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AUTOMAT DEVICE FOR MICRO-BEARINGS DIMENSIONAL MEASUREMENT

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ABSTRACT
The new idea of product quality assurance as well as the control effectiveness lay down the necessity of a strong interaction and integration among different branches of engineering. The structure effectiveness for processing and control is worldwide a top concern.
The national programme "Engineering and nanosciences" paves the way for a field of applied and basic research, characterized by varied technical applications. The collaboration at the deepest nanometric level of matter, in the interaction between substance and span, allows us to obtain materials endowed with exceptional properties and to realize components and systems of high complexity, with uncommon performances.
The new production has to undertake a continuous quality improvement due to its major economic involvement and the consequence consists in high performances in the quality assurance. Going in for these tendencies, the staffs of authors' aims at promoting and developing the use of micro-systems of high precision for the special bearing production. In this respect, we assess a range of techniques and systems for controlling and ensuring the quality of miniature bearings. The performed researches aimed at a very modern approach of the automatic control systems through a unitary, modular designing with a high universality degree.
Key words: micro-bearings, dimensional inspection, radial play, Microsystems**.**

1. THEORETICAL ASPECTS

Miniature bearings and micro-bearings are of great utility in constructing measuring instruments and, in general, in constructing Microsystems. Miniature bearings have to answer the general conditions of bearings, as well as the special ones, which depend upon the conditions of practice specific to the Microsystems whom they belong to. Their dimensional properties are comprised between 0.5 and 30 mm, with working up accuracy of 1…2μm

One of the important factors in designing, using and developing Microsystems or miniature bearings as system components, consists in quality. The quality of Microsystems is measured by the precision of their geometrical parameters and, in order to enhance them, testing and controlling Microsystems of high performance are required. Ideally, each stage of the micro bearing production process has to be followed by an adequate quality control, in order to discover errors and faults in good time. Taking into consideration that, nowadays, there are few dimensional control Microsystems for micro bearings available, the analysis, the design or the improvement of testing methods and plants for them is of a special interest.

The control methods used for miniature bearings have to secure the accomplishment of the special conditions required by the characteristics of the measuring (some slight measuring errors, narrow measuring field, diminished tolerance zone). Taking into account these characteristics, as far as the miniature bearings industry is concerned, we recommend so-called classical methods (with contact), as well as methods with no contact (optical).

2. EXPERIMENTAL ASPECTS

In the circumstance we attach great importance to ensuring the product quality, as far as the dimensional inspection is concerned, there have been prefigured the trends for applying and generalizing the modern methods of quality analysis and control, for the dynamic orientation towards retechnologization with immediate and important effects upon the growth of the production precision, the dispersion reduction, the decrease of the labour and energy consumption and the fundamental shift of the inspection attribute, out of notable to preventive, laying a particular stress upon ensuring an optimum among the performance, the needs and the costs.

The performed researches aimed at an original method of grouping the parts based on the relation between dimensional micro-inspection process characteristics and modular design of all micro-control equipments with a high universality and flexibility degree.

In designing the process, we emphasize that the modular control station could be organized as follows: All modularly and flexibly organized devices; Modular device designed in the most propitious way for each families of parts; Measuring and automation checked by an electric computer controlled device; High accuracy of operating; Interchangeable modulus; Different measuring and control transducers and sensors to be used; High productivity and efficiency.

All modular devices are defined in order to execute the inspection operations in correlation with all parts in group. Based on these analyses, the authors build the information system (fig. 1) dedicated to design the modular and flexible micro- dimensional inspection systems.

