

Supplementary Material

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1. DERRICKS

The steel framework over the well is called a derrick. The derrick is constructed directly over the site selected for a well. From this the machinery that drills the hole is raised and lowered.

The function of a derrick is to provide the vertical clearance necessary to the raising and the lowering of the drill string into and out of the hole during the drilling operations. Derricks are of two general types, standard and portable. A standard derrick cannot be raised in a working position as a unit, i.e. it is of bolted construction and must be assembled part by part. Likewise, it must be disassembled. A portable derrick of mast is one capable of being erected as a unit. The substructure is the support on which the derrick rests. This substructure must be of sufficient strength to support the anticipated loads with adequate safety factors. Its height must be of 43 m and higher.

Notes

Clearance – зазор, просвет

As a unit – целиком

Substructure – подвышечное основание, фундамент

Support – опора, станина

2. OIL FROM SEA BOTTOM

The Caspian Sea is a veritable storehouse of oil and gas. Over a hundred such deposits are situated under its bottom at prospecting up to 200 metres deep. It is possible to drill over a dozen wells from such a platform.

The history of sea extraction in the Soviet Union goes back a century and a half. Off-shore oil wells were built in the area of Baku, capital of Azerbaijan, as early as 1824. The first rigs appeared in the sea at the start of this century. They were made of timber and placed on wooden platforms, then dropped in shallow water.

Today modern machinery and technology permits the extraction of oil from lower depths. Oil rigs are going farther out to sea. There is now a whole town in the sea standing on piles called Neftyanije Kamni.

The bold dream of oilmen to stretch a chain of steel isles from the shores of Azerbaijan to the shores of Turkmenia is becoming a reality. It will pass along the so-called Apsheron rapid. Now oil fields have been found under this underwater range which divides the Caspian latitude.

Russia cooperates with many countries interested in the development of the riches of the continental shelf. Together with the Japanese firm Sodeco, which signed an agreement on prospecting on the Sakhalin shelf, the Soviet Union has already done much prospecting. Our country has contracts with firms in France, Japan, Finland and other countries. Talks on projects of cooperation are in progress with various countries.

(Moscow News).

Notes

Installation – *установка*

To prospect – *производить поиски, разведку*

Prospecting - *поиски, разведка, изыскания.*

3. OCCURRENCE OF OIL, GAS AND WATER IN RESERVOIRS

In reservoirs oil, gas and gas-oil mixtures can occur in a liquid, gaseous, or multiphase state, depending on the content, composition, pressure and temperature of each phase.

If the gas content of an oil pool is considerable, the gas can accumulate in the form of a gas cap in the elevated section of the stratum, and a portion of liquid hydrocarbons that evaporate under temperature will replenish the gas cap. At a high reservoir pressure, the gas density becomes rather high and approaches the density of highly volatile hydrocarbon liquids. Under these conditions, a large amount of oil dissolves in oil and the gas-oil reservoir occurs in a single-phase (liquid) state. By the mode of occurrence of oil and gas and their volumetric proportions, reservoirs are divided into oil, gas, gas-and-oil, and gas-condensate reservoirs.

Oil, gas and water are distributed in a bed according to their densities: gas occupies an upper part, oil a lower part, with water underlying oil. Water portions of beds are, as a rule, tens or hundreds of times larger than gas-and-oil portions, and extend over the area for great distances.

(Production of Oil and Gas, 1985).

Notes:

volatile - *летучий*

to occur - *залегать, встречаться, находиться*

mode of occurrence - *условия залегания*

4.0 I L RECOVERY

The amount of oil in the reservoir which is not recoverable by ordinary pumping methods is considerable. It is found that the amount ranges from 15 to 75 per cent, depending upon the type of natural recovery mechanism and other factors. It is possible to recover a large part of the left in the reservoir by secondary recovery methods. Liquids or gases are injected into the common reservoir through one or more injection wells and the oil and gas are produced through other wells by flowing or pumping.

Water injection into oil productive zones has been a real revolution in oil field practice and theory. This method has led to higher rates of oil production, it has made it possible to develop oil fields of enormous reserves and to switch over to the wider spacing of wells, thus reducing their numbers and greatly economizing on time and capital investments.

The Russian oil industry has already accumulated considerable experience in automating oil fields. Basically new standard systems of control over the operating of the wells have been created during the last few years. Their application results in the maximum centralization and automation of all technological process and remote control. This reduces the need for servicing personnel, which is particularly important in the new thinly populated regions.

(Production Engineering).

Notes:

capital investments - *Капиталовложения*

thinly populated region - *малонаселённый район*

5. Planning the well.

The function of an oil or gas well is to provide a conduit from the subsurface petroleum-bearing formations to the surface through which the petroleum can flow and be recovered at the surface. In order to provide this conduit, a hole must be bored or drilled to the petroleum-bearing formation. This hole is then cased with pipe, usually steel or steel alloy, and cemented, and production equipment is placed in the cased hole and at the surface to control and regulate the fluid-withdrawal rates. The drilling system used to bore this hole will depend upon a number of factors: 1. Cost per foot for the different drilling systems, 2. Character of the formation to be penetrated, 3. Character of the producing formation. The drilling system will normally be either the cable-tool system or the rotary system.

