EXPERIMENTAL RESEARCHES ON THE INFLUENCE OF THE SEALING BOX ON THE DEFLECTIONS OF THE MIXING DEVICE SHAFT

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Abstract: The aim of the paper is to confirm in a practical way the theoretical result which were presented in a paper named "Theoretical researches of the sealing box influence on the deflections of mixing devices shafts" by the same author. The paper presents the experimental installation, measurement system and experimental.

Keywords: mixing device, shaft, deflection

I. INTRODUCTION

In order to realize the experimental researches many variants of the experimental installation have been conceived, in the end choosing the installation which was regarded to have the smallest errors.

The experimental installation is formed of a mechanical part built from a mixing device recipient (whose shaft is to determine its deflections) and a measuring device, whose role is to acquire data regarding the specific technological parameters, which the paper focuses on.

2. PRESENTATION OF THE EXPERIMENTAL INSTALLATION MECHANICAL PART

For a better accuracy of the collected data, an installation with a higher stiffness was chosen, the taking over the vibrations others than the ones included in the working environment of the mixing device being almost impossible.
Due to its stiffness, a milling machine FU was chosen for the experimental installation, the movement of the mixing device shaft being transmitted to the main axis of the head cutter, by means of an elastic clutch. *figure 1.*

For this variant two measuring devices were conceived, being preferred the one providing the data with the smallest error.

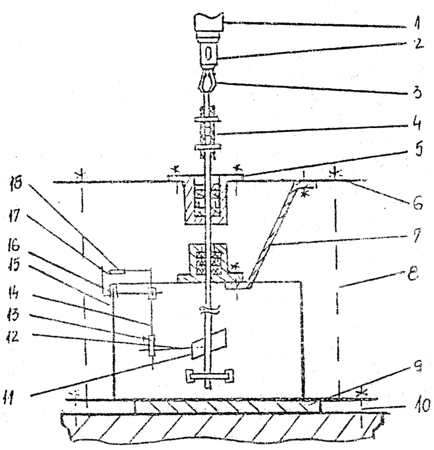


Fig. 1 Experimental installation for determining the shaft's deflections

3. THE EQUIPMENT FOR THE TECHNOLOGICAL MEASURING PARAMETRES

According to figure 1, by means of the device 4, the transducer 5 is fixed on the bar 6, which is seized with the element 7 on the tank's wall. The bar 6 is stiff and close enough from the tank's wall in order not to receive vibrations from the working fluid to be then transmitted to the transducer.

The transducer is initially mounted in a deflection measuring position at the end of the shaft 2. A mark is made on the bar 5 on a gradation which is read on the graded bar 9, placed close to the bar 6. This is considered as the zero mark, the distance at the end of the bar 6, at the bottom of the tank, being the same with that from the end of the shaft to the bottom of the tank. The bar 6 can be elevated in the fixing device 8. The reading on the graded ruler to know how much it moved from the zero mark can show the mark where the shaft made the determination.

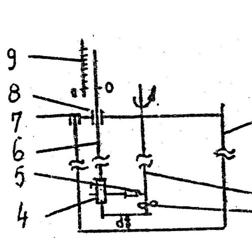
The transducer shall not be stuck to the shaft, before each measurement, the distance between the transducer's reading head and the shaft being checked with a 2-millimetre fitting. In order to avoid the data collected by the transducer not to be influenced by the possible execution errors of the shaft, by means of a reference clock, they were previously studied in a static system, in set measuring points. It was observed that, being very low (-0.0008 mm), they will not influence the collected data, the shaft being perfectly centered in a static system, the deviations appearing only dynamic system.

During operation, a point on the shaft describes a circular trajectory. According to its measuring principle, there is the possibility that the inductive transducer not to read the shaft's shift when it is placed on this direction with the shaft. *–figure 3*

In order to decrease the measuring errors, as well as the mounting errors, a differential measurement was needed, by mounting two transducers, at the same level, on perpendicular direction Ox and Oy which simultaneously read the shaft's deflections v_1, respectively v_2, which are transmitted to the collecting board, being read on the computer's display.

When the shaft is in position B *-figure 4,* the transducer 1 will read the shift as "fictive" v_1 = OD and transducer 2 will simultaneously read the shift "fictive" OC The relative shift will be calculated according to Pitagora's theorem. Therefore:

$$v = OB = \sqrt{OC^2 + OD^2} = \sqrt{v_1^2 + v_2^2} \quad (1)$$



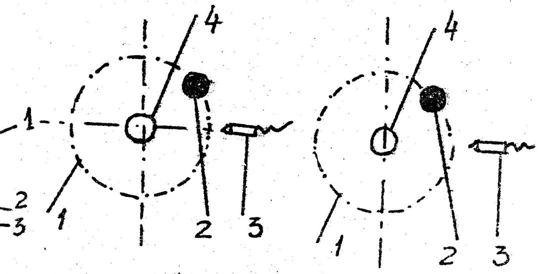


Fig. 2. The scheme for fixing the inductive proximity transducer
Fig. 3. The position of shaft 2 on its trajectory l towards the transducer 3

The distance between the transducer's reading head is adjusted by means of a 2-millimeter fitting. Actually, the transducer measures in fact the distance l_1. – *figure 5.* In order to read on the computer's display the actual value of the vector v_1, there will be introduced in the data collecting board software the following conversion relations:

$v_1 = 2 - l_1$ and respectively $v_2 = 2 - l_2$.

