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ПРОСПЕКТ СВОБОДНЫЙ-2016

МЕЖДУНАРОДНАЯ КОНФЕРЕНЦИЯ СТУДЕНТОВ, АСПИРАНТОВ И МОЛОДЫХ УЧЁНЫХ

ЭЛЕКТРОННЫЙ СБОРНИК МАТЕРИАЛОВ МЕЖДУНАРОДНОЙ КОНФЕРЕНЦИИ СТУДЕНТОВ, АСПИРАНТОВ И МОЛОДЫХ УЧЁНЫХ **«ПРОСПЕКТ СВОБОДНЫЙ-2016»**, ПОСВЯЩЁННОЙ ГОДУ ОБРАЗОВАНИЯ В СОДРУЖЕСТВЕ НЕЗАВИСИМЫХ ГОСУДАРСТВ

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«Oil and Gas Machinery»

УДК [691.7]

ASSORTMENT FOR OIL PIPELINE THREADS

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The oil industry is developing and therefore increasing the volume of works on drilling wells in the North, the Western and Eastern Siberia and Central Asia take place. In addition, many drilling operations are carried out on shelf zones of the seas and oceans.

The analysis of pipe market in 2015 has shown it is most likely that in Russia demand for oil and gas extraction pipes will increase. In 2015 the number of new wells and drilling volumes have increased by 15 percent. Among all pipes using in oil and gas industry tubing is 50%.

According to the official statistics of oil and gas industry the percent of accidents that are connected with tubing makes about 80%. In figure 1 you can see the percentage of defected pipe products and its quantity for various reasons.

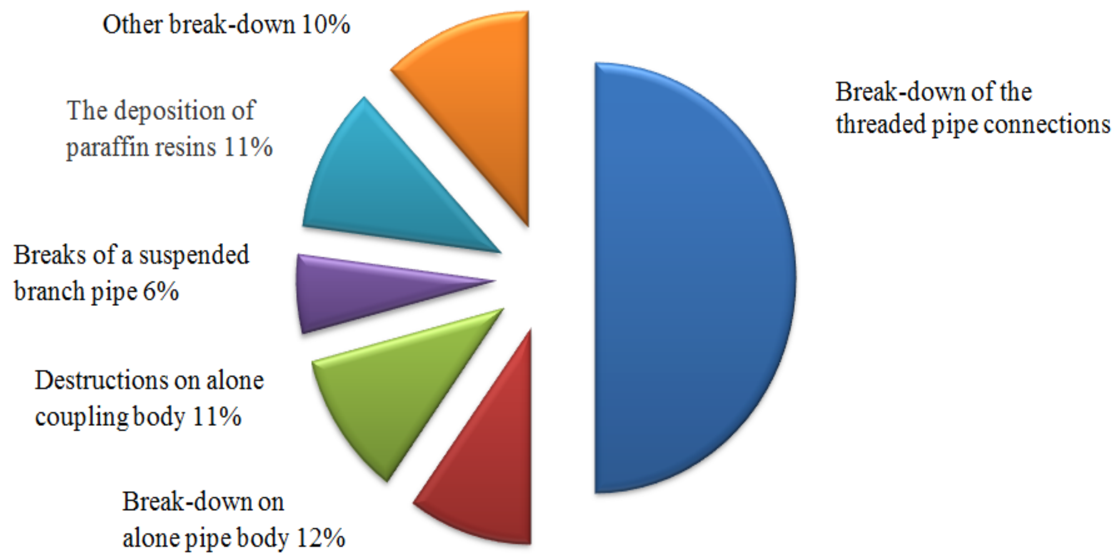

Fig.1 - The percentage of defected pipe products for various reasons

As we can see the most common defect problem of pipe products is the frequent break-down of the threaded pipe connections in oil and gas range.

