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FEATURES OF OFFSHORE PRODUCTION OF HYDROCARBONS

ОСОБЕННОСТИ ОФФШОРНОГО ПРОИЗВОДСТВА УГЛЕВОДОРОДОВ

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Abstract. The authors examine the production processes. The disadvantage of a Jack-up rig and method of its installation is the high constructive complexity of the devices supporting its float ability. This leads to large labour costs for installation and removal of jack-up floating drilling rig.

A constraining factor in the development of projects on the shelf of the seas is the lack of technical means and technologies for the development of oil and gas fields, taking into account different climatic conditions, particularly in the Arctic seas.

Аннотация. Авторы рассматривают производственные процессы. Недостатком нефтяной установки и метода ее установки является высокая конструктивная сложность устройств, поддерживающих его плавучесть. Это приводит к большим трудозатратам на установку и демонтаж плавучей буровой установки.

Сдерживающим фактором при разработке проектов на шельфе морей является отсутствие технических средств и технологий для разработки нефтяных и газовых месторождений с учетом различных климатических условий, особенно в арктических морях.

Keywords: oil production, offshore production, the Arctic.

Ключевые слова: нефтедобыча, шельф, производство, Арктика.

Deposits of natural gas are found not only on land. There are offshore fields - oil and gas are sometimes found in the depths of the hidden water [1].

Now the oil extracted from sea fields accounts for about 30% of all world production. How do people get this wealth?

Geologists explore both land and waters of seas and oceans [2]. If the deposit is located close to the coast in the coastal area inclined exploration wells need to be built on the land. Deposits which are farther from the shore belong to the area of the shelf. The shelf is called the edge of the continent with the same geological structure as the land, and its boundary is the edge – a sharp drop depth. For these deposits floating platforms and drilling rigs are used, and if the depth is small - just high piles from which drilling is carried out.

There are three types of platforms- jack-up drilling platforms, semi-submersible drilling platforms and drilling platforms of gravitational type.

For shallow depths using of jack-up drilling platform is used Jack-up drilling platform (fig.1) is a floating pontoon (1) with a cut, which has a drilling rig above it. The pontoon has three-, four- or polygonal shape. The drilling and service equipment, the multistoried cabin with cabins for crew and workers, electric power station and store area are placed on it. The multimeter – bearing columns (2) are installed at the corners of the platform.

In a drilling point, the columns are sunk by means of a hydraulic jack. They reach the bottom, lean on soil and go deep into it, and the platform rises to the water surface. After the end of drilling in one place, the platform is transferred to another. The reliability of the installation of jack-up drilling platforms depends on the strength of the soil which forms the bottom in the place of drilling.

The disadvantage of a Jack-up rig and method of its installation is the high constructive complexity of the devices supporting its float ability. This leads to large labour costs for installation and removal of jack-up floating drilling rig.

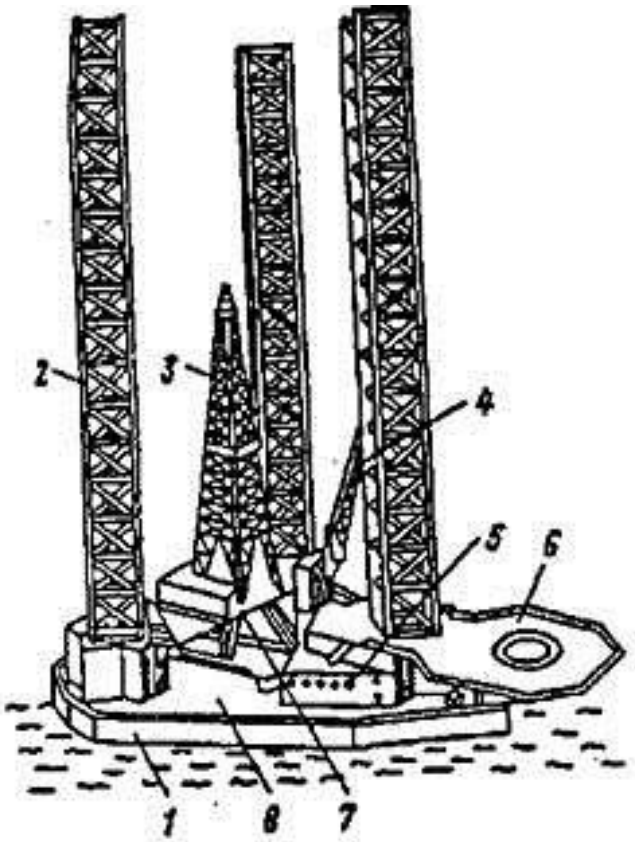

Fig.1. Jack-up drilling platform in the transport position: 1 - a floating pontoon; 2 - lifting support; 3 - oil rig; 4 - rotary (cargo) crane; 5 - accommodation module; 6 – heli-desk; 7 - underrig portal; 8 - main deck.

