THE RING EXCENTRICITY INFLUENCE FROM THE SPINNING MACHINES UPON THE STRETCH FORCE OF THE YARN

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The frequency of the end-breaks in the spinning machines is influenced especially by:
- stretch force of the yarn;
- the technical state of the equippment;
- the caracteristics of the processing material;
- the machine quality.

The yarn stretch force is also influenced by numerous factors among which we can mention:
- spindles speed;
- traveller mass;
- rubbing coefficients in textile tribosystemes: ring – traveller and yarn – traveller;
- the structure and the quality of twist – winding mechanism;
- winding diameter;
- the structure of the prelucrated yarns.

Regarding the quality of the twist – winding mechanism, it has been ascertained that the excentric setting of the ring to the spindle produces increases of yarn stretch force.

In this application it will be determined the yarn stretch force values in zone: delivery roller - yarn thread guide, according to ring excentricity to the spindle and its turation.

In case the ring is correctly arranged to the spindle, this means without excentricity, at delivery speed, spindle speed and constant winding ray, theoretically the result is for the traveler a tangential speed and constant normal acceleration and zero tangential acceleration; in an excentric ring arrangement, speed variations and accelerations appear. Consequently the yarn stretch force is variable, the maximum values having a negative influence upon the tearing frequency. The values and the stretch force variations can be theoretically and also experimentally determined.

In fig..1 the ring is presented having the center in $\mathbf{O_I}$ excentrically arranged to the spindle that has its center in $\mathbf{O_f}$ (**e** = excentricity) ; traveler **C** mass is determined by φ angle measured from $\mathbf{O_IO}$ axe and the position of winding point **A** to α angle is marked such as:

R – ring ray;
r – ray of winding in the reel;
ω - spindle angular speed;
μ - traveler-ring rubbing coefficient;
m – traveler mass;
$\mathbf{a_c^n}$ and $\mathbf{a_c^t}$ normal and tangential traveler accelerations.

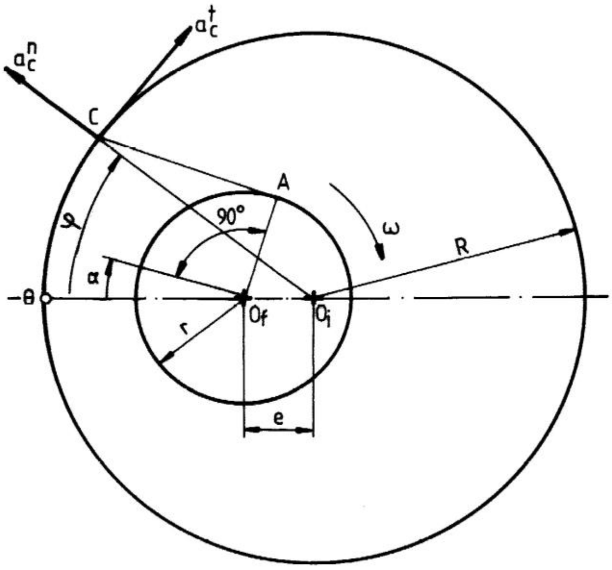

Figure 1.

The last ones are calculated with (1) and (2) relations and then relations with (3) and (4):

$$a_c^n = R \cdot \omega \cdot \left(\omega \cdot \frac{d^2\varphi}{d^2\alpha} + \frac{d\omega}{d\alpha} \cdot \frac{d\varphi}{d\alpha} \right) \quad (1)$$

$$a_c^t = R \cdot \omega^2 \left(\frac{d\varphi}{d\alpha} \right)^2 \quad (2)$$

$$e \neq 0 \begin{cases} \Delta a_c^n = R \cdot \omega^2 \left[\left(\frac{d\varphi}{d\alpha} \right)^2 - 1 \right] \\ \Delta a_c^t = a_c^t \end{cases} \quad (3) \text{ and } (4)$$

Taking into consideration traveler-ring rubbing variation ΔF_f - relation (5), the variations of the centrifugal force of the traveller ΔF_c - relation (6) and the links expressed by relations (7) and (8) can be settled the yarn stretch force variation ΔF - relation (9) and fig.2.

$$\Delta F_f = \mu \cdot (\Delta F_c - \Delta F_n) \quad (5)$$

$$\Delta F_c = m \cdot \Delta a_c^n \quad (6)$$

$$m \cdot a_c^t = \Delta F_t - \Delta F_f \quad (7)$$

$$\sin(\varphi - \alpha) = \frac{1}{R}(r - e \cdot \sin\alpha) \quad (8)$$

$$\Delta F = \pm \frac{m \cdot e \cdot \omega^2}{\mu\left(1 - \frac{r^2}{R^2}\right) + \frac{r}{R} \cdot \sqrt{1 - \frac{r^2}{R^2}}} \quad (9)$$