In oil and gas industry there are many problems connected with the repair and transportation of equipment. Therefore I have put forward the following purposes:

- Define the most perspective threaded connection for using in the North
- Choose light alloys for working at installation «UPA 60/80» which is used in the Northern areas of Krasnoyarski Krai
- Minimize the problem of transportation and repair of equipment by choosing the nearest manufacturer of tubing

In my research, I consider some types of tubing threads according to the Russian and foreign standards manufactured by the foreign company “Boart Longyear”

The first type of tubing threads according to GOST 633-80 by «Pipe metallurgical company»:

- Socket-threaded connection of smooth tubing
- Socket connection thread tubing with external upset tubing (Fig. 2)
- Highly hermetic, threaded coupling connection tubing (Fig. 3)

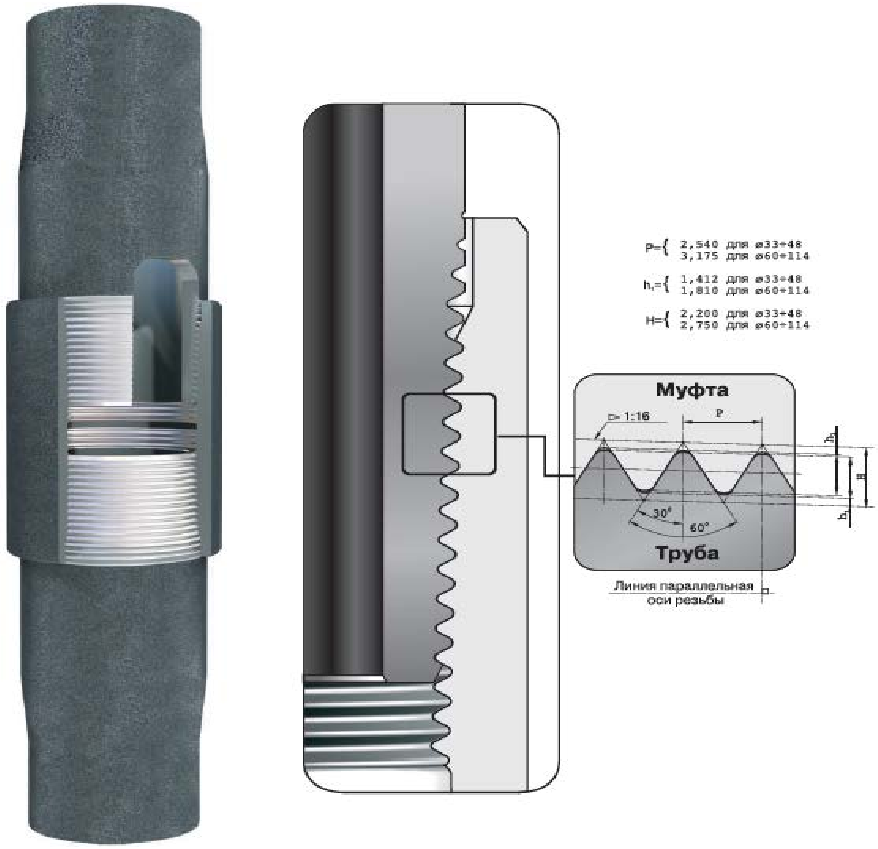

Fig.2 -The socket connection thread tubing with external upset tubing

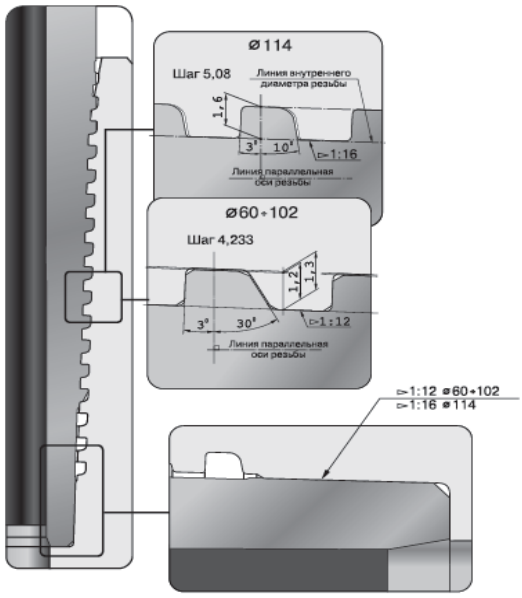

Fig.3 -The socket connection thread tubing with external upset tubing

The considered threaded connections are quick unions as they provide:

- Tightness of fastening of pipe columns and necessary firmness at any loadings
- High pass ability in strings of figurine wells, including intensive integrated curvatures
- High maintainability and resistance to wear out

