1.3.79. DEVELOPMENT OF LONG LENGTH ITEMS TESTING USING CONTACT AND NON-CONTACT METHODS

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Relevancy of the topic. In the process of rapid development of industry and appliance of new construction materials and production technological processes a new problem emerged concerning development of new non-destructive testing methods that could detect defects without excessive expenses [1]. At present, rolled products made from different metals and alloys are used almost in every branch of industry. Thus, the non-destructive testing of rolled products before its further processing gains vital importance making it possible to save considerable funds. An NDT method most widely used in industry is the acoustic method which is rapidly developing and considered as one of the most multipurpose one. Using this type of testing makes it possible to detect foreign particles, voidage, cracks, shrinkage holes, liquidation zone, silver spots, internal strain zones etc.

Introduction. Defects extending along the product's generatix that can result in deterioration of characteristics or even failure of a product made from such material can occur in the process of rolled long length items production due to disturbances in technological process.

In accordance with the State Standard 21120 [2] defectoscopy of rod-shaped products must be performed from several perimeter directions throughout the length of a product. It leads to significant losses of working hours. Productivity of such method is low [3]. Especially it concerns rods and other stretched products with small scale section, for example blanks of round, hexagonal, rectangular and other shape sections. At that, as a rule low-frequency methods are used for the purpose of defects detection both contact and non-contact. On the one hand, utilization of low-frequency testing aids increases its productivity and on the other hand it doesn't have sufficient sensitivity, especially for defects extended along the product's generatrix. Thus, the high sensitivity and low productivity of the traditional testing on one hand and the insufficient sensitivity with high productivity of the low-frequency methods and testing aids on the other resulted in creation of a scientific task important for industry. Its main point is to create a method that would provide defects detection in extended products at high productivity testing.

Main part. For the purpose of solving this task that would make possible to detect defects without scanning the surface of a product, a new technology has been developed. The gist of the technology is utilization of diffraction effects for defects detection in rods. The method is implemented by formation of a wavepacket in a rod by means of an inclined piezoelectric sensor (see fig. 1). Through the contact liquid 1 at the extended product 3, the piezoelectric sensor 2 at the angle to the normal excites elastic ultrasound vibrations which being deflected from the edge of the product transform them into other wave types. For

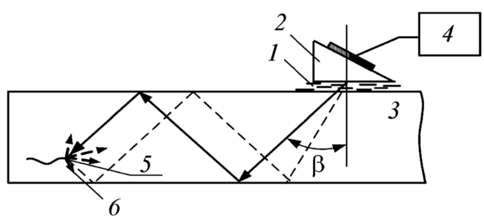

Fig. 1. Scheme of implementation of high-productivity rods testing technology with usage of mechanism of acoustic waves diffraction on defects

example, a cross wave being deflected from the surface of an object transforms into cross, compressional and surface waves. With multiple redeflections and transformations in a product, a wavepacket will be forming at a definite distance from acoustic waves source. Hence, filling of the whole volume of the product with different types of waves will happen. Since the product has limited scale section, such wavepacket will outspread to significant distances.

I.e. it makes possible to perform testing of long length products without necessity of scanning throughout the whole surface. In case of presence of a defect 5, the wavepacket diffracts on its edge 6 and forms corresponding packet towards the transducer. Diffracted impulses are detected by the transducer and depicted at the defectoscope display.

Results of rods testing by contact method considerably depend on presence of a contact liquid on the surface of a product. Impulses from droplets of the contact liquid conceal valuable signals which results in decrease of sensitivity of the method to defects.

It is possible to eliminate influence of the contact liquid on testing results by using non-contact methods of exciting and reception of ultrasound impulses. The most developed one is the electromagnetic-acoustic method [4]. By means of electromagnetic-acoustic transducer bulk waves can be excited similar to ones excited by a piezoelectric transducer. I.e. shear waves with vertical polarization. Also, EMA transducers have double diagram of acoustic field direction. I.e. starting from EMAT an acoustic field spread from the middle of an extended (in one direction) product towards both sides at the same time [5]. It gives an opportunity to increase productivity of defectoscopy twice as much by means of the new testing method.

For the purpose of an acoustic field formation with a direction, the axis (which has inclination towards the inlet) should be of a “zigzag” shape with a back pitch and duplicate the form of an object under testing. In that case exciting forces will be forming in a very thin metal surface layer due to dimensional distribution of alternating magnetic and polarizing magnetic fields.

Research of the given method and analysis of educts allowed to make the following conclusions:

1. The developed method enables to increase reliability of defects detection, since with its help it is possible to detect linear defects in rods in irrespective of their position in a scale section, form of a defect and material of its filling.
2. The new method has high productivity since it allows to test rods up to 6 m long by 3–4 transducer units.

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