Something must be known of the character of the formations to be penetrated in reaching the producing horizon in order to select the proper drilling system.

In an effort to improve drilling, engineers have been working at new techniques. Most of these are still in the experimental stage, but one day they may revolutionize drilling methods.

Some of the new techniques, such as the electrodrill and turbodrill, are designed to give more direct power to the drilling process by locating the drill motor just above the bit at the bottom of the hole. Rotary percussion drills use a circulating fluid, air, or high frequency sound waves to activate a hammer-like mechanism above the drill bit that creates a rapid series of percussion blows. In this way, rotary percussion drills bore and pound their way into the earth. Still in the experimental stage is flame-jet drilling, which uses a new liquid rocket fuel to actually burn a hole through the earth strata. This leaves a ceramic-like sheath on the walls of the hole and eliminates the need for well casing.

(Petroleum).

Notes: withdrawal rate – *темп отбора, скорость извлечения*

6. THE CIRCULATING SYSTEM

The primary function of the circulating system is to force drilling fluid down through the drill column, back to the surface through the annular space and through various surface facilities designed to separate drill cuttings.

The drill stem and swivel are hollow so that water and mud can be pumped down through the stem to the drilling bit and out into the well through holes in the bit. This fluid sweeps under the bit, picks up the rocks material loosened thereby and carries it to the surface through the annular space between the drill stem and the walls of the well. Fluid from the well overflows into a mud ditch through which it moves slowly, allowing the coarse cuttings from the well to settle. The fluid, thus freed of the coarse gritty material, and containing only finegrained clay in suspension, flows into the slush pit, from which it is picked up by the pump suction for further circulation through the well. The mud fluid, thus used repeatedly in closed circuit, need be replenished only to the extent that it is absorbed by the porous formations penetrated by the well.

The main elements that are properly regarded as a part of the rotary rig are (1) one or more slush pumps (usually two) and their suction lines and manifold; (2) the rotary hose; and (3) the swivel. Other essential /main/ elements, apart from the drilling rig proper, are (4) the mud ditch and (5) the mud pit.

(Handbook of Petroleum).

Notes:

swivel - *вертлюг*

loose - *рыхлый, рассыпной*

mud ditch – *амбар для хранения бурового раствора*

slush pit – *амбар для хранения бурового раствора*

pump suction – *прием насоса, всасывание*

slush pump – *буровой насос*

manifold – *система труб, коллектор*

7. THE TURBODRILL.

The turbodrill is a rotary device employing the same basic mechanism as the conventional method. The principal difference is that the bit's rotation is provided by a downhole multistaged turbine which is powered by drilling mud. The turbine section contains stators and rotors, each part being referred to as one stage. Current models of the turbine use 100 or more stages. Drilling mud is deflected by the stator and strikes the rotor blades, causing them to rotate. In early designs of turbodrills bearing failure brought about by the action of abrasive muds often occurred. Russian engineers succeeded in solving this problem, in Russian Federation rubber bearings were developed. Over 80% of all Russian drilling is performed with turbodrills. The best drilling fluid for turbine use appears to be water.

Turbodrilling has some advantages: 1. Higher penetration rates due to increased rotating speeds. 2. Elimination of drill string rotation. 3. Quieter operation - no rotary table noise.

The disadvantages are: 1. Turbodrill cost, both initial and maintenance;
2. Greater care required to remove abrasive solids from the mud.

(Handbook of Petroleum).

Notes:

multistaged - *многоступенчатый*

to deflect - *отклонять*

a blade - *лопасть долота; лопатка (турбины)*

bearing failure - *поломка подшипника*

maintenance - *текущий ремонт, обслуживание*

8. THE ROTARY DRILLING EQUIPMENT

The equipment used in rotary drilling may be classified into five groups. The first of these groups is the derrick and other structures for supporting drilling equipment. The second includes the power engines and power transmission mechanism. The third group is the lifting (hoisting) equipment, the fourth is the rotating element, and the last group (5) is the circulating system.

The derrick is used for raising and lowering the drill string. The second group consists of different types of engines such as steam engines, internal-combustion engines and electric motors. One must note that steam engines for rotary drilling are seldom used now. In recent years there have many applications of internal combustion engines and the popularity of this type of prime mover has been rapidly increasing. Internal combustion engines as a class include all engines operating on gaseous or liquid fuels. We may classify many engines according to the fuel used, as gas engines or oil engines. Use of electric motors in rotary drilling is a means of transmitting and applying power developed by other means.

The third group of elements of the rotary drilling rig is the equipment used in supporting the drill column and handling drill pipe and other heavy loads in the derrick. This includes the draw works, the crown block, the hoisting block and hook and the hoisting cable. These elements should be carefully selected. They are of equal strength so that they will function together to perform a maximum hoisting operation without failure of any component.

(Drilling Engineering Handbook)

Notes: prime mover - *первичный двигатель*

crownblock - *кронблок*

hook - *крюк, крючок*

hoisting cable - *подъёмный канат*