The second type of tubing threads according to API. (Specification by American Petroleum Institute) by «Pipe metallurgical company». I have considered three of them:

- Socket-threaded connection of smooth tubing
- Socket connection thread tubing with external upset tubing
- TMK FMC- casing connection for vertical mounting with a high degree of integrity and directional low-intensity curving borehole (Fig. 4)

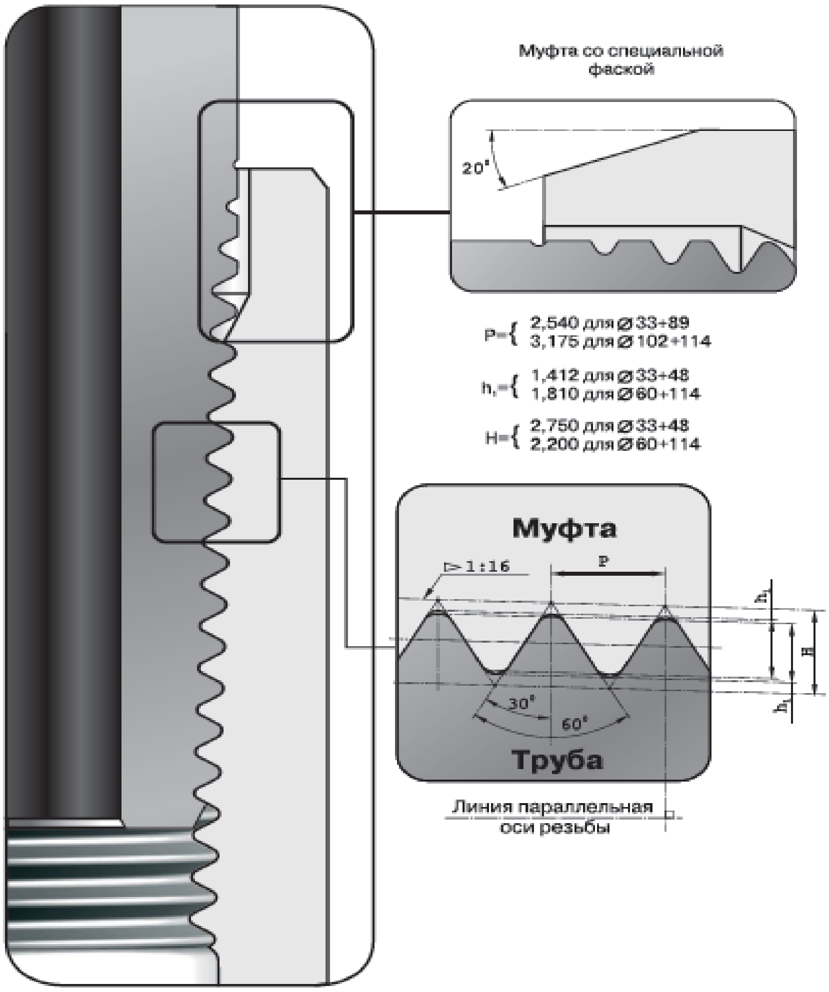

***Fig.4** - TMK FMC- casing connection for vertical mounting with a high degree of integrity and directional low-intensity curving borehole*

In practice, the Russian companies do not understand correctly the main requirements to the foreign standards.

But tubes by foreign manufacturers are becoming more popular. For example the company Boart Longyear manufactures drilling and casing pipes with threaded conical according to DCDMA standards.

All the threaded connections we have considered have the pluses and minuses. I have chosen the most appropriate threaded connection that meets to my requirements. I suggest solving these problems in the following way:

First of all if we want to minimize expenditure on transportation of tubing products in the Northern areas of Krasn. krai It's more rational to cooperate with the nearest factories such as:

• Pipe Metallurgical Company (Sinara Tube Works, TMK Steel, TMK CPW, Seversky Tube Works)

• ZAO "TD Chelyabinsk caliber «

• Center for Construction and Procurement of buildings«

• NTMK

• Chusovoy Metallurgical Works

ZAO "Severstal"

Secondly the most perspective threaded connection by «Pipe metallurgical company», which provides the highest hermetically of tubing has the thread of conical profile and coupling with special facet (Fig. 4)

However, the Boart Longyear Company makes the most hermetical threaded connection as company representatives say. This threaded connection is called RQ (Fig.5) and has trapezoid profile.

