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SIMPLE MECHANICAL CLUTCH WITH MULTIPLE FUNCTIONS

Ioan STROE

Universitatea "Transilvania" din Braşov, e-mail stroei@unitbv.ro

Abstract: The paper presents a new type of clutch, whose component elements can accomplish the functions of a combined clutch. It will be presented by the name “Elastic and Safety Clutch”. The paper presents the structural schemes, of the elastic and safety clutch and presents the transversal section through the clutch with flat translation followers. For the expressions simplifying it was considered the case when the cam semi-clutch is profiled by circle arcs, the algorithm being also valid for the case of the profiles with others curves. There are presented the torque forte and the elastic characteristic of the elastic and safety proposed 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 elastic clutch could take over, overloads up to a certain torque value. Over this value, when the transmission is not provided with a load disengagement system, the elastic elements of the clutch are destroyed, this corresponding with the placing of transmission out of the operation. The safety clutch fulfils (besides the main function of the torque transmission) the function of torque limitation or automatic interruption of the connection between the coupled shafts, in the case of some overloads’ occurrence, during the performance.

The safety clutches assure the transmission performance up to the limit torque value, for what the safety elements are designed. Over this value, it appears the relative slipping between the semi-clutches that involves the mechanical transmission protection. Taking the data above into consideration, it results the necessity of some clutches, that by the associated functions to allow the load disengagement before that the elastic elements to be destroyed. In the case of diverse applications, when the mechanical transmission imposes it, there can be combined the simple functions of one clutch type with the simple functions of another clutch type, obtaining a combined coupling. In this case, the combined coupling is obtained by the connection, of two or more simple clutches, in a certain manner, on purpose to accomplish accordingly the imposed complex functional role of mechanical transmission.

Taking the data above into consideration, this paper will present a new type of clutch, whose component elements can accomplish the functions of a combined clutch. It will be presented by the name “Elastic and Safety Clutch” [1], [2]. In the first Figure 1 there is presented a classification of the mechanical clutch which includes also the new type of the elastic and safety clutch [2].

2. CONSTRUCTION OF THE CLUTCHE

Figure 2 presents the structural schemes of the elastic and safety clutch and figure 3 presents the transversal section through the clutch with flat translation followers [2].

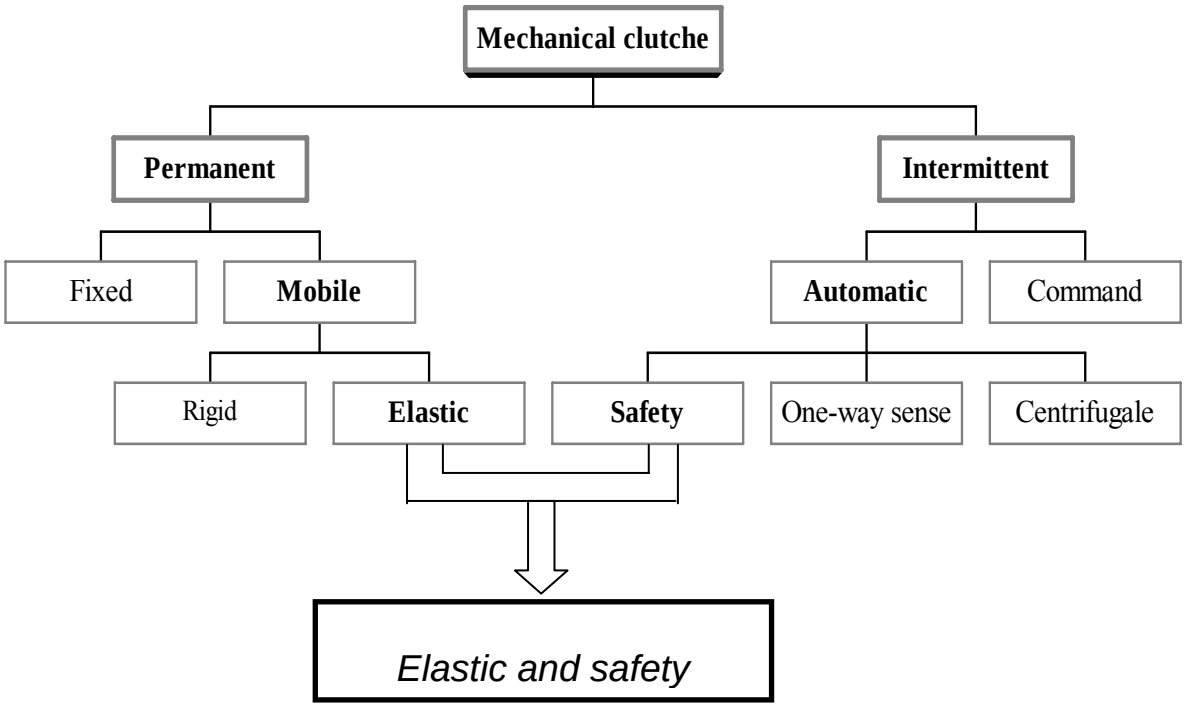

Fig. 1. The classification of the mechanical clutches

The elastic and safety clutch presented in figure 3 belongs to the category of clutches generated from mechanisms with rotation cam and flat translation follower; the cam as well the follower is non-degenerated. The constructive solution allows the pretension adjustment without to take to pieces the clutch.
The clutch contains the equiangular cam 3, with three prominences, which represents one of the semi-clutches and the second semi-clutch is represented by the flange 1. On this flange there are mounted the three flat translation followers 13 – that are equiangular disposed – as well as the fastening and adjusting elements 12, that are necessary for the pretension of the compression spiral springs 11.

