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NORMATIVE PROVIDING TECHNOLOGIES DISMANTLING JOINT WITH INTERFERENCE FIT RESPONSIBLE FOR THE USE OF INDUCTION HEATING

Розглянуто основні умови якісного нагріву деталей при розбиранні з'єднань з натягом за допомогою індукційного нагріву, які забезпечують мінімально можливу витрату енергії.

Ключові слова: індукційний нагрів, енергія, фреза.

In the article the basic terms of quality heating parts during disassembly Joint with interference fit using induction heating, which provide the lowest possible energy consumption.

Key words: induction heating, energy, rollingmills.

Introduction. Joint with interference fit with third in total connections in engineering after a gap of cylindrical, threaded, and often they are used in critical articles such as wheel sets of rail transport rolls for rolling mills, pulleys and hoists other. Their disassembly or repair in order to carry out a variety of ways: mechanical, hydraulic or thermal (heating or cooling from). Choose how disassembly of a connection with interference depends on its structural characteristics, quality requirements for parts and, in some cases, the availability of equipment.

Method disassembly of heating is sometimes the only one by which you can ensure separation of parts of the compound without damaging them. This usually refers to large-sized units and formations of the massive piece covering and thin shaft. Due to the rapid heating details covering (which exceeds the

rate of heat transfer in detail that to overcome) receiving a gap in dismantling connection. The most efficient induction heating, a distinctive feature of which is that the details of the shooting may have a variable temperature field in time and space. You can also change the depth and heating the metal by changing the frequency of the inductor current. This method allows for a productive and good showdown in which the parts are deformed and their material retains its physical and mechanical properties.

Statement of the problem. The main difficulty when using induction heating technology is to provide the necessary connections for the heating mode. It is largely determined by the possibility of placing an inductor around the complex configuration details of a connection, or heated in a small space next to it, due to the presence of a number of other details. Choosing the design of the induction heater, the absence or presence of a concentrator of electromagnetic fields, magnetic, location, depending on the required capacity, versatility and form parts that get hot. Therefore, the actual technical capabilities of the characteristics of inductors for the selection of different types of connections.

The main material. Inductors can be to have one coil and to have many coils. To produce inductor to have many coils using heat-resistant copper wire or copper tube section 35-50 mm^2. Explorers of magnetic stream are intact or split, made of transformer steel with a thickness of 0.3-0.5 mm.

Theoretical and experimental studies Mode at dismantling joints, research on the design of induction heaters and pilot test allowed us to develop some recommendations. As you know, the more powerful inducer, the faster heat up detail wrap-round of connection and the gap formed demolition. However, there are two limitations: 1) heating temperature should not exceed the permissible provided that the properties of the metal; 2) the temperature field should not cause unacceptable stresses in the metal. So that the first limitation was observed intensity of the heat must be agreed with the velocity of propagation of heat in the material that covers details and heat transfer between the parts connection. Compliance with the second restriction requires efficient heat distribution on the details of the heating and regulating their power over time.

When heated, simple in form – smooth conical or cylindrical parts connection must withstand only the first restriction. Examples of such compounds are the shaft of the cone bearing band centered more. Mode of heating is determined by solving the one-dimensional heat conduction problem with heat source, in accordance with the method of Fourier. [3] For thin-walled parts – parts whose wall thickness of no more than two depths warm-up metal vortical currents, the minimum heating time to achieve the desired temperature T2 at which the surface layer does not overheat above T_2 accurately be determined by the dependence:

$$\tau = \frac{c\gamma L}{q}(T_2 - T_1),$$

where c and γ – specific heat capacity and density of the material, respectively; L – thickness of wall detail that is heated; q – specific power inductor.

If the part thick-walled continuously (such as a disk), you use the term “time constant taking of temperature” that introduced in [2], the power at which ruled inadmissible overheating of the surface layer is determined from the expression

$$W \le \frac{cmT_{\max}}{\tau_T},$$

where m – bulk metal layer heated; T_{max} – maximum allowable temperature; $\tau_T = \frac{L^2}{\pi^2 a}$ – time constant conductivity. Here α – coefficient of thermal.

When heated details of complex profile such as degreeal wheels (hub, disc and rim) takes into account both constraints. Mode of heating is determined by the solution to the problem of thermoelasticity when determining the relationship between the temperature distribution along the radius and length that covers details and necessary expansion of its hole in the allowable stresses and temperature [1].

Induction installations of structurally different inducers are created with the following requirements:

– disassembly is performed in the vertical or horizontal axis of the connection that sorting out;

– induction heater purpose or a special;

– inductor single – or three-phase;

– plant of fixed or portable.

