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IMPROVEMENT OF THE SCREW CONVEYOR CONSTRUCTION OF THE DRILLING RIG

Аннотация: *в статье приводится описание разработки усовершенствованной конструкции винтового конвейера буровой установки, который входит в состав системы отчистки бурового раствора, а также общие требования к циркуляционной системе буровой установки. Основная цель заключается в модернизации конвейера: облегчить обслуживание, сократить количество ремонтов, уменьшить износ.*

Ключевые слова: *буровая установка, винтовой конвейер, очистка бурового раствора, модернизация конвейера.*

Abstract: *the article describes the development of the improved design of the screw conveyor of the drilling rig that is the part of the drilling mud cleaning system, as well as the general requirements for the drilling rig's circulation system. The main object is to modernize the conveyor: to lighten the maintenance, to reduce the number of repairs, to reduce the wear.*

Keywords: *drilling rig, screw conveyor, cleaning of drilling mud, modernization of the conveyor.*

The drilling mud cleaning system is the most important component of the drilling rig for drilling oil and gas wells. It provides the necessary quality of the washing liquid. The quality of the drilling fluid greatly affects the drilling speed, the wear of expensive

equipment, the efficiency of drill cuttings removal and the cooling. The discrepancy with the required parameters of the washing liquid leads to accidents and complications during the drilling of wells, which leads to an increase in the cost price. Multiple closed circulation provides significant economic benefits by reducing the consumption of chemical components and other expensive materials that make up the mud. It is also important to note that closed circulation prevents contamination of the environment by drilling fluids containing chemically aggressive and toxic components. The work on modernization of the cleaning system is the main development of drilling technologies.

The circulation system is a set of mechanisms and equipment that is part of the drilling rig. In the process of deepening the well, drilling mud enters the drilling rig and forms fluid (oil, water, condensate) or gas (hydrocarbon gas, including acid gas) which must be removed quickly. The presence of drill cuttings in the solution has a harmful effect on its technological properties and leads to a deterioration of the technical and economic parameters of drilling. In connection with this, cleaning of the drilling mud from solid, liquid and gaseous impurities is given special attention [1, с. 198].

Circulation systems can be classified according to different characteristics. It is common to distinguish the circulation systems by: a) functional and b) constructive features. They are distinguished also by the fact that the cleaning system belongs to one or another type of drilling rig, for example, for cluster drilling, for stationary drilling rigs or for mobile plants. These classifications also establish the basic solutions for the design, location and composition of the equipment of the circulation systems.

Drilling of oil and gas wells without the use of drilling mud cleaning systems is impossible. The better the cleaning, the more reliable the drilling rig equipment: drilling pumps and rock cutting equipment, the higher the technical and economic parameters of drilling. Depending on the mining and geological features of the section and the planned technology of the well construction, the following drilling mud may be used as: technical water; drilling mud on water basis; drilling mud on oil basis, unsuspended and suspended; drilling mud of polymer-clayey with a low content of clay; drilling fluid; hydrocarbon liquids and etc.

Cleaning of drilling mud from drill cuttings is carried out with the help of technological equipment, which is part of the unit for cleaning the drilling rig of the circulation system [2, c. 134].

The sludge removal system is designed to collect sludge after the treatment equipment, transport it and remove it outside the drilling rig during drilling. The sludge removal system includes a screw conveyor or several conveyors with a drive and additional devices. The conveyor drive can provide its operation in different speed modes depending on the amount of incoming slurry. The discharge of the sludge can be carried out in the sludge pit, if conditions permit, either in the intermediate bunker or in the lorry to transport to the disposal sites.

At the rig the main waste is drill cuttings, from which the drilling mud has already been separated is a dry, loose mixture. Drilling mud with the help of conveyors is transported to containers or barns intended for storage, and then taken out for further utilization.