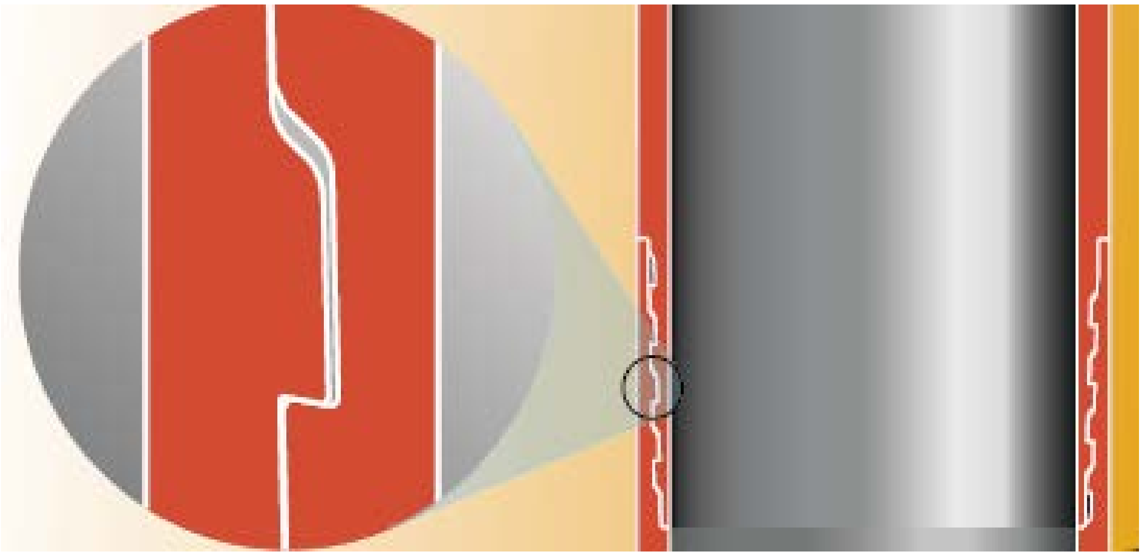

Fig.5 - RQ threaded connection by «Boart Longyear»

The last one is cold-resistant and corrosion-resistant material for Northern conditions. Among them, the lightest is the alloy D16T. That is why it is more suitable for working at installation «UPA 60/80». Nevertheless, the most common materials are steel: 20ФА, 09СФА, 14Г2САФ, 09Г2С, 09ГСФ.

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УДК 622.276.34

THE DESIGN OF FILTERS FOR THE PROTECTION OF SUBMERSIBLE PUMPS OF VANKOR FEILD.

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Well operation producing oil reservoirs sands is accompanied by a large amount of sand and other impurities. Sand is abrasive and its presence in the wellbore production leads to increased wear of downhole pumps and other equipment. Now a days there is no information on the use of filters at the Vankor field.

As a result of long-term oil without filtration begins problems such as clogging, abrasion, damage equipment. In this connection, it stops well, and are increasingly undergoing renovations, bringing the company incurs losses.

In the Vankor oil production is carried out in such a way that at first goes well in the vertical direction, but in the end comes the end of the horizontal, and the design of the well involves the installation of a filter before the pump in the vertical part.

Using the filter in the vertical portion of the wellbore, set before the pump, with proper filter design, production rate is maintained, as well as most of the grit is removed, and their concentration is reduced, allowing extended maintenance-free operation of the well, as well as lowering the cost of repair work internally.

