SUSTAINABLE USE OF THE PRODUCTS

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Abstract

The term „sustainable development" has been defined by the Word Commission on Environment and Development (Brundtland Commission 1987) as "the development that meets the needs of present without compromising the ability of future generations to satisfy their own needs."Sustainability thus includes general concepts of economics and politics in addition to its more familiar concepts related to environmental considerations. The concept of „sustainable development „emphasizes the sustainable use of the machine-tools as a resource of the machine building development. In this context the paper presents the importance of spiral bevel gears and their field of application in machine building. Another point, which together with the above mentioned may confer to the auxiliary materials the quality of being sustainable, is the one referring to the possibility that can be reused in several cycles, after reconditioning. In present research is underway to establish the behaviour of this type of materials in exploiting machine tools so that the project of future constructs to provide their widespread use.

Key words: machine tools, bevel gearings, cylindrical gearings, manufacturing, module

INTRODUCTION

The field of gearings constituted an area which attracted the researchers, both by the complexity of the theoretical issues and by their involvement in fields of great interest for humanity, such as: transports (by land, sea and air), energy equipment, technological equipment or the most diverse devices starting from watches and ending with space shuttle and radio telescopes.

MATERIAL AND METHODS

The sustainable use of machine tools is an opportunity that depends on their abilities and on their operation management. It manifests itself in two distinct periods of their existence: the operating period and post operating period. The sustainable use of the machine tools during their operation should be considered from two aspects: the operation manner and the results of the operation.

A sustainable use implies the need for the maximal load degree provided in the catalogue characteristics of the machines. Such a practice allows to obtain the approaching the prescribed one. It depends on the managerial possibilities of the users and is strongly reflected in the energy consumption and the operating possibilities. Another way to approach the use of machine tools is the one that takes into account the relation between the mission time and that of operation. In order that the time of operation to be as long as possible; it is necessary that the availability of the machines to

be maximal, for that purpose is necessary that the machine tools to be maintainable, a thing that is possible only by following best maintenance programs. Availability depends on reliability too, so that for sustainable utilisation the machine tools have to be designed in correlation with that too. All are in their turn dependent on the type and maintenance programs that adopt in present and increasingly outline the extension of the" total productive maintenance „ system, which has among its main objectives to ensure the maximum use of the machine tools. Another aspect of the sustainable use is represented by non-energetic consumption for exploitation. Among these stands out lubricants, cooling and greasing liquids and so on, those are currently obtained from exhaustible primary resources or of synthetic substances.

Sustainable use, both in terms of maximum load capacity, as well as in term of increasing the mission time, stands in the fact that such a system leads directly to reduced work units and ensures the best operating efficiency with remarkable consequences on energy consumption and pollutant effects. The sustainable use during operation is a responsibility of the designing and conception of the machines. It should be a main concern of the research in order to find options through which the use of the machine tools have an as low as possible negative impact on the environment. In the light of the exploitation results, the sustainable use of the machine tools must be assessed not only by the intensity and the duration of use, or the efficiency of these, but also by the range of processing they can provide. Such competency allows reducing of the variants and standard sizes, and therefore reducing the consumption of energy and materials. In this way pollution is low and it is ensured a better use of the resources.

The reuse of the component phase is linked to the development of an effective management and the implementation in the design of the refurbishment principle.

The approach of the design, execution and exploitaion of the machine tools, in the above mentioned manner, can ensure the sustainable use of these and contributes to economic growth without a major negative impact on the environment.

RESULTS AND DISCUSSION

The unprecedented development of the industry during this century has led to a greater demand for gearings of the most various types, both for the small scale and large scale production of the different machines and of the mass production of the means for transportation. Due to the complexity of the bevel gearings with curved teeth it is necessary to be mentioned the place that these occupy in the industry. Bevel gearings with curved teeth can be divided into two categories: power gearing and kinematics gearing.

The power gearings have as main purpose the transmission of high torques moments, achieving high transmission ratios.

Kinematics gearings have as main purpose achieving of the rotation movement between the axes with high accuracy regarding the angular rotation velocity constancy, respectively the constancy of the movement transmission ratio.