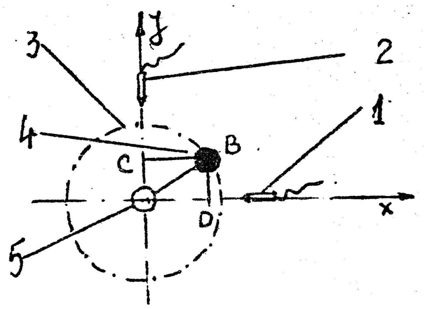


Fig.4 Mounting transducers on directions

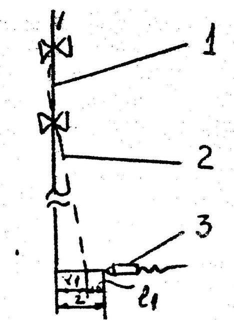


Fig.5 The principle of the conversion relation

For data collection and interpretation there are used given collecting boards, which are mounted in a computer, where, together with the latter and adequate software they can record and process the data from the measurements.

The signal interpreted by the collecting board is amplified and processed by different models on the board, ending up into a signal which can be visualized on the computer's display by means of a visual instrumentation program or the data obtained can be recorded on the computer in a text file.

For collecting data, specialized graphic programming software is used in the virtual field Lab View, by means of which it can be soft programmed by a graphic programming and realizes virtually any electronic measuring device. For this purpose, a data record was made, whose block-scheme is presented as follows.

The components of the block-scheme of the virtual instrument are the following:

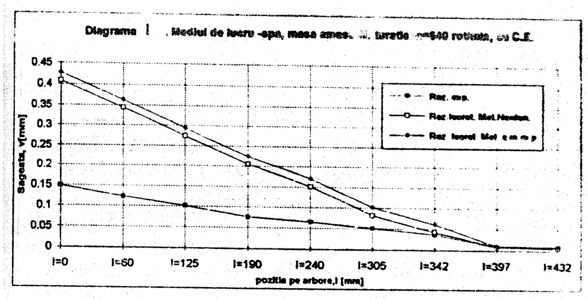
- the configuration module AI CONFIG which recognizes the data collecting board by means of the number "device", sets the channels by means of which the signal collection is made " Collecting channels (15:0)" and establishes the number of scans which the programmer needs;
- the start module AI START which commands the beginning of the data scan and allows to choose the scan rate which the programmer or the user of the virtual instrument wants.;
- the data reading module AI READ which reads the data collected according to the number of collected channels, the number of scans and the scan rate and transmits these data to a graphic displayer;
- the data deletion block AI CLEAR which deletes the data from the "buffer" as a result of a scan and allows to start a new data collection process;
- the error block ERROR ?! , which signals the existence of a hardware or software error during the program and data collection;

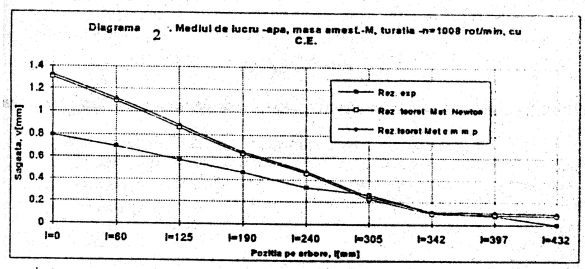
Starting from this block-scheme, a graphic panel control for the virtual instrument is automatically built, by means of which different values regarding the number of scans, the number of channel for the data collection, etc. can be set. The front panel of the virtual device is made up of the digital switches for setting the number of channels, the scan rate and the number of scanned data.

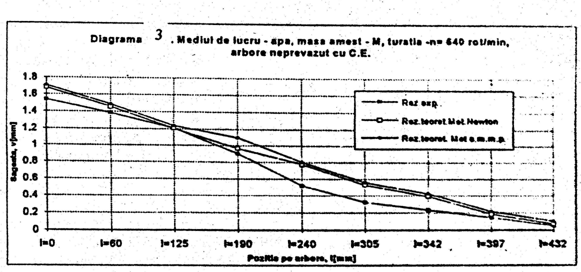
4. CONCLUSIONS

Analyzing the diagrams 1,2,3, it can be seen that, if the shaft is provided with a sealing box, the values of the deflections are far lower, the stiffness effect being obvious.

Comparing the results of the diagrams 1,2,3 from this paper with the diagrams 1, 2 from the paper "Theoretical researches of the sealing box influence on the deflections of mixing devices shafts" by the same author, it can be noticed a good compatibility between the theoretical results and the experimental ones, although the theoretical values are higher (however, within the admitted limit) than the experimental ones.







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