Semi-submersible drilling platforms are used at great depths. Platforms do not rely on the seabed, they just float over the drilling site on huge pontoons. Such platforms are held from movements by anchors weighing 15 tonnes or more. Steel ropes connect them with automatic winches, limiting horizontal displacement towards the point of drilling.

However, maintaining a constant load on the floating structure is a difficult and expensive operation.

Therefore, on some platforms, such as Deepwater Horizon a computer dynamic positioning system is used which by means of powerful underwater engines constantly keeps the platform at a specific location, accurate within several meters.

The disadvantage of semi-submersible platforms is the possibility of their displacement towards the point of drilling under the influence of waves.

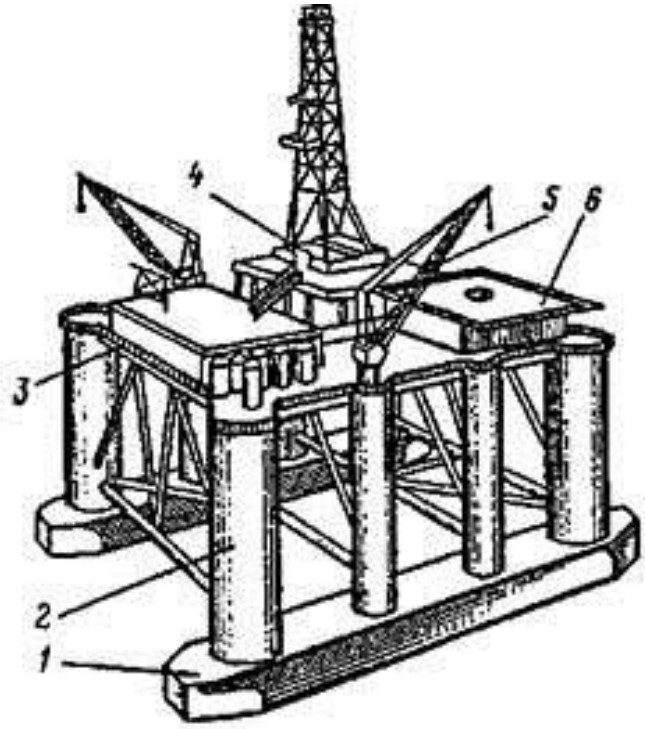

Fig. 2. Semi-submersible drilling platform: 1- submersible pontoon; 2- stabilization column; 3- upper hull; 4- drilling rig; 5- cargo crane; 6- heli-deck.

Drilling platforms of gravitational type are steadier. They are equipped with powerful concrete base resting on the seabed. In this base there are not only the conductor drilling strings but also cell-storage tanks for produced oil and diesel fuel used as an energy source, numerous pipelines. Elements of the foundation are delivered to the installation site in the form of large blocks.

The seabed at the installation site of gravitational platforms must be carefully prepared. Even a small slope of the bottom threatens to turn the oil rig in the Leaning tower of Pisa, and the presence of protrusions on the bottom can cause a split of the basis. Therefore before setting the rig “on point” all protruding stones are removed, and cracks and hollows on the bottom are sealed with concrete.

The disadvantages are primarily that the waves and the ice thickness impact on vertical walls. In this case, the force will be the greatest, which will require the increasing of the volume of the array to keep the platform from shifting or tipping over.

