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Analysis Of Vibration Effects On Sewing Machines

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ABSTRACT

This article is to justify the design and parameters of the mechanism of pushing a new elastic element (rubber) fabrics, which provides high-tech performance of sewing materials, increasing the speed procedures on unversal sewing machines.

KEYWORDS

Elastic element, thrust mechanism, materials, vibration, mechanisms, tools, rubber

INTRODUCTION

Today, in the light industry, machines and mechanisms consisting of advanced turning, vibration and complex moving workpieces are widely used. Such mechanisms are widely used in periodic and continuous motion machines and require the use of vibration dampers as they are mainly considered active in vibration.

However, while vibration dampers protect against dynamic stresses acting on the foundation by the machine, they do not change the nature and value of the stresses in the machine itself. This has a negative impact on the technological process. Increasing the speed of the mechanism and working parts to increase the labor productivity of the machine leads to an increase in the dynamic and inertial stresses in the gears. Such stresses have a negative impact on the reduction of service life of the engine links and kinematic pairs, the volume and quality of the product produced. If the reduction of inertial stresses in the kinematic pairs of the mechanism is achieved, it is possible to increase the speed of the mechanism, as well as reduce operating costs. Based on the above, one of the urgent tasks is to create new designs of machines and mechanisms of the garment industry, which will increase the speed of machines and reduce dynamic stresses. This article focuses on problem solving.

THE MAIN PART

The main direction of improvement of sewing machines and mechanisms for the development of sewing machinery and technology is to increase labor productivity and improve technological processes. At the same time, research is being conducted to reduce the mass of working parts and the main external forces, to develop effective technologies through the use of automatic control systems.

However, little research has been done to create new mechanisms with elastic elements of working bodies with high productivity, which provide high quality of stitching, reduce stresses in the links and kinematic pairs.

The mode of deterioration of the working conditions of objects (mechanisms, tools) under the influence of vibration is determined by the type of mechanical effects and the characteristics of the object.

RESULTS AND DISCUSSION

The copy of the object (model) should reflect the main features that affect the assessment of the dynamic reaction of the real system, and at the same time be easy to analyze and interpret the results. n such conditions, a linear pattern that can adequately reflect the properties of a wide class of structures at small vibrations is most suitable. A convenient way to describe the properties of a linear object in the conditions of vibration effects is the dynamic flexibility operators lBA (P), which connects the force GB (t) burned in the direction indicated by point V with the projection of the displacement of point A in any direction; xA (t) = lBA (P) GB (t). Inverse kBA (P) = l-1BA (P) operators are called dynamic virginity operators. The properties that relate the force applied to point A to the projection of the displacement of the same point along the line of action of the force are called the operators of dynamic flexibility and dynamic virginity at point A. The frequency characteristics of an object are called dynamic flexibility and dynamic virginity, respectively [60].

The mathematical expression for the dynamic flexibility operator can be given in the following form:

$$l_{BA}(P) = \sum_{v=1}^{n} \frac{g_{Bv} g_{Av}}{P^2 + 2\beta_v w_v P + w_v^2} \quad (1)$$

In this case, wv are the specific frequencies of the conservative system; normalized coefficients of oscillations at points v - th view; βv – we obtain this frequency property of the

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object, leaving out the dimensions of linear damping in the v-th form of oscillations:

$$l_{BA}(iw) = \sum_{v=1}^{n} \frac{g_{Bv} g_{Av}}{(w_v^2 - w^2) + 4\beta_v w_v^2 w^2} (w_v^2 - w^2 - i2\beta_v w_v) \quad (2)$$

Thus, the dynamic flexibility of an object with a number of degrees of freedom is given by the sum of the flexibility of n systems with a single degree of freedom and a frequency of its own conservative system (a system in which the total mechanical energy is constant during vibration). At these frequencies, the dynamic flexibility increases modulus due to the appearance of a small threshold in the denominator w = wv. As the number of oscillations increases, the maximum value of the dynamic flexibility modulus decreases. Figure 1 shows an approximate view of the frequency dependence of the dynamic flexibility module.

When considering a mathematical copy of a given linear system, the expressions of dynamic flexibility can be calculated by finding the solution directly from the effect of a single amplitude harmonic force.

In many cases it is possible to ignore all manifestations of vibration except the predominant bit. Such objects are usually modeled by a system with a mass m, a coefficient of elasticity s, and a coefficient of friction b, with a single degree of freedom (Figure 2).

