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THE RESULTS OF LABORATORY STUDIES ON THE IMPROVEMENT OF INDUCTION HEATING TECHNOLOGY

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Annotation:
This article presents the results of research conducted in order to improve the technology of induction heating and increase the efficiency of heat treatment of plowshares. As a result of the research, an "Induction heating device" was developed.

Keywords: heat treatment, elasticity, ploughshare, inductivity, wearing, wear resistance.

Heat treatment of details can be conventionally divided into two: volume, surface. The first one is used when it is necessary to change the structure of the detail on the entire volume, and the second one is used when it is necessary to change the structure of the detail only on the surface layer. The purpose of such heat treatment is to increase the wear resistance of the detail, to improve the physical, chemical, and mechanical properties of the metal. For example, when a part is heat treated, its metal can become harder. In this case, the structure of the detail material changes to martensite, sorbite or troostite. During the surface heat treatment of the details, the initial elasticity and plasticity properties of the material of the inner layer of the detail are preserved. One of such details is plug plows. Since they work in the environment of high loading effect of the soil, they are subjected to surface thermal treatment.

In order to increase the corrosion resistance of plug plows, heat treatment is performed. The induction heating method can be used for heat treatment of plowshares. In this case, the induction heat treatment equipment differs from other heat treatment methods with advantages such as high productivity, the possibility of use in various conditions, low electricity consumption, simplicity of the work process, high level of mechanization, good sanitary and hygienic environment.

Based on the above, induction heat treatment of plowshares device has been improved.

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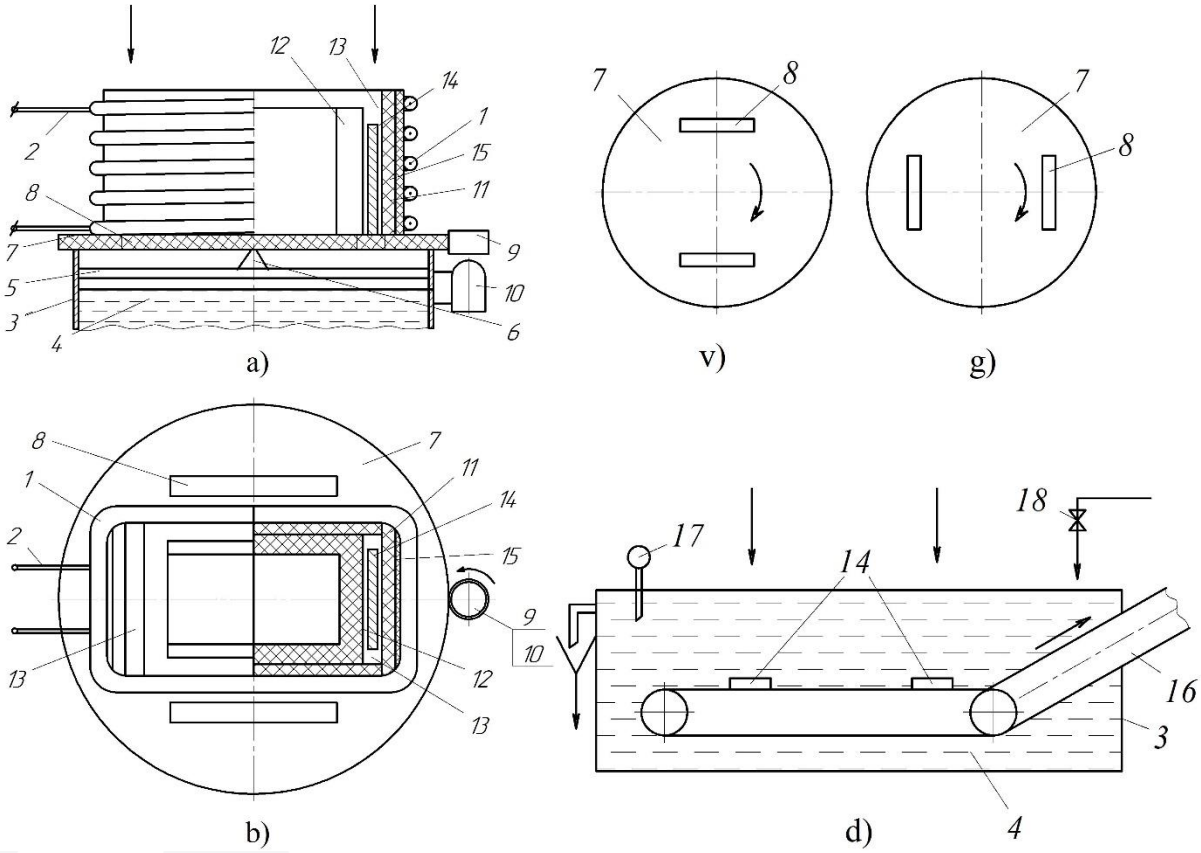

