%) and Fmean
Cotton, 15 tex, package dia.=8 cm
Fmax(10%)/Fmean
yarn speed=500 m/min
4
3
2
1
0
type A
type B
type C
brake type
low brake
high brake
Ratio between Fmax(10%) and Fmean
Cotton, 15 tex, package dia.=8 cm
Fmax(10%)/Fmean
yarn speed=800 m/min
4
3
2
1
0
type A
type B
type C
brake type
low brake
high brake

Fig. 4

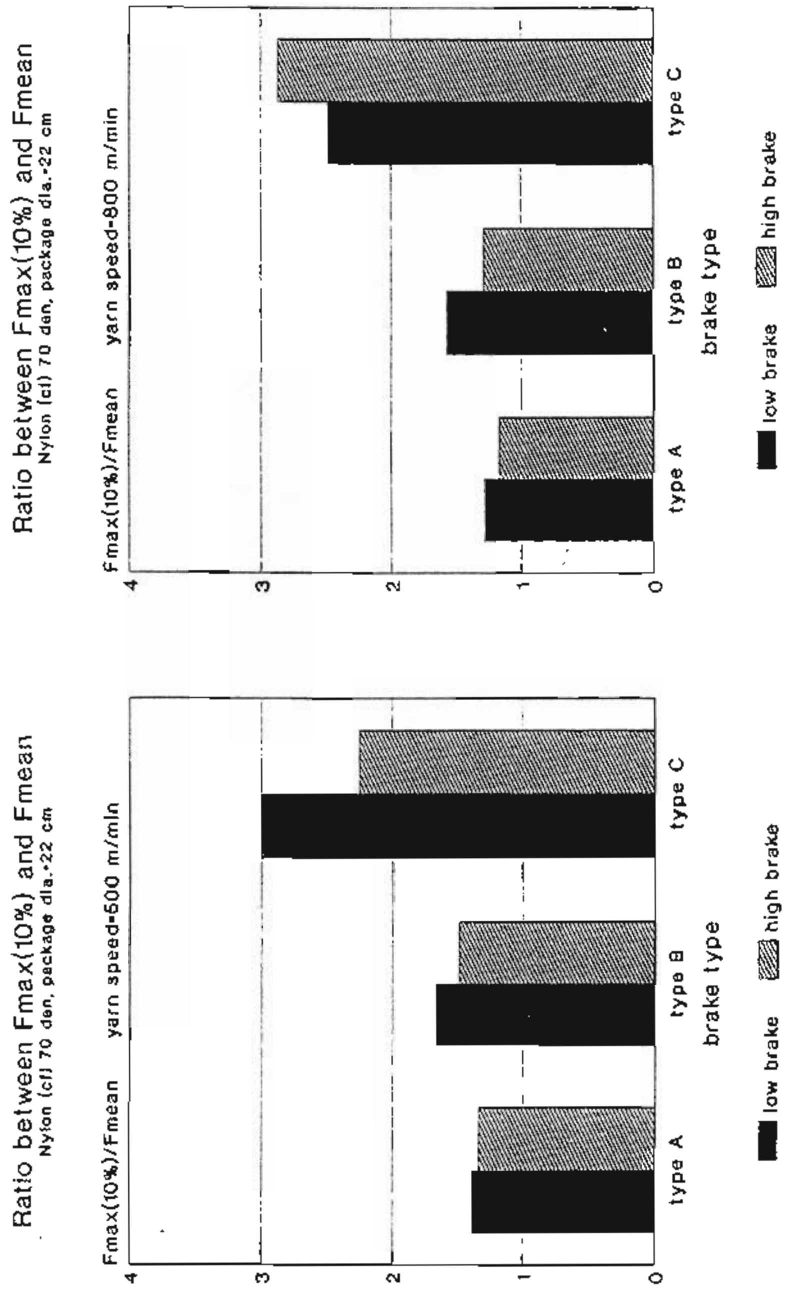
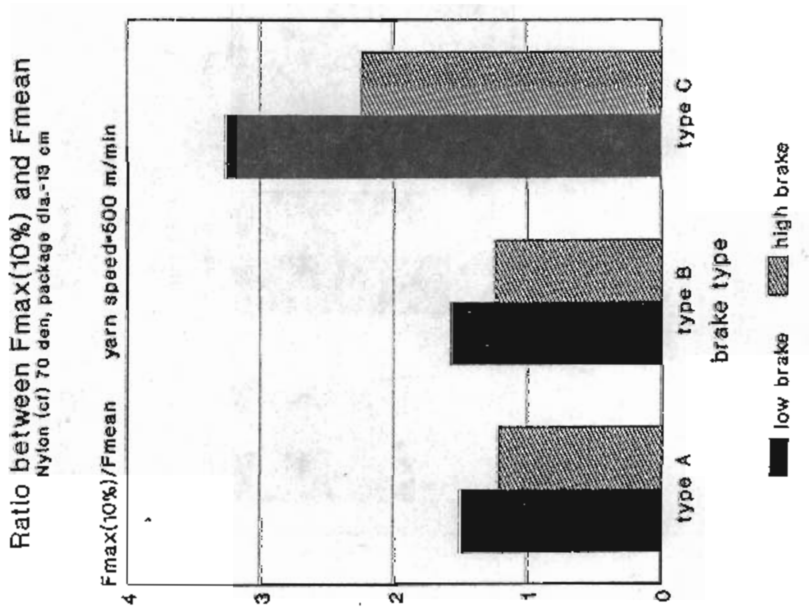

