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THE EXPERIMENTALLY DETERMINATION FOR THE ELASTIC AND SAFETY CLUTCH

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Abstract: The paper presents the roll and importance of testing for the elastic and safety clothes. There are also presented the function, characteristics theoretical and working principle of an elastic safety clutch. This clutch represents a new type clutch, that by its simple functions, accomplishes the functions of a combined clothe. There are also the characteristics static and dynamic experimental presented, it is also useful for the analysis of the representative influences of the geometrical and functional parameters on the dynamic behavior of the clutch. Respectively conclusion references of a study this clutch.

Key words: clutches, elastic, safety, function, simple.

1. INTRODUCTION

A condition imposed to the elastic clutches is that at the breakage of an element, the clutch does not failure immediately. If there is only an elastic element, the total breakage of the clutch has to be inferred, in case of partial fractures or the fissures. Another condition imposed to elastic clutches is that the elastic elements that can rapidly be destroyed, to be easily replaced – if it is possible without the clutch disassembling or the axial displacement of the axle stubs.

The paper presents the experimental characteristics for the elastic and safety clutches with flat followers fig.1, [1][2][3]

Elastic and safety clutches are characterized by the following representative functions [2] [3]:

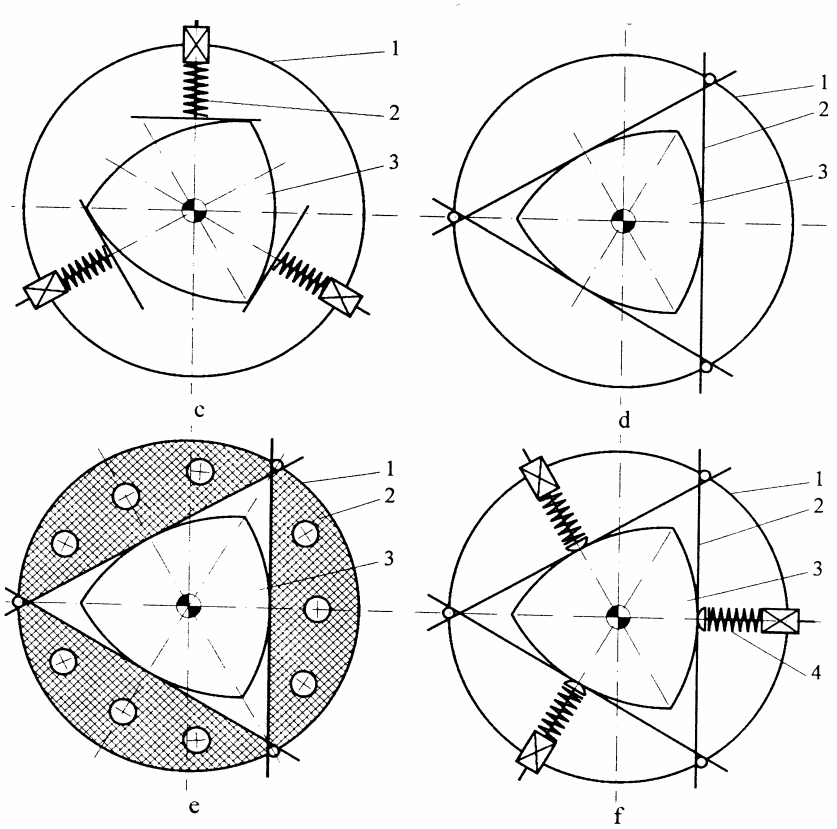

Fig.1 The structural scheme of three – elastic and safety clutches – variants

- it makes the connection between two shafts (with fix or variable relative position) and it ensures the transmission of the moment and of the rotation velocity between shafts;
- the strength transmission is interrupted when the resistant moment autumns an imposed limit value ; the interruption of the energetic wave it's being realize basis on an elastic element deformation (when the deformation achieves the value which correspond to the limit moment, the connection between the semi clutches will be interrupted).

The clutch has in his component the equiangular cam 3, which represents a semi clutch; the second semi clutch it's constituted from flange1 and degenerated followers in elastic elements 2 (lamellar bow, elicoidal bow, and rubber shoes).

The charge is being transmitted from one semi clutch to the other through the degenerated followers. The pushing force of the degenerated followers is given by the compression elicoidal bows, by lamellar bows and rubber elements. When the limit torsion moment, which can be transmitted by the clutch, is overfulfield, between the semi clutches appears a relative rotation movement, which allows the charge interruption of the mechanical transmission.