The filter includes a housing comprising two sections which are in turn connected to coupling the upper and lower guide rails pipe picker chamber, as well as tubes that create the inside of the sections, the top is still holding the snap ring and washer. (Pic. 1)

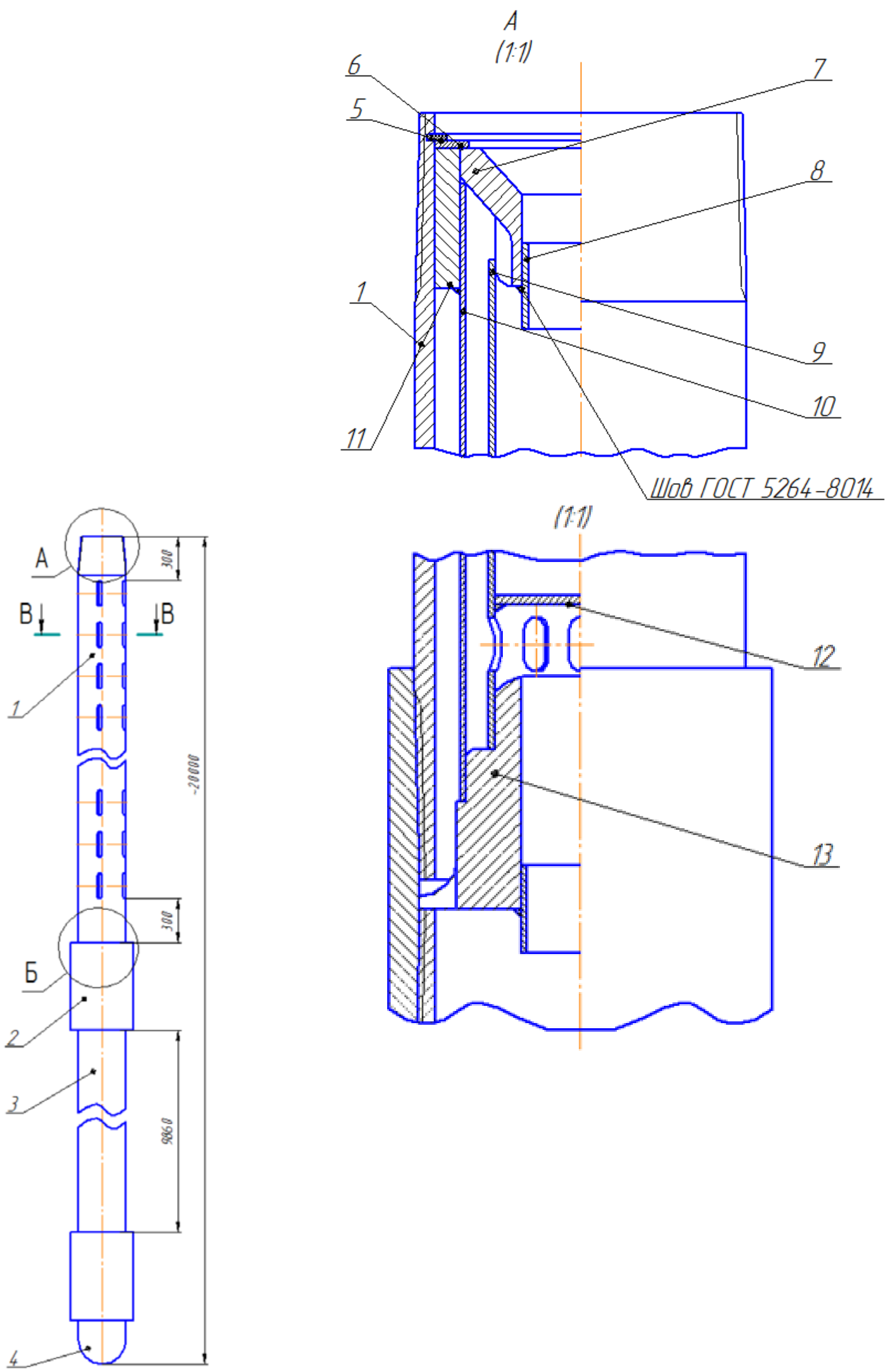
Liquid enters through the perforated top section, twisting creates a turbulent movement, further fluid enters the lower section in the through-holes in the bottom rail. Via transverse ducts liquid enters a fishing in the first chamber, and of the fact that the liquid will change to the opposite direction - through inertia sand settles in a fishing chamber. Then the liquid moves into the second chamber a fishing smaller in the same way the liquid is filtered. Then the purified liquid passes into the pump. The filter design is made in extremely easy way to use, all cameras are mounted on threaded connections, and so it can be easily disassembled and cleaned.