Screw type of conveyor consists of a drive (gearbox and electric motor), rotating the screw (the working part of the machine), the drive shaft with the fastening screws of the transporting screw, the trough with the semi-cylindrical bottom, the loading and unloading device. Through the holes in the lid of the gutter, a bulk cargo is delivered and slides along the gutter as the screw rotates. The joint rotation of the load with the screw is impeded by the gravity of the load and its friction against the trough. Through the holes in the bottom, provided with the gates, the gutter is unloaded. Screw is performed one, two or three-way, with the right or left direction of the spiral. The surface of the screw is lobed, shaped, ribbon, continuous some manufacturers of screw conveyors use knots in which bearings and sealing elements are in a single body. The reduction in weight, dimensions and, sometimes, the cost of the bearing assembly, in practice, turns out to be frequent repairs and long downtime [3, c. 205].

Experts understand that the time lost during emergency repairs, the replacement of bearings, sealing elements and the expectation of delivery of replacement parts – the time lost in production, used the original scheme of outboard bearing supports.

In the event that the sealing element is broken for some reason, the transported material loosens out of the housing freely and does not fall into the bearings. Increased dusting or accumulation of material during the operation of the screw can be easily detected even with a superficial examination of the equipment, and timely replacement of the sealing element will avoid serious damage. Thus, a simple technical solution that makes visual control of the seal condition possible, reduces equipment downtime, saving both money and energy. Axle of the screw of the increased diameter for transmission of the maximum twisting moment.

The internal surface of the housing, feeding the screw of the screw conveyor, is subject to abrasive wear, the intensity of which directly depends on the physico-mechanical characteristics of the material being transported. Cement, powdered lime, ash, slag, mineral powder, as well as a number of other bulk materials for transportation, which are used screw conveyors, are medium or highly abrasive materials. It is for this reason that screw conveyors designed for heavy duty operation should have an increased thickness of the shell walls, an illusory saving in this matter subsequently turns around expensive repair.

The proposed modernization of the screw conveyor consists in the transition from two short conveyors consisting of three sections installed one after another, the upper conveyor receives the cleaning products from the shaker and the centrifuge and transports to the reception of the second, the latter conveys further to the barn, to one conveyor consisting of five sections four meters. And the modernization of the directly selected prototype, which consists in the modernization of the bearing assembly of the driven shaft.

At the bearing assembly of the driven shaft, the seal before the upgrade is pressed from the inside, which makes maintenance difficult, maintenance can be carried out only during technological downtime of the cleaning system (such as waiting for the cement to solidify after filling the column). The stuffing box is permanently erased, the service personnel have to pull it up regularly. To do this, it is necessary to stop the screw conveyor, open the top covers, clean the bolted connections from the remnants of the solution and only after that carry out a tightening of the stuffing box packing.

A bearing assembly of the driven shaft has a number of drawbacks, such as: laborious lifting of stuffing box packing, labor-consuming change of worn stuffing box packing, wear of the packing bags, difficult disassembly of threaded connections, difficult disassembly during major overhaul, higher metal content compared to the new sample.

The modernization consists in the fact that the bearing assembly is completely taken out to the outside of the screw conveyor, the packing follower is replaced by the gland box, and as a result, the task of replacing the gland packing is much easier. Also, during the overhaul, the shaft and the bearing are replaced. When replacing the bearing unit in the field with the drilling rig, the most time consuming work is to remove the shaft of the assembly from the screw and the proposed construction. It is possible to replace the shaft. Reducing labor intensity for maintenance and repair is the main indicator of the proposed modernization.

As practice shows, the main reason for premature failure of the bearing is the penetration of the transported mass through a weakened seal into the bearing cavity. And since the environment is highly abrasive, the failure of the whole mechanism and the failure of the whole mechanism occur. In the proposed design, if leakage occurs through the seal due to the negligence of the maintenance personnel, they will not bear such severe consequences as with the old design.

Список литературы

1. Баграмов Р.А. Буровые машины и комплексы. – М.: Недра, 1988. – 501 с.

2. Волокитенков А.А. Технология отбора шлама при бурении скважин / А.А. Волокитенков, А.С. Волков, И.И. Толокнов [и др.]. – М.: Недра, 1973. – 200 с.

3. Скрыпник С.Г. Сооружение буровых на суше. – М.: Недра, 1991. – 360 с.