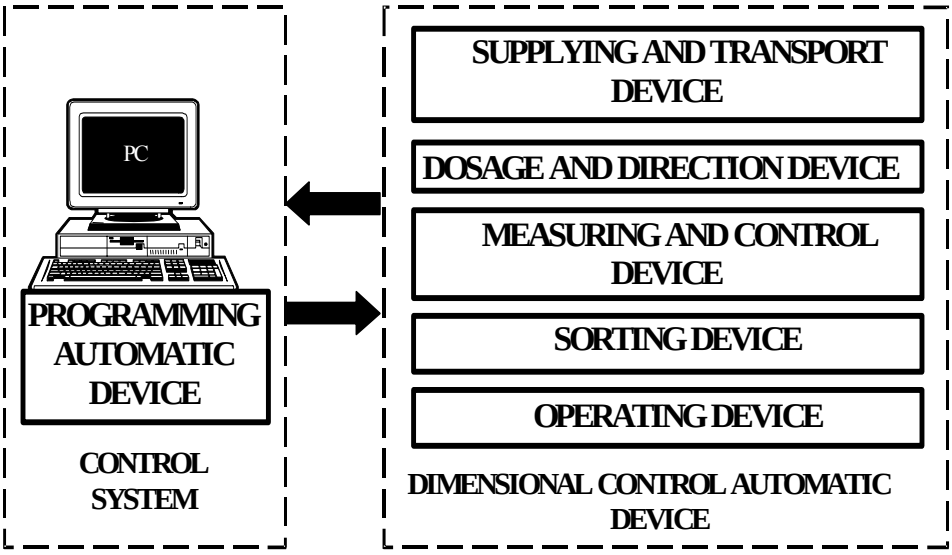

Fig. 1. The block chart of information system

The illustrative control means comes down to combining a small number of constructive parts, devices and subassemblies, which are part of all means of parametric or multiparametric inspection. From case to case, the control means may wholly or partly comprise the elements, devices and subassemblies of the illustrative control means.

In producing miniature bearings, the accomplishment of a complete inspection, of high precision and productivity, stands for an essential characteristic, for an indispensable factor of the scientific management of the production process, as well as of the maintaining and raising the quality of the

products to a proper level.
The micro-objects may not be handled so easily as a tool of regular size. In order to accomplish these operations we need adequate gripping elements, such as micro pliers, and gripping nozzles. The micro pliers play an important part as they exercise a direct influence upon the manipulator's handling ability. They may clasp, realize hitching by abrasion or adhere to the material, according to the physical or geometrical properties of the measuring. Within the framework of the manipulation and transport modulus, it is compulsory, in the detriment of flexibility, to resort to some sets of grippers (pliers) adapted to the form and size of the pieces, which have to be manipulated.
A major problem consists in correlating the gripping forces to the characteristics of the manipulated pieces, forces, which have to ensure the gripping, but not modify the dimension and quality parameters of the surfaces. The use of a scanning electronic microscope within the manipulating modulus implies that the latter be functional in vacuum and stand electronic radiation.