1 – inductor; 2 – coil; 3 – tank; 4 – coolant; 5 – barrier; 6 – base;
7 – roof; 8 – rectangular hole; 9 – roller; 10 – electric motor;
11 – heating pot; 12 – deposit; 13 – slot; 14 - ploughshare; 15 - storage;
16 – plate conveyor; 17 – thermometer; 18 – faucet
Figure 1. Device for heat treatment of ploughshares

The developed induction heating device is shown in Figure 1 below. Figure 1a shows the front view of the “Device for induction welding of plowshares”, Figure 1b shows the top view, Figure 1v and Figure 1g show the state of the shutter during loading and unloading of plowshares from the device, Figure 1d a cooling liquid bath is provided.

The device for finding plowshares consists of an inductor 1 with a current-carrying coil 2 and a tank 3 filled with a cooling liquid 4. A barrier 5 is fixed inside the tank, on which a support 6 holding a circular hatch 7 is installed, the hatch is provided with two rectangular holes 8 at the same distance from the center. The shutter is connected to the roller 9 connected to the electric motor 10 through a friction coupling.

Inductor 1 is equipped with a heating pot 11 and holder 12 made of heat-resistant material. There is a slot 13 between the inner diameter of the heating tank 11 and the insert 12, and the coulter 14 is installed in this slot.

Between the inductor coils 1 and the heating tank 11, there is an electrical insulating storage 15. Tank 3 is equipped with plate conveyor 16 immersed in cooling liquid 4, initial temperature of cooling liquid is controlled by thermometer 17, liquid consumption is regulated by tap 18.

An induction ploughshare device works as follows

The rolling blades 14 are periodically loaded into the inductor 1 through the slot 13 in pairs. In it, the coulters rest on the surface of the shiber 7 (Figure 1g). After the plows are loaded, a high-frequency current flows automatically in the inductive current conductor 2, as a result of which the plow 14 heats up to the required temperature. The heating temperature is set at 830 – 850 ℃ for 45G steel . When heated to the required temperature, the thermocouple automatically turns off or works in continuous mode. Due to the rotation, the shiber brings the square holes 8 under the ploughshare, and the heated ploughshares fall into the coolant tank 3 due to the force of gravity. The part is cooled and hardened at a speed higher than the critical speed. In continuous operation mode, loading and unloading of coulters into the inductor continues automatically.

When heated ploughshares are constantly placed in a cooling liquid, their temperature naturally increases, which affects the cooling rate of the parts and makes them less durable. When solving this problem, the temperature in the tank must be constant, which is controlled by thermometer 17. So that the liquid in the tank does not heat up, it is replaced with cold liquid, and the consumption of liquid in it is regulated by the faucet 18.

Using the proposed device for induction heating of coulters, one of the most important technological processes, which is the transfer of ploughshares to the inductor and their cooling liquid, is partially mechanized, which increases production efficiency.

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