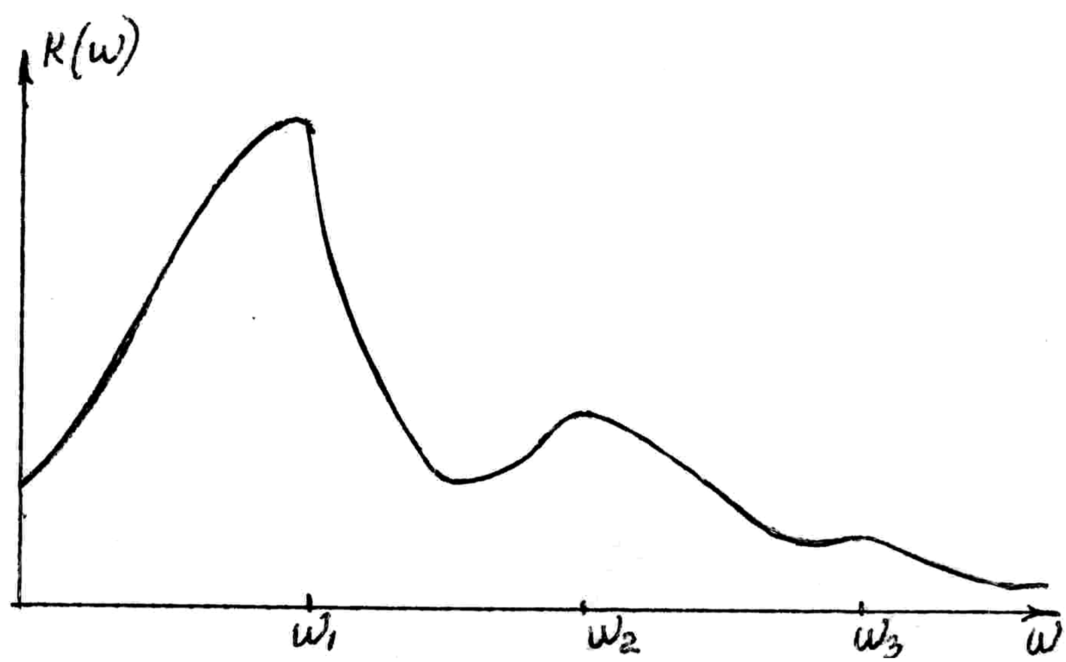

Figure 1 Frequency dependence graph of dynamic flexibility module.

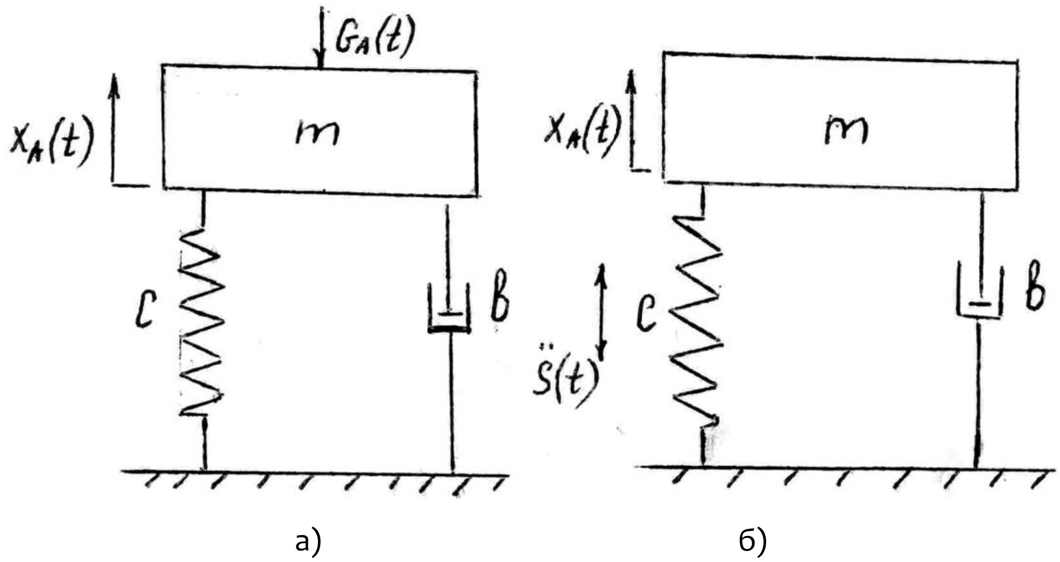

Figure 2. Model of a system with one degree of freedom.

If the system is excited by force G (t), the dynamic flexibility modulus will look like this:

The reaction of an object to mechanical action can be calculated both on the basis of the concept of time and on the basis of the concept of frequency. It is more convenient to calculate the system's response to vibration based on the concept of frequency. The calculation of amplitude and phase distortions for harmonic and polyharmonic effects is performed for each harmonic organizer of the process. Since the object is linear, it is equal to the sum of the effective separate effects of the effects of several harmonic constituents.

The most important part of a vibration insulator or shock absorber, which is an element of a vibration protection system, is an elastic element. As a result of internal friction, vibrations in the elastic element are suppressed. In addition, a number of damping devices use special damping devices to dampen the vibration energy. The dynamic properties of the shock absorber are largely dependent on its static properties, but both are non-linear. Nonlinearity of shock absorber properties is explained by a number of reasons: nonlinearity of elastic element properties (eg rubber), internal friction of elastic element, limiting struts in shock absorber, dry friction dampers, non-linear springs and similar structural elements.

In this article, the pre-planned research work on the elastic element (rubber) to prevent vibrations and dynamic stresses in the pushing mechanism of fabrics in order to increase productivity and improve the quality of the sewn machine on a universal 1022-M class sewing machine.

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