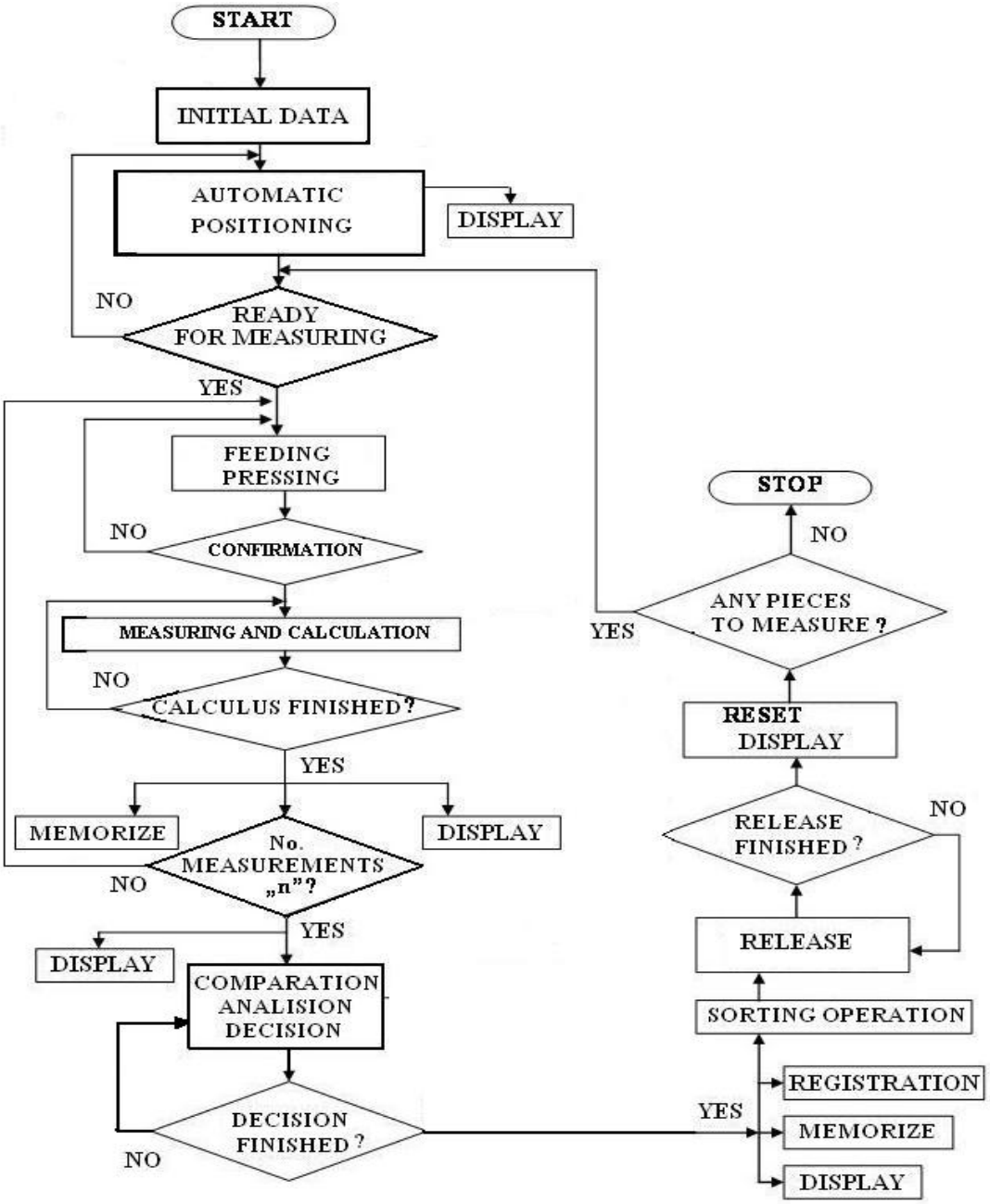

Fig 2. General logical diagram for micro- measuring

The systems of automatic dimensional inspection used for miniature bearings raise another important problem, consisting in the transmission of the information from the micro to the macro-world. The solution of this problem may be found in the visual supervision of the processes, associated to a sensory system of high performance and to a processing modulus in good time.
As far as the feed modulus is concerned, for the miniature bearings it is used with feeders type store, or vibrating feeders. It is the manipulation and transport modulus, which raises special problems. We are compelled to state that we may not always adapt the conventional methods of manipulation to the demands of the micro-world.
The processing modulus consists in a central computer, which controls all the component parts of the system (fig. 1). Beside this one, the command and inspection modulus must also comprise: a computer for processing the image, a block for the control of the manipulation, a block for tracking the measuring in motion.
The electronic modular systems for decision consist of assemblages specific to the theme of dimensional inspection from independent or deification integrated modules for: feed, measurement, operation and dimensional classification.
The interactive work between user and server assures the possibility for varied analysis and changes of the inputs. Figure 2 shows the general logical diagram of the interactive measurement.
For the automatic systems of high universality, for whom passing from one type of measuring to another (in the same field of micro-bearings) takes place at low cost, therefore at high efficiency, we ought to use methods of optical control, that is measurement posts, consisting also in optical systems for identifying the shapes (microscope with laser scanning, stereo optical microscope with CCD camera etc).
The comparing and sorting electronic unit processes the information provided by the measurement unit. The signals coming from this unit are transferred to the automating block, which provides the mechanization of the entire process. The automating unit may select the bearing type and may adjust the work regime.

3. CONCLUSIONS

By means of the present research, we have intended a particularly modern approach of the automatic inspection systems and the implementation of the latest methods of measurement and analysis required in establishing and ensuring the quality of miniature bearings as mechanical elements essential for micro-systems.
All these studies are very important in the field of precision mechanics and mechatronic systems. The main purpose of this research is to generate optimised automatic inspection systems for more mechanical efficiency. This system is reorganized to meet the international trends in achieving the automatic control systems.

4. REFERENCES

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