Ratio between Fmax(10%) and Fmean
Nylon (cf) 70 den, package dia.=22 cm
Fmax(10%)/Fmean
yarn speed=800 m/min
4
3
2
1
0
type A
type B
type C
brake type
low brake
high brake
Ratio between Fmax(10%) and Fmean
Nylon (cf) 70 den, package dia.=22 cm
Fmax(10%)/Fmean
yarn speed=600 m/min
4
3
2
1
0
type A
type B
type C
brake type
low brake
high brake

Fig. 5


Ratio between Fmax(10%) and Fmean
Nylon (cf) 70 den, package dia.=13 cm
Fmax(10%)/Fmean
yarn speed=500 m/min
4
3
2
1
0
type A
type B
type C
brake type
low brake
high brake

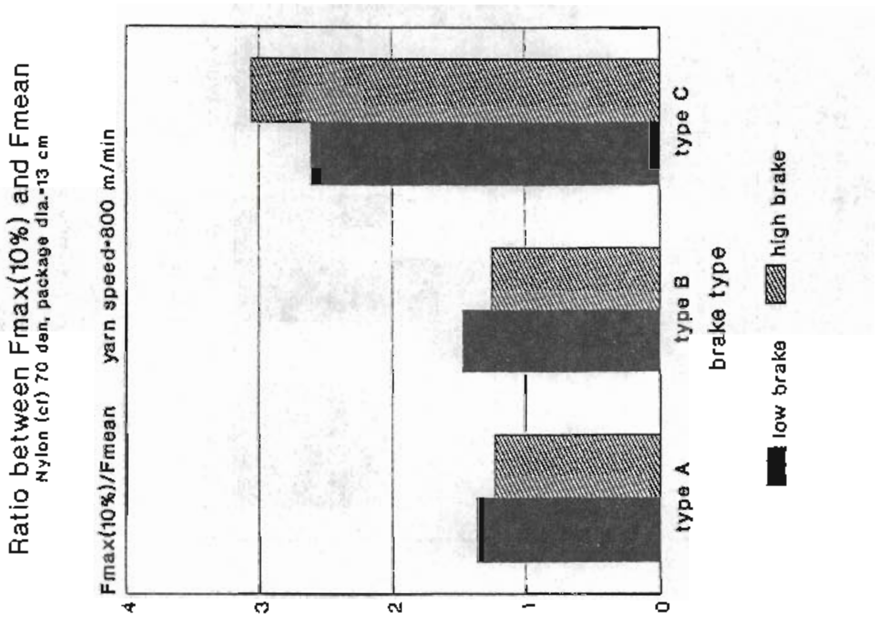

Ratio between Fmax(10%) and Fmean
Nylon (cf) 70 den, package dia.=13 cm
Fmax(10%)/Fmean
yarn speed=800 m/min
4
3
2
1
0
type A
type B
type C
brake type
low brake
high brake

Fig. 6