2. STATIC EXPERIMENTAL CHARACTERISTICS

The elastic and safety clutches are characterized through a variable rigidity (nonlinear characteristic) – relation (1) – and the protection condition of the mechanical transmission is expressed with relation (2).

$$k(\varphi) = \frac{dMt(\varphi)}{d\varphi} \tag{1}$$

$$M_{t\,lim}(1+\Delta) \le M_{t\,max\,a} \tag{2}$$

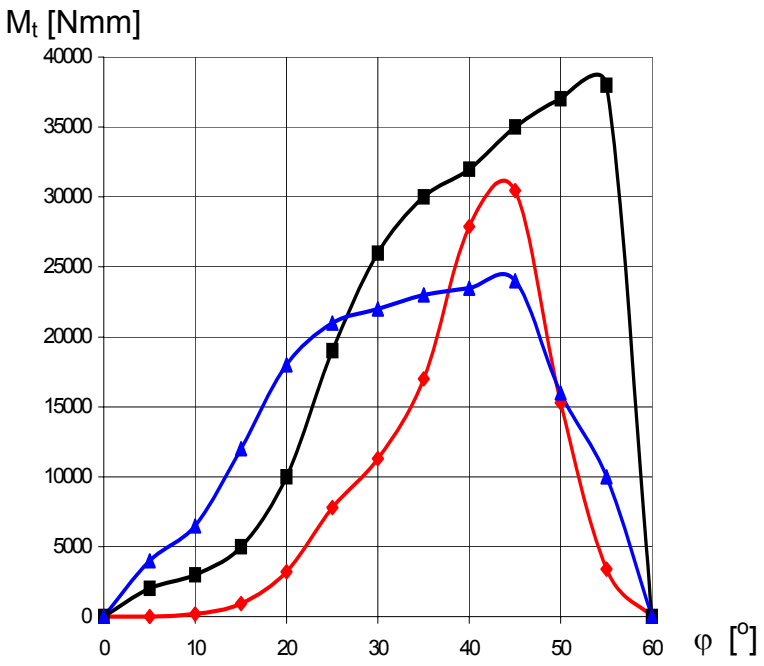

Fig.2 The static experimental characteristics

Where:

k – the clutch rigidity; φ – the relative rotation angle of the semi clutches; $M_t(\varphi)$ – the torsion moment which corresponds to the clutch deformation with angle φ; $M_{t\ lim}$ – the

moment when is produced or is ended the decoupling; $M_{t\ max\ a}$ – the maximum torque moment that is admitted by the resistance of the weakest element of the clutch; Δ – the relative error of the safety clutch.

The static experimental characteristics, of the three variants of elastic and safety (figure 1), are presented in figure 2 [3].

The elastic characteristics that were presented had been determined for the elastic and safety clutch.

◊ (rhomb) – With degenerated followers in lamellar bows (figure 1d); □ (square) – With degenerated followers in rubber shoes (figure 1e); Δ (triangle) – With degenerated followers in lamellar bows and elicoidal bows (for compression) (fig. 1f);

3. DYNAMIC EXPERIMENTAL CHARACTERISTICS

The experimental determinations for the elastic and safety clutches were realized for the representative testing regimes. The experimental determinations are illustrated in diagram [2][3].

The start: with a resisting moment that is build up from a inertia moment and a transmitted moment in charge of 5000 Nmm. The diagram of this regime $M_t(t)$ is represented in figure. 3. The resistant moment rises suddenly, touching a moment of 14500 Nmm in a time interval of 46,6 ms; it follows an oscillating variation of the moment, specific to the starting shock damping; after this it take place a moment stabilization at the value of 5000 Nmm, in a time interval of 450 ms.

