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DEVELOPMENT OF A NEW GENERATION OF MACHINE-TOOL EQUIPMENT FOR ACCURACY OF MACHINING

The creation of new developing technical systems, which include machine tools and robotic systems, require further improvement of their subsystems. One of these subsystems is machine tool equipment designed to manipulate, install and clamp objects of various shapes (blanks or parts, cutting tools or their elements). Currently, the search for new solutions is impossible without an interdisciplinary approach and the use of the latest scientific achievements in various fields, combined in the form of NBIKS technologies (nano-bio-info-cogno-socio) and using artificial intelligence.

The challenges of the fourth industrial revolution “INDUSTRY 4.0” are mainly focused on artificial intelligence, full automation with the use of robots, robotic systems, communications, the creation of a new generation of intelligent production while significantly reducing the time and cost of manufacturing products.

In this case, machine tool and tooling, is of great importance, expanding the technological capabilities of automated equipment and increasing its technical and economic indicators. In recent years, using the system-morphological approach, fundamentally new clamping mechanisms and devices have appeared: highprecision, self-adjusting, wide-range, fast-adjusting, high-speed and multifunctional. Their application allowed to solve the problems:

- saving metal by eliminating the secondary operation of trimming the face after cutting short parts (especially in the bearing industry);
- increase machining accuracy due to chucks with a fixed cylindrical collet and double clamping;
- switching to processing cheap non-calibrated rolled products – hot rolled bars and pipes instead of calibrated ones;
- reduction in the number of readjustments and time for readjustment.

The application of the genetic-morphological approach in was oriented towards the clamping of one axisymmetric rotating object with access to the radial and axial clamping principles, which limited the field of search for new solutions. Works and especially prof. Shinkarenko V.F. allowed us to expand our worldview on an interdisciplinary approach in science and technology, in particular, on the evolutionary and genetic synthesis of anthropogenic systems that develop over time.

The solution to the problem of simultaneous multi-place clamping of rotating objects with the application of a tangential force displaced from the axis of rotation determined the relevance of the present research.

All these studies are reduced to ensuring the accuracy of processing, since accuracy is one of the most important indicators of the quality of machines, significantly affecting all the criteria for the operability of their mechanisms, and, consequently, the output indicators of machines.

The development of technology is associated with a continuous increase in the requirements for the accuracy of machines, including tooling, including its preservation under load and in time. Improving the accuracy of machines increases their productivity due to the possibility of reducing the number of working passes, optimizing machining modes by creating a new generation of machine tool equipment, and reducing the complexity of the final operations.

In this way, the economic efficiency of improving the accuracy of machines is determined by two factors of national economic importance:

- improving the quality of machines, devices and other products manufactured on machine tools;
- increased machining performance.

Accuracy affects the operation of machines according to the following criteria:

- dynamic loading, vibration and noise;
- strength due to dynamic loads, the use of multi-contact designs, stress concentration;
- loss of friction, heating and wear, non-optimal gaps and surface condition;
- reliability associated with all performance criteria, their mutual influence, as well as initial accuracy margins;
- speed associated with dynamic loads and heating;
- material consumption due to limited speed and additional harmful loads.

The accuracy of parts and mechanisms should ensure the exact position and movement of the links.

The requirements for the roughness and accuracy of the surfaces of parts are established taking into account their functions.

Errors of machines and machine tools by their nature can be divided into:

- own, not related to external influences,
- manufacturing and assembly errors;
- systematic errors due to the principle of operation of machines or process;
- errors from external influences without irreversible changes in the system -elastic and temperature deformations;
- errors from irreversible changes in machine parameters - wear, aging, warping.

Most machines and parts fail not because of damage and general obsolescence, but because of a loss of accuracy due to wear, hogs, warping, resulting in a significant reduction in the main output devices of machines, especially tooling.

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РОЗРОБКА КОНСТРУКЦІЇ СО₂-ЛАЗЕРНОГО РІЗАКА

Одним з найбільш значущих винаходів минулого століття можна вважати винахід лазера, який зараз використовується практично у всіх сферах життя. Слово LASER утворилося від скорочення англійського словосполучення «light amplification by stimulated emission of radiation» – «посилення світла за допомогою вимушеного випромінювання»

Ще в 1916 р. Альбертом Ейнштейном було спрогнозовано можливість переходу атомів з вищого енергетичного стану в нижчий під дією зовнішнього впливу. При цьому переході звільняється деяка кількість енергії, і таке випромінювання називається вимушеним. Вимушене випромінювання і лежить в основі роботи лазерів.

Принцип дії лазера ґрунтується на вимушеному випромінюванні фотонів світла під впливом

зовнішнього електромагнітного поля.

Ефект лазера (лазерна генерація) може виникнути тільки в тому випадку, коли число атомів у збудженому стані перевищує число атомів в стані спокою. Середовище з такими характеристиками, можна підготувати, накачавши його додатковою енергією з певного зовнішнього джерела. Ця операція так і називається – накачування. Саме від способу накачування і розрізняються лазери за типами. Накачування може здійснюватися при впливі електромагнітного випромінювання, електричного струму, електричного розряду, пучка релятивістських електронів, а також хімічної реакції. Вид використовуваної енергії залежить від того, яке саме застосовується активне (робоче) середовище.