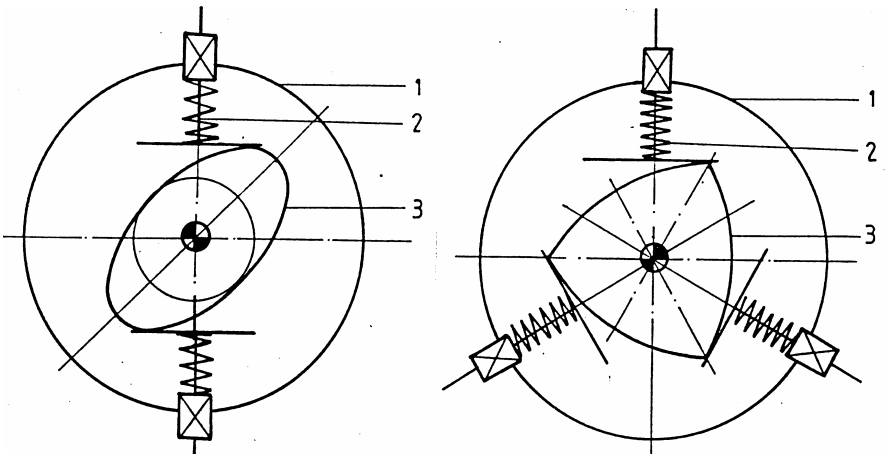

Fig. 2. Structural scheme of the elastic and safety clutch with flat translation followers

The driving semi-clutch 1, transmits the torsion moment by means of the equiangular cam 3, that are in contact with the three flat translation followers 13, due to the pressing force of the compression spiral springs 11. Knowing the elastic characteristic of the

compression springs, the pressing force necessary for the torque transmission can be adjusted by means of the special screws 12.The new type of clutch accomplishes the functions of the elastic and safety clutches and it assures a good damping of torsion shock and vibrations; it also provides the compensation of axial, radial and angular deviations in relative large limits.

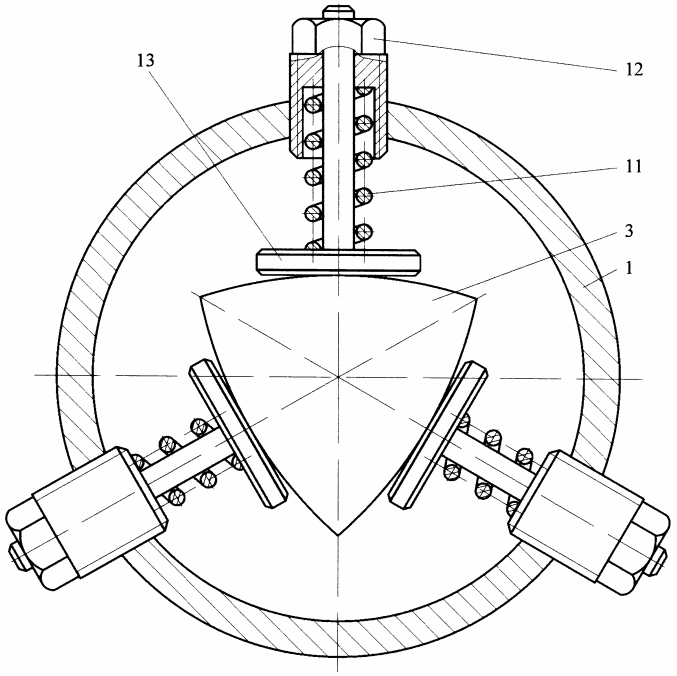

Fig. 3. Constructive scheme of the safety clutch

3. THE TORQUE FORTHE AND THE ELASTIC CHARACTERISTIC

$$T = nT^* = n k_a \left(s_2 + \delta\right)\left[a_2 \sin\gamma + \mu\left(s_2 + r_0\right)\right] = n k_a \left[a_2 \frac{1}{\sin\varphi_1}\left(\sin\alpha - \sin\gamma\cos\varphi_1\right) + r_2 - r_0 + \delta\right]\cdot$$

$$\left[a_2 \sin\gamma + \mu\left(a_2 \frac{1}{\sin\varphi_1}\left(\sin\alpha - \sin\gamma\cos\varphi_1\right) + r_2\right)\right] \quad (1)$$

where by T* it had been written down the moment that corresponds to a single proeminence ($T^* = T/n$, n – the number of the prominences of the cam and the number of the flat translation followers). The determination of the s_2 - change of place will be performing distinctly, for each circle arc of the cam profile.