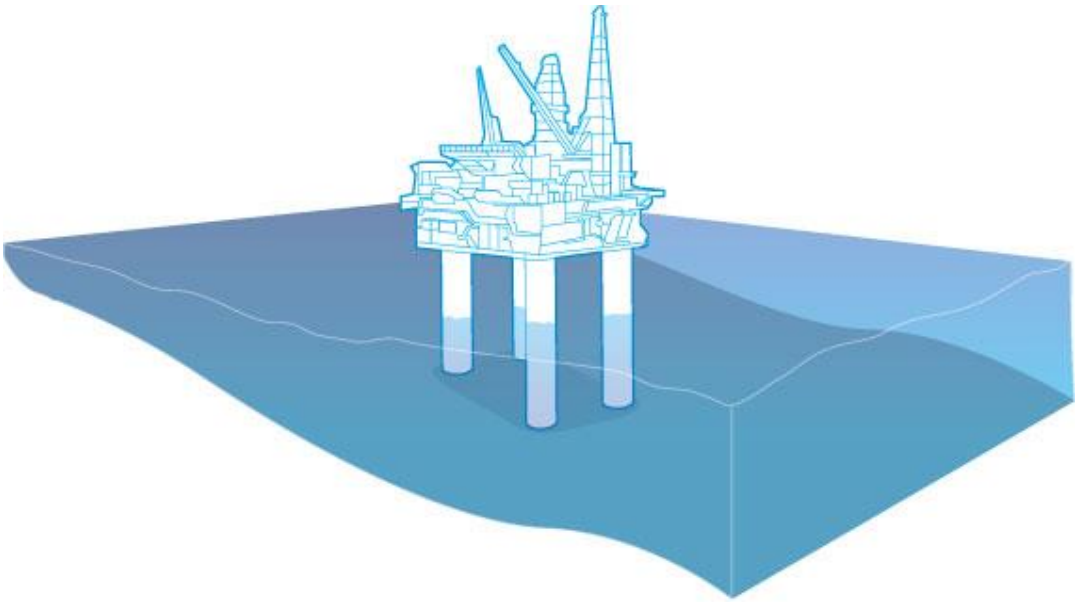

Fig.3

The most mobile design, capable of operating at any depth is the drilling ship [3]. It is designed specifically for the implementation of drilling at great depths, though it is not as resistant as semi-submersible marine drilling rigs.

Features of IRFP-1(ice-resistant fixed platform-1)

- Overall length (flare boom) of about 115 m.
- Trunk length of 95.5 m.
- Overall width (with brackets for piles) 72,2 m.
- Trunk Width of 64.2 m.
- Overall height from sea level about 90 m.
- Weight (dry) of about 16 000 t.
- The weight of the platform when parked on the ground with liquid ballast 25 655 T.

It’s applied in the Filanovsky and Korchagin fields. The Filanovsky deposit is discovered by "LUKOIL" in 2005. Located in the Russian sector of the Caspian Sea, 190 km from Astrakhan, at a depth of 7-11 m. This is one of the largest offshore oil fields in Russia. Recoverable oil reserves are 129 million tonnes, gas-30 billion cubic meters.

The Korchagin Deposit is located in the Russian sector of the Caspian sea at the depth of 11-13 m. The nearest beach (the Delta of the river Volga) is about 120 km. The nearest seaports are located in the city of Astrakhan (175 km) and Makhachkala (250 km). Railway stations are in the cities of Astrakhan, Makhachkala, Kizlyar and Derbent. The offshore platform which is mined is built at Russian enterprises. It works on the principle of "zero discharge" when all kinds of industrial and domestic waste are transported from facilities ashore and disposed of.

Fig.4

The twentieth century was the beginning of the development of work on the extraction of oil and gas on the shelf seas of the world (North sea shelf, continental shelf of the Gulf of Mexico, Beaufort sea shelf, Caspian sea shelf, etc.).

Significant oil and gas reserves on the shelf of seas and oceans are discovered, which are the basis for the development of large-scale works for the extraction of oil and gas in the XXI century and are associated with the development of the world economy with increasing needs for motor fuels. They received a large development [4].

However, a constraining factor in the development of projects on the shelf of the seas is the lack of technical means and technologies for development of oil and gas fields, taking into account different climatic conditions, particularly in the Arctic seas.

The analysis of world experience of development of deposits of oil and gas on the shelf of the seas accumulated in the XX century showed that existing tools and technologies do not fully meet the diverse natural and climatic conditions, which may include:

- high seismicity;
- presence of icebergs;
- presence of ice fields;
- occurrence of tsunamis by earthquakes;
- tornadoes and hurricanes, increased in recent years;
- surface currents as a result of the hurricanes – because of high wind speeds;
- depths of the sea to 1000 m and more.

Offshore production of hydrocarbon components is relevant nowadays. The hydrocarbon crude plays an important role in human life. Workers associated with the extraction and processing of oil are required. The job is well-paid and requires comprehensive knowledge, because of its danger. The most important thing today is not to stop and continue to develop [5].

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