Benefits of the proposed well screen:

- Maximum cleaning oil from the sand;
- Possibility of producing wells for different flow rates, as well as the diameter;
- Mount the pump facilitates ongoing repairs;
- It includes the methods centrifuge and gravity.

Advantages of the filter:

- Reduction of fuel consumption, electricity, etc., resulting in increased maintenance intervals of the well;
- Production of additional oil volume;
- Simplification of labor production staff (operators of mining, etc.);
- Reduction of funds for the overhaul of wells.
- The design of the device allows you to simulate the standard series for operational pillar 127-178mm, flow rate of 200-800m^3/s and a solids content of up to 8000mg/m^3.



Pic.1 - Well filter

This work is based on a patent №2010125178 / 03. Inventor Kondrashov P.M.

УДК 622.32.002.5

VORTEX COOLING TECHNOLOGY OF WELLHEAD AREA

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The warming and destruction of the walls of wells by circulating drilling fluid with positive temperature creates serious difficulties (landslides and avalanches of loose rocks, reducing the core exit, freezing the solution, low quality grouting) and often leads to serious accidents (collapsed casing, gas breakthrough for the conductor during gas shows, the formation of griffins and the failure of the wellhead).

The main cause of these complications is a mistake of the temperature due to the use of drilled wells drilling techniques without regard to heat exchange processes between permafrost and circulating drilling fluid.

Fig.1 - Violation of the well condition

It was found that drilling conditions in permafrost respond to drilling technology using the air purge, cooling it to freezing temperatures.

Mass air flow is typically 15-25 times less than any flow of washing liquid, and its heat capacity is much smaller when the same starting temperature of air carries heat 60-100 times less than the circulating liquid. This significantly reduces the risk of complications associated with the thawing of permafrost. Air is much more effective than saline, which, although it does not freeze in the well, could easily disrupt the natural physical state of permafrost. However, the compressed air does not always eliminate the complications associated with the thawing of rocks. Regulating and normalizing the temperature in drilling wells with a purge in the permafrost is necessary to provide an effective system of forced cooling the compressed air.

Areas of permafrost are the most rational use of foam.

In recent years, oil and gas is increasingly used to produce nitrogen foams in domestic and foreign practice of drilling wells. The gas is inert, non-flammable, and its content in the atmosphere is 78% on drilling nitrogen delivered in liquefied form in special containers. With its entry into the washing liquid, foam is formed. The nitrogen content in the drilling fluids vary from 50 to 95% depending on the technological problem to be solved.

In the oil and gas industry, vortex technologies are actively used. Vortex tubes are used for gas separation, gas treatment homologues from methane, and separation of methanol from the purge gas. Vortex technology used for cooling the process gas in an industrial scale.

On the distribution station №1 Orenburg vortex tube operated reliably and consistently for three years. The results of the test tube for natural gas showed relatively high efficiencies. At the end of this period, a small corrosion of steel grade 321 (12X18H10T) was discovered.

Our research into vortex technologies have led to the conclusion of the applicability of vortex tubes to cool the process gases in the oil and gas fields. Passing the cooled gas is used in the preparation of drilling mud. There are various options for using the cooled gas. Made direct cooling of the earth's surface near the mouth of the well, pumping in additional gas-cooled technology well.

Vortex technology is based on the use of tube-Hilsch Ranke.

