

1.1.26. DEVELOPMENT AND AUTOMATION OF NDT MAGNETIC PARTICLE TECHNIQUE

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Quality provision has always been the most actual objective in industrial production management. JSC “IrkutskNIIkhimmash” implements motivated investigations regarding adaptability of magnetic particle NDT techniques that goal to create the control means providing:

- reliable detection of hazardous imperfections;
- increasing of magnetic particle inspection speed;
- handling quality of techniques;
- compliance with design requirements.

As a result of investigations became the development and adoption of a wide range of magnetizing devices MDS (fig. 1) [1] and production accessories for magnetic particle weld joints inspection. These devices are certified and successfully operate during an investigation of steel vessels and pipelines at a variety of industrial facilities using new techniques [2]. The subjects of magnetic particle inspection could not only be pressure vessels and pipelines but also the equipment used in a power generation sector and in metallurgy as well as weight lifting devices, railroad and highway vehicles.

The magnetic particle method is basically founded on magnetizing of inspected elements with alternating field when the magnetic leakage fields (MLF) are formed. The reliability of the method provided with the correct choice of magnetizing mode that enables to reach the optimal conditions to detect surface and subsurface imperfections. Magnetizing mode is defined according to the standard [3] and production [4] samples made of corresponding grade of steel (fig. 2). The peculiarity of such standards is that the internal, not external defects are modeled inside of them. The investigations and experience prove that application of standards with external imperfections considerably decreases the magnetizing modes, besides, micro flaws and subsurface defects couldn't be identified while using the physical product.

To substantially increase efficiency and handling qualities of inspection a new device has been created that can combine stepwise magnetizing and leakage field visualization on the screen indicator; it is in the interpolar space of a magnetizing device and could be forced against the inspected surface (fig. 3).



Fig. 1. Magnetizing device MDS -3 conforming the inspected surface

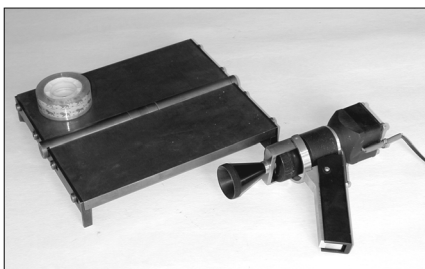


Fig. 2. Production accessories for MPK (a weld seam simulator, a magnetic particle sprayer and a scotch tape for recording)

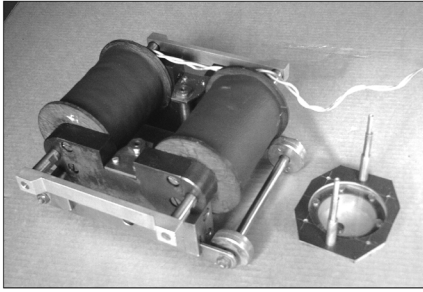


Fig. 3. Movable magnetizing device with leakage field screen to indicate magnetic leakage fields from defects

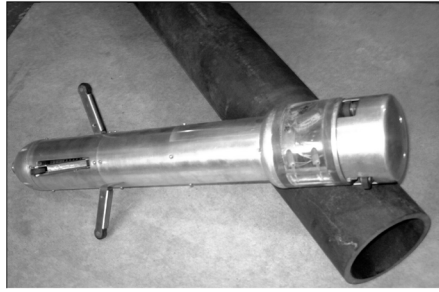


Fig. 4. Self-moving detector with ferroprobe transducer to inspect internal surfaces of industrial pipelines

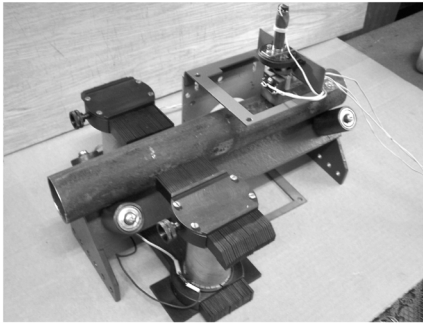


Fig. 5. Magnetizing and recording unit to detect residual leakage field with a ferroprobe device used in magnetic particle inspection during conveyor production

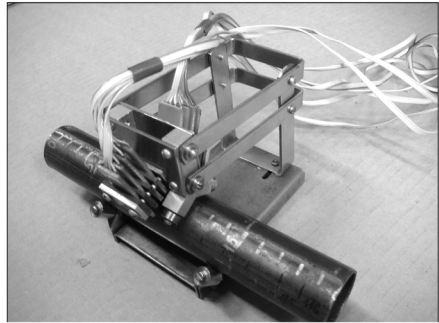


Fig. 6. Multiple-unit device to identify magnetic leakage fields used in magnetic inspection of external surfaces of welded pipes



Fig. 7. Indicators capable to display line-by-line results and to subsequently distribute signals to a sorting machine

Ferro-probe devices enabled to elaborate a self-moving fault finder (fig. 4) to inspect an external surface of industrial pipelines and to size the welded pipes during conveyor production (fig. 5).

The device capable to inspect pipes on external surface was created; besides, the leakage field recording system having multiple-unit device consisting of 8 Hall sensors (fig. 6) was elaborated. The unit is equipped with the transducer orientation device.

The significant element of an analyzer or an automation unit is the system of visual magnetic particle inspection result indication. For this purpose an indicator (fig. 7) was created using a LED-matrix DG-24064. The indicator enables to form signals used by a sorting machine sending pipes with identified imperfections for rejection.

References:

1. **Fedyukovich G.I.** "New magnetic particle units to control the welding quality of steel vessels and pipelines", The 8-th International specialized exhibition and the conference "NDT and diagnostics in industry – 2009", Moscow.
2. **STO 00220227-02-2006** "Steel welded vessels and pipelines. Magnetic particle inspection techniques", JSC "IrkutskNIIhim mash", 28 pp.
3. **Fedyukovich G.I.** "Inspection device used in magnetic particle inspection" Patent of Russian Federation RU № 1647373.
4. **Fedyukovich G.I.** "Standard sample for magnetic particle inspection" Patent of Russian Federation RU № 1018001.