Construction and technological problems of bevel gearing are quite different of those of cylindrical gearing. Achieving and maintaining the angle between the axes, during the operation, is more difficult than achieving and maintaining the parallelism of the axes, at cylindrical gearing. The fact that most of the bevel gears have axes in console leads to elastic deformations during operation and to the danger of appearance of a contact on the edge, of large and uncontrolled stress accumulations, in the contact areas. For this reason bevel gearing with straight and bent teeth are less and less used, especially in demanding gearing, leaving space to curvilinear toothed gears. Still for this reason the problem of crowning of the side edges of the bevel gears teeth, becomes a main problem, performed in various ways for the types of the bevel gearing depending on the gear cutting systems. For these reasons were designed and built over the time a variety of bevel gears with various execution technologies and ways of getting the crowning, which involved the creation of a very large and diverse number of gear cutting tools and machines types. Spur gears have a low coverage degree and those with inclined teeth are highly sensitive to the variation of the angle between the axes. Bevel gearing with curved teeth ensures a high degree of uniformity at the movement transmission. At these gears the coverage degree by forwarding of the sidewall increases, significantly improves the overall coverage degree, and in the end the functional qualities of the spiral bevel gearing are superior to the other types with spur or inclined teeth. If we take into account the benefits offered by these gears, i.e. avoiding the total lift by optimal locating of the contact patch due to the crowning which makes that the convex side of a tooth to come in contact with the concave part of the pair tooth, as well the reducing of the force application arm, the superiority of the bevel gearing with the curvilinear teeth becomes evident.

The great diversity of the bevel gearings is explained by the facts that, practically, for the functional needs of each transmission, have to be made other constructive characteristics of the bevel gears.

The kinematic accuracy being the main requirement pursued for the gearings depending on the destination of the gearing it is established its constructive type and the type of the technological process of realization. If the constructive type it is chosen between straight teeth and curved teeth, the selection criteria being constructive, but in same manner determined by the

existing equipment of gearing machines, there is the possibility for the substitution between these gearings fact that simplifies the endowment with machinery.

The degree of usage of these teeth in machine construction taking into account the frequency of use of the teeth type it is shown in Figure 1.