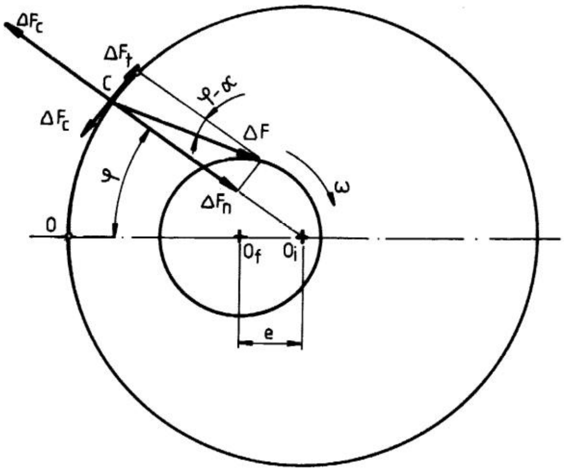

Figure 2

The transducer **T** – fig.3, is made up of an elastic slide **1** upon which resistive marks $\mathbf{R_1}$ and $\mathbf{R_2}$ are applied; the resultant of **F** of yarn stretch force guided by pieces **2** provokes bendings in slide **1**; the effort σ_1 of the slide as well as the elastic deformations are derectly proportional with force **F**; under the influence of the elastic deformations ΔR_1 and ΔR_2 variations appear of the $\mathbf{R_1}$ and $\mathbf{R_2}$ resistances.

As the transducer is binded to the bridge gange the value of force **F** is read on the measure(ment) instrument of the bridge.

The yarn stretch force variations ΔF can be followed on the screen of an oscilloscope binded in **b** and **d** points. A spinntester is used for attempts that offers the possibility of spindle training with turations from 5000-15000 rot/min – fig.4 where then are: spindle **3**, ring **4**, traveller **5**, delivery cylinders of the drafting system **6**, yarn guide **7**, ring rail **8**, that is modified for regulate the ring excentricity value with the help of a micrometric screw **9**.

The value of the yarn stretch force detected by transducer **10** coupled to the tensiometric bridge through the amplifier **11** is read both in the measure bridge instrument as a medium value F_{med}, and also on the oscilloscope screen **12**, where in addition, the ΔF variations of the mentioned force appear.

To remove the parasite influence upon the yarn stretch force it is necessary to be assured the following:

- rod perpendicular side in the spindle and ring bank;
- ring with minimum turing off from cylindrical side;
- well-centered yarn guide;
- uniform yarn;
- rigid fixation of ring rail;
- yarn derect winding on the spindle rod;
- force reading when the ring rail passes through the same position.

The restalation standard callibration is made when a force with a known value of 20...30 cN is applied to a yarn passed through the thread guide. In this way in the outlet 11 of the amplificator, a constant tension and it represented the value of force F of the yarn, which, if it is applied also for the input of the continue fluent of the oscilloscope it dispaces the scavenging line proportionally with the force applied to the transducer; both the amplificator 11 and the oscilloscope is adjusted so as to be obtained convenient scales for forces reading.

For ease, the oscilloscope is adjusted when the transducer is not loaded so that the scavenging line be situated at the basis of the screen, representing the line of "zero".

If the yarn is winded on the spindle, the image of fig.5 is seen on the oscillator's screen and offers the possibility to determine force F_{med} and force variation ΔF .

$$\Delta F = \Delta F' - \Delta F_0 \quad (10)$$

ΔF_0 represents a posibile variation of force into the yarn when the ring is centered, the force is resulted, for exemple, by the elipsed ring or by the vibrations of the cursor.

The maximum force into the yarn *Fmax* meaned only the influence of ring's excentricity is:

$$F_{\max} = F_{med} + \Delta F \quad (11)$$

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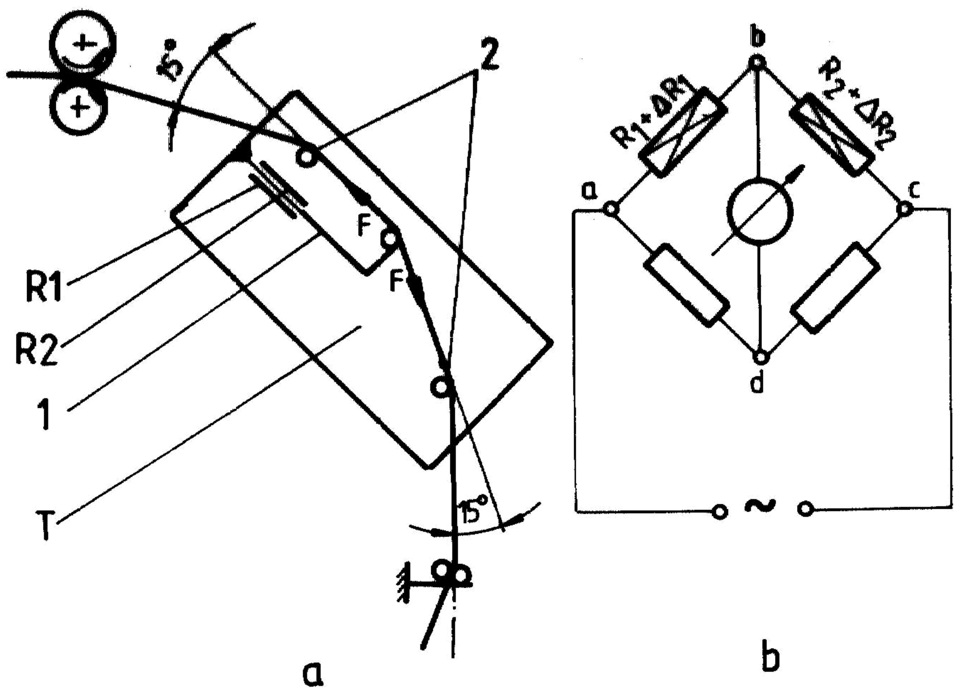

Figure 3 .

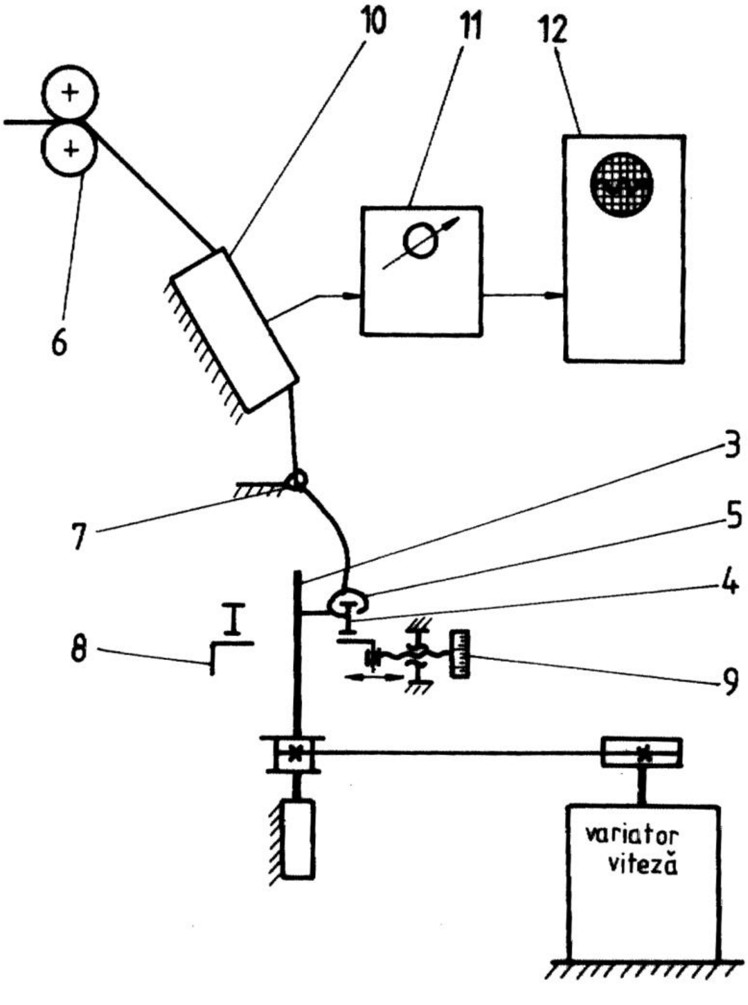

Figure 4.

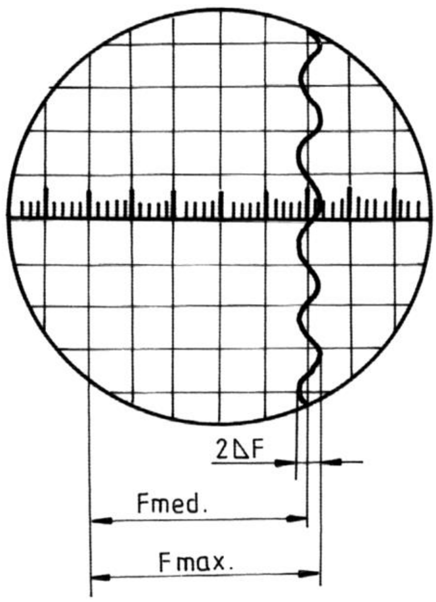

Figure 5.