$$K\left(\varphi\right) = \frac{dT\left(\varphi\right)}{d\varphi}, \quad (2)$$

$$\frac{dT}{d\varphi_1} = nk_a\left\{\left(r_1 - r_0\right)\left[\dot{s}_2 \sin\varphi_1 + \left(s_2 + \delta\right)\cos\varphi_1\right] + \mu\dot{s}_2\cdot\right.$$

$$\left.\cdot\left(2s_2 + \delta + r_0\right)\right\} = nk_a\left\{\left(r_1 - r_0\right)\left[\left(r_1 - r_0\right)\sin^2\varphi_1 + \left(\left(r_1 - r_0\right)\cdot\right.\right.\right.$$

$$\left.\left.\left.\cdot\left(1 - \cos\varphi_1\right) + \delta\right)\cos\varphi_1\right] + \mu\left[\left(r_1 - r_0\right)\sin\varphi_1\right]\left[2\left(r_1 - r_0\right)\cdot\left(1 - \cos\varphi_1\right) + \delta + r_0\right]\right\}. \quad (3)$$

$$\dot{s}_2 = \left(r_1 - r_0\right)\sin\varphi_1\ ;\ \varphi_1 \in \left[0, \nu\right]. \quad (4)$$

$K\left(\varphi\right)$ express the tangent to the curve moment which is traced in function oh the φ relative rotation angle between the semi-clutches

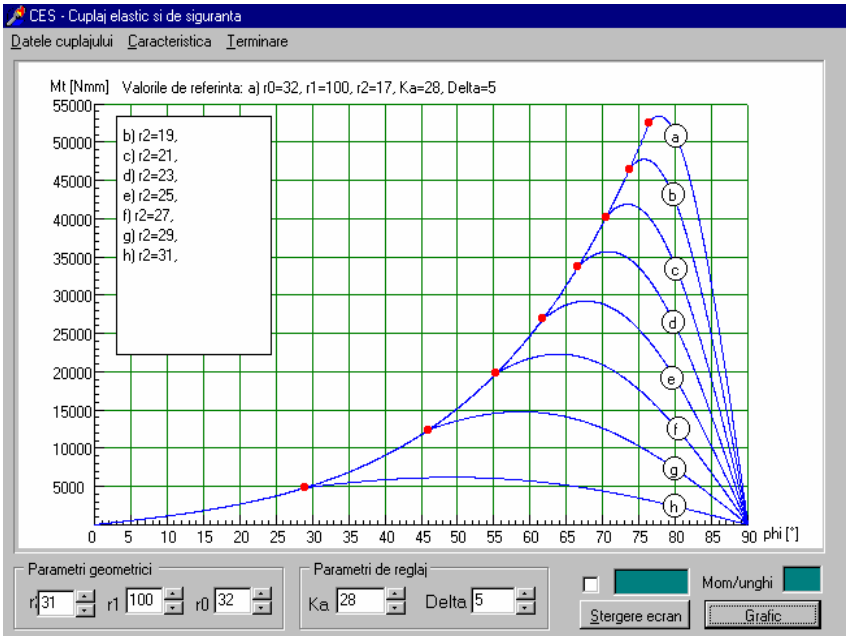

Fig. 4. The elastic characteristic of the clutch

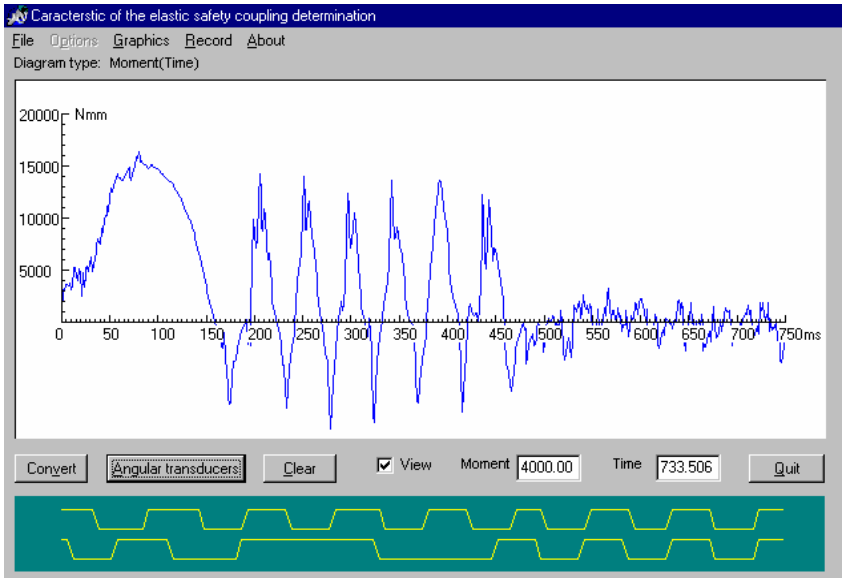

Fig. 5. Dynamic diagrams for a big shock value

The analysis of the diagrams figure 4 and figure 5 presented leads to the following conclusions: the clutch characteristics are progressive; the clutch has an important capacity of elastic deformation, determining the torsion shocks damping; the uncoupling is made without the elastic elements destroying and without any further shocks [2].

4. REFERENCES

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