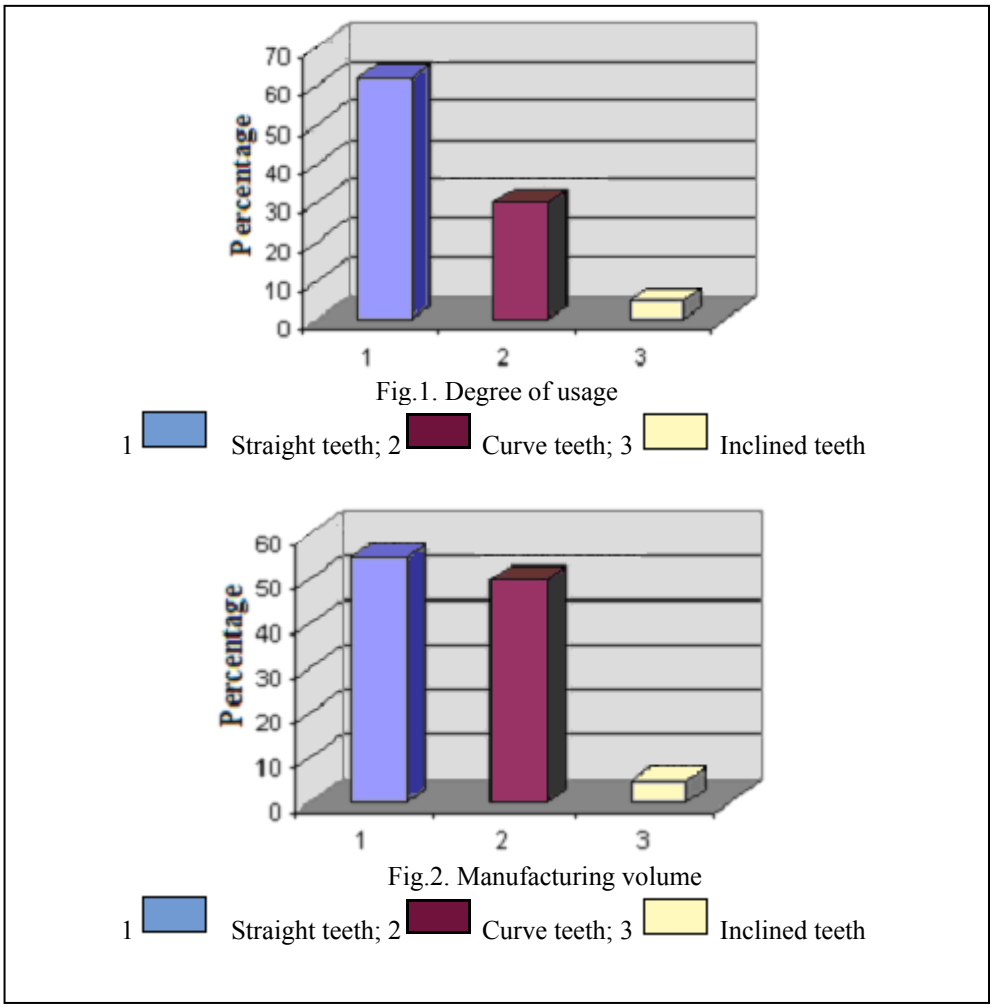

Fig.1. Degree of usage

Fig.2. Manufacturing volume

It can be noticed the high frequency of usage of the straight teeth determined by the great number of utilization cases in the machine construction in general as well as for mean of transportation where the number of satellites is greater. Curved conical teeth being used for the main conical gearing (Pantea, I et al. 2008).

In terms of manufacturing volume (fig.2) it can be noticed a smaller difference between the straight and curved teeth, determined by the fact that

the straight teeth is used in the machine construction more for one of the kind or small series, for large series (mean of transport), the use of straight and curved teeth being roughly at an equivalent volume of manufacturing. Inclined teeth are less used, generally for large pieces, in other cases it can be replaced by the curved teeth.

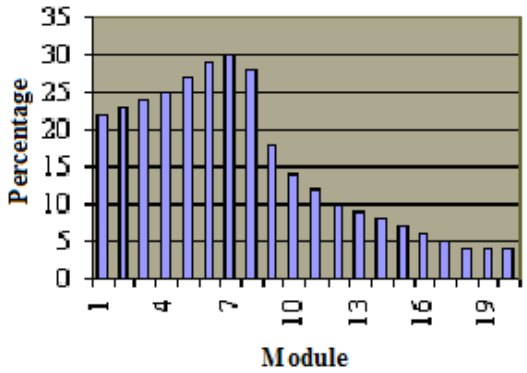

Fig.3. Use of conical teeth according the module

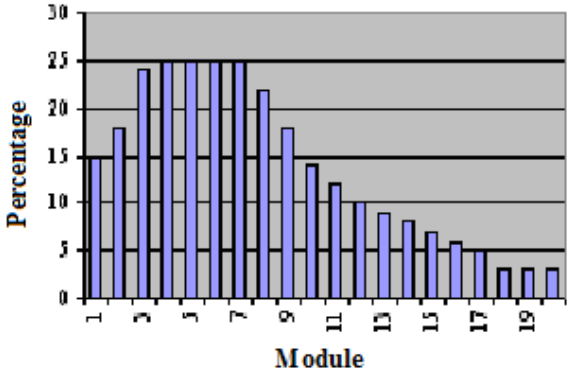

Fig.4. Manufacturing volume according the module

Thanks to the advantages enjoyed, the appearance of performance numerically controlled machine tools CNC on six axes, there is the tendency for the spreading of the curved teeth in most various fields of mechanical engineering. The use of curved conical teeth according the module (fig.3) have the maximal values in the area of the values 3...10 due to means of transportation, cars, trucks, tractors and so on, all these characterized by large series of manufacturing (Pantea, I. 2004). In figure 4 it is shown the frequency of the usage cases of curved teeth from the point of view of the fabrication volume depending of the module.

CONCLUSIONS

1. Until the beginning of 90s the use of conical teeth after cyclic curves can be appreciated as 50-60% of the curved teeth usage cases for machine building, for one of a kind gearing and small series, power gearings in general, due to the fact that there is no possibility for rectification.
2. If 20-30% of the curved conical teeth usage cases are represented by the means of transportation gearings manufactured in large series, 75-80%, 92% is represented by the circular arc conical teeth, realize through the envelope surface method, which requires great preparation time, and complex operation of gear cutting and control, but thanks to the large series and reduced changes of settings, the time for the crowns preparations (with large number of teeth) is reduced.
3. After 1990 Klingelnberg Company launches on the market WNC80 grinding machine for cyclical teeth, which changes the balance if usage of the circle arc conical teeth for means of transportation. In 1995 the gearings for cars were grinded in totality, and the rest of it in a percentage of 70%. A large amount of gearings used in low speed area of 10m/s existing a trend for growth of the gearings volume for high speed, mainly due to space activities.

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