CREATION OF OIL COOLING SYSTEMS BASED ON PELTIER ELEMENTS

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For long-term operation of loaded units and mechanisms, for example, sliding bearings, rolling shafts of metallurgical plants, turbines, etc., it is necessary to optimize the operating mode of lubricants, namely to stabilize their viscous characteristics by controlling the operating temperature. This problem becomes especially relevant in the summer season, given the tendency of constant growth of average temperature at this time of year. Heating of the lubricating fluid above the permissible limits leads to loss of operating characteristics, violation of the lubrication regime, damage to the bearing surface and the need to stop the production process, which entails significant financial losses. Solving the problem of creating local cooling units located in large workshops of enterprises is possible by using semiconductor cooling elements created on the basis of the Peltier effect. The advantages of the Peltier element over other cooling devices are small size, the absence of any moving parts, and the simplicity of the cooling module design. When changing the direction of current through Peltier element, both cooling and heating of oil is possible, which allows thermal stabilization at ambient temperatures both above and below the operating temperature of the oil. Another advantage of Peltier elements is the absence of noise. They have high reliability, simple design and allow automating local cooling of working bodies in large workshops with high energy efficiency.

The purpose of the work was to calculate the main structural elements of the oil cooling unit and select the most effective Peltier elements in terms of characteristics.

When developing the refrigeration unit, schemes for effective heat removal were proposed, including by creating cascade structures from Peltier elements, and original designs of oil heat exchanger with high throughput (up to 10 l/min) were also developed, both for laminar and turbulent oil flow.

The cooled unit was a remote oil flow indicator. The temperature of the lubricant was reduced using Peltier elements TEC1-12740 with a power of 338 W, capable of reducing the temperature on its surface to -15 °C.

When creating the refrigeration unit, a significant number of original developments were involved both in the design itself and in the heat exchange elements.

A set of experimental equipment was developed to control and ensure the necessary operating modes of lubrication systems and maintain the operational properties of the lubricant in the sliding bearings of rolling shafts of metallurgical plants. Control and ensuring the necessary operating modes and parameters of the lubrication system allows you to avoid an emergency exit and increase the resource of sliding bearings and lubricants. It is planned to manufacture a prototype of the cooler, conduct the necessary tests and, based on their results, make a decision on the possibility of replicating this device.