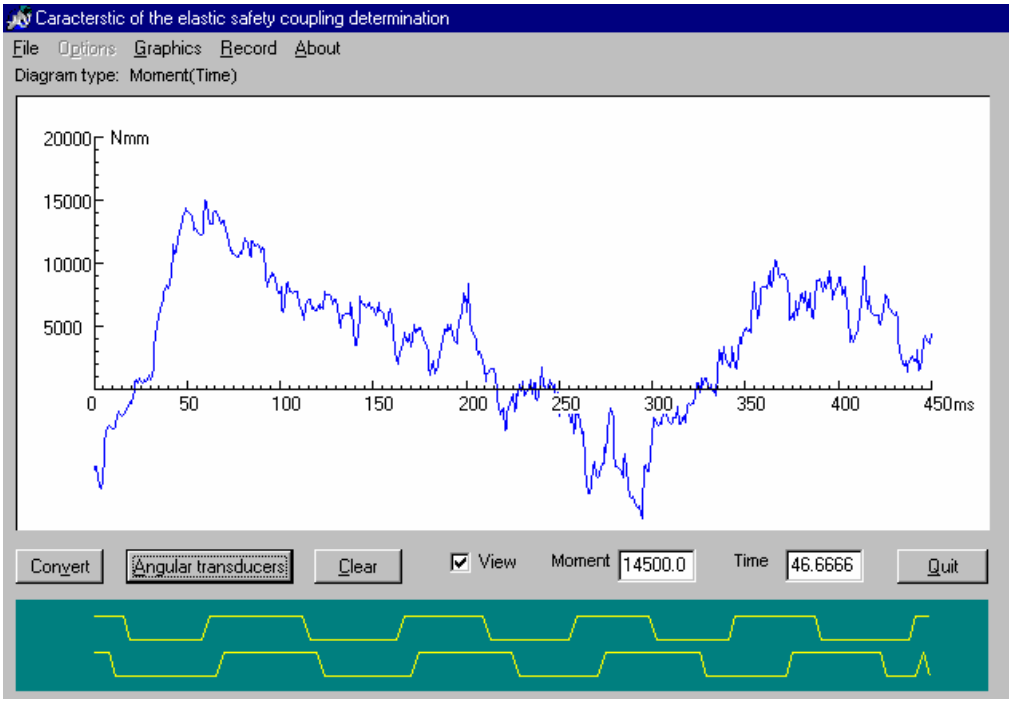

Fig. 3 The start

The decoupling under shock followed by stabilization and stopping is presented in the diagram – figure. 4. The charge decoupling takes place at a shock moment of 16500 Nmm, in short length, time in which the relative rotation angle between the two semi clutches becomes 360^0. It follows the stabilization at the charge moment, in an interval of 225 ms; the stopping of the stand takes place in 150 ms from the supply stopping of the electric motor.

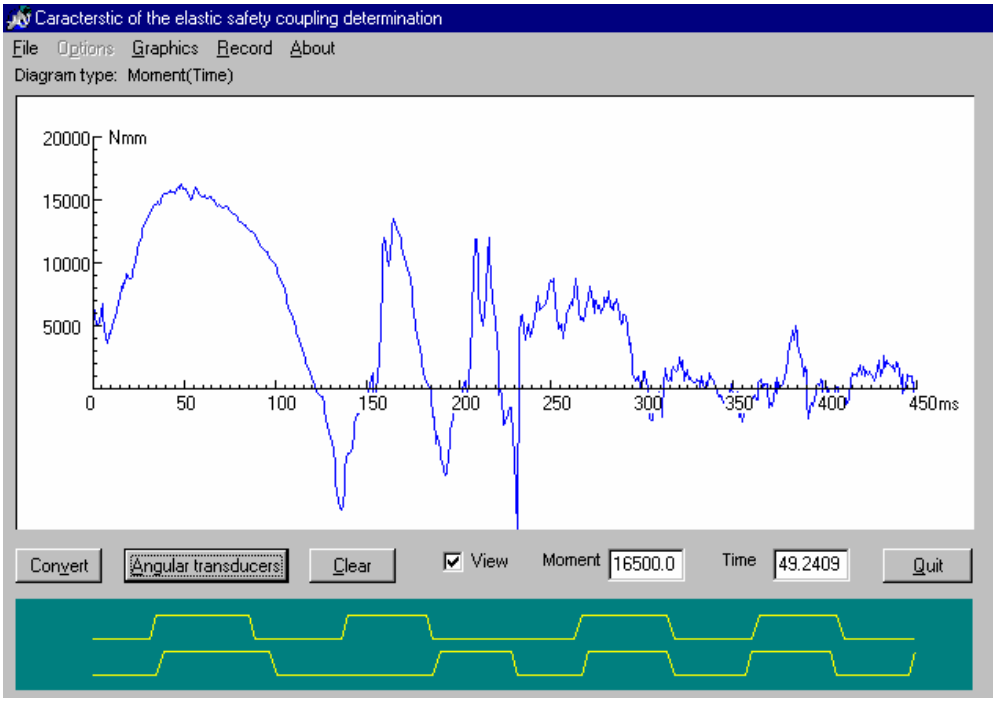

Fig. 4 The decoupling under shock followed by stabilization and stopping

4. CONCLUSIONS

After the study and analysis of the experimental determination, static and dynamic concerning the elastic and safety clutches with degenerated followers in multilamellar bows, the next conclusions were formulated:

- The elastic and safety clutches characteristics are progressive;
- The clutches have a big elastic deformation capacity;
- The relative rotation angle between the semi clutches is function of the cam profiles number;
- Because of the big elasticity, the clutches have a big damping capacity of the tensional shocks;
- The clutches can take over radial deviations – of 2-4 mm – and big relative angles;
- The start and the stopping are made without big shocks;
- The charge decoupling within the framework of the overcharge or the gear deficiency is made without the destruction of the elastic elements and without any additional shocks.

5. REFERENCES

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