Dismantling joints with smooth thin-walled parts to carry out quite easily using conventional solenoidal coil type without explorers of magnetic stream. Heat thick-walled parts to improve the electrical and thermal characteristics of the inductor must be performed using explorers of magnetic stream covering solenoid coil and closed on the detail. In induction heaters can be used by one or more solenoid coils of different shapes.

When using inductors for dismantling joints with details covering with hub and drive to conserve energy and to avoid the occurrence of unacceptable stresses advisable to heat the hub and drive in different modes.

A typical representative of the inductor for heating intricate parts is the inductor for locomotive wheelset disassembly. Railway wheel has a complex shape, consisting of a nave, a relatively thin disk and a massive rim. Induction heater consists of two inductors: one with a round coil and explorers of magnetic stream system and the other which has 2 sliding radially form of “kidney bean” coil form with your system explorers of magnetic stream. Both inductors operating simultaneously and dismantling connection occurs in 4–5 minutes under the weight wheels and heaters.

The researches allow to make the following recommendations for the creation of inductors for heating details during disassembly connections:

1) inductors – solenoid, explorers of magnetic stream system with or without;

2) form a coil inductor should most probably meet the profile of the object being heated;

3) control system is selected depending on the purpose of the heater;

4) control of induction – heating device (IHD) has performed for temperature, time, current limiting, or two or three of these parameters simultaneously;

5) inductor should be designed taking into account the possibilities of electricity grid company;

6) IHD must fully comply with the “Rules of the device and operation of power plants” and other safety regulations in force in this company.

The control system (CS) is complicated, depending on the number of simultaneously controlled objects and the number of control parameters. Thus, if the heater has one position (both heats one product) is designed to heat one size products (not required setup), and temperature control is only one point, the most simple CS. It allows you to work with a tight program in two modes: 1) heated to the desired temperature; 2) maintain the desired temperature. Accuracy of this CS mainly depends on the inertia of its constituent parts and the accuracy of the temperature measurement. Its advantages – reliability, relative simplicity and low cost. In most cases, it provides the required accuracy of the process. This CS somewhat complicated when will include maximum protection current flowing in the inductor, and control heating time as the backup temperature control system is necessary when heated responsible productions. If a special induction heater has several independent inductors that work at different times, you may use sophisticated version of CS. The work will be similar to this CS action with a tight program mode temperature. The difference will consist in the fact that since the inductor is done in the form of several independent coils are connected, then as switching elements using semiconductor keys.

Conclusion. The basic terms of quality heating details during disassembly connections with induction heating, which provide the lowest possible energy consumption, and the implementation of which allows you to design induction heaters are used for different types joint with interference fit.

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IMPROVING OF MANUFACTURING METHOD OF THREE-CONE ROCK BITS

Запропоновано критерії побудови оптимального технологічного маршруту виготовлення бурового тришарошкового долота, які встановлюють логічний об'єднуючий зв'язок між показниками якості деталей долота та технологічними операціями. Особливістю вдосконалення технології виготовлення є розроблений підхід до декомпозиції бурового долота, на основі якої встановлюються множини показників якості, що висуваються до технологічних операцій.

Ключові слова: оптимальний технологічний маршрут, декомпозиція, бурове тришарошкове долото.

The construction criteria of optimal technological route of three-cone rock bits manufacturing are offered. These criteria define the logical connection between the quality factors of rock bit parts and production operations. The developed approach to rock bit decomposition is one of the main features of improving of manufacturing process. On its base the sets of quality factors placed to production operations are defined.

Key words: optimal technological route, decomposition, of three-cone rock bits.

Introduction. Three-cone rock bits are often used for multifunctional well drilling. It is the main reason for our domestic manufactures to solve the difficult complex problem connected with such rock bits planning and manufacturing. In spite of the wide usage of integrated computer-aided information systems and technologies, the rock bits manufacturing meets the problem of improving of approaches either to preparation for production or to technological processes.

Analysis of the latest researches and publications. Such companies as "Halliburton International, Inc", "Baker-Hughes International, Inc", "Shlumberger", "Smith International", "National Oilwell Inc", "Security DBS", "Varel International", "Lilin Industrial Park", "Reed Tool" and other take the first place in manufacturing of three-cone rock bits of modern design. These companies have flexible system of designing, engineering and mobile preparation for production. It creates conditions for continuous development of specialized production of various designs and standard sizes of rock bits. Such system allows to fill rock bit consumers' fast-changing needs for short period.