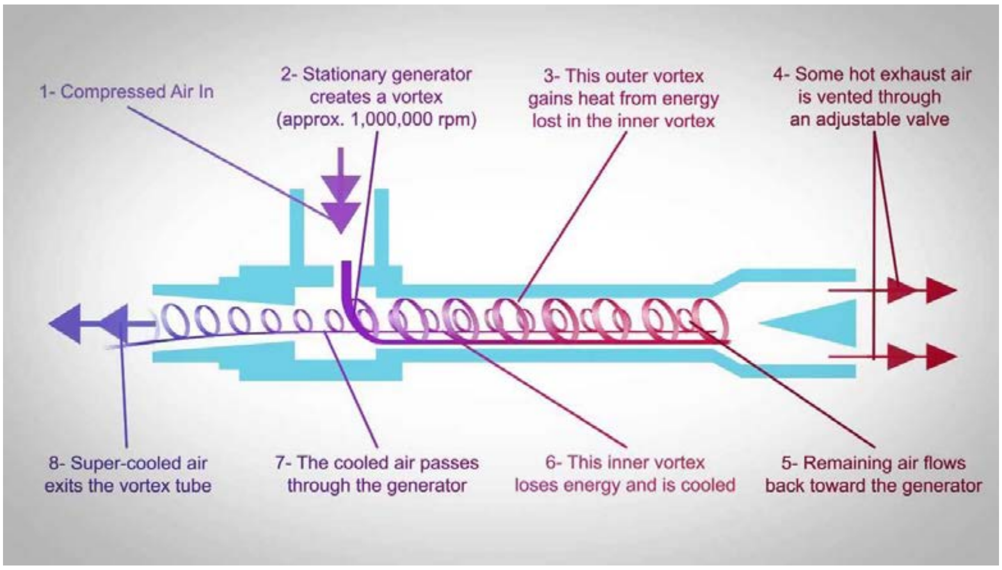

Fig.2 - The scheme of the vortex tube

We considered various parameters of the vortex tube and conducted demonstration experiments on the efficiency ratio for the manufacture of industrial designs of the vortex tube.

The vortex tube has a simple structure. It is possible to design and manufacture at the enterprises of the region. Such companies have the ability to "Nika", "RosKomSever" LLC.

Statement of the problem and a significant contribution to the realization of this work have Kondrashov PM, Pavlova PL. The authors express their deep gratitude.

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УДК [531.8+536.248.1]

THE HEAT FLOW DISTRIBUTION ALONG A PIPE USING DOWNHOLE THERMOELECTRIC DEVICES

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Construction and exploitation of oil and gas wells in frozen rock area affects natural balance due to heat impact of the extracted fluid on the surrounding rock, which results in formation of melted rock area, or talik, which, in its turn, can cause subsidence, frozen rock fall, tubing leak, crush of well head equipment. Therefore the problem of thermal interference between the system elements "well – frozen rock" and solution of this problem is becoming increasingly important [1, 2, 3, 4].

The schematic design of downhole thermoelectric devices based on thermoelectric effect Peltier is proposed in this article. This device is designed to be installed in the borehole shaft 20 metres (appr. 65 ft.) below the wellhead, as intensive processes of heat and mass transfer between frozen rock, well and surrounding environment take place there.

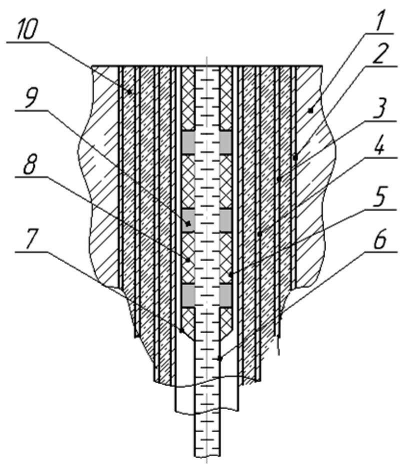
Downhole thermoelectric device shall compensate heat leakage of the fluid caused by temperature difference, which occurs at electric current flow in thermoelectric modules [5].

At the development of the mathematical model for borehole thermal protection module based on Peltier effect the following assumptions have been takes into consideration:

1. Stationary process in the "well – frozen rock" system has been analyzed.
2. Thermoelectric module has been designed as O-ring cylinder.
3. The borehole diameter is far less than borehole length.
4. Axis Oz corresponds to the borehole axis.

Figure 1 illustrates the borehole design with the downhole thermoelectric device.

Design model and the elementary volume segment with sides dz, dx and dy are dedicated to the development of the mathematical model downhole thermoelectric device (Fig. 2).



1 – frozen rock; 2 – direction; 3 – conductor; 4 – intermediate string;
5 –production string; 6 – tubing string;
7 – outer tube; 8 – heat insulator; 9 – thermoelectric device

Fig.1 - Schematic structure of a borehole with downhole thermoelectric device

The take away and delivered heat quantity through the outer edge of the elementary volume segment in the axis Oz equal to

$$-Q_z - \frac{dQ_z}{dz} = 0 \qquad (1)$$

The integrate (1)

$$\int dz = -\int \frac{dQ_z}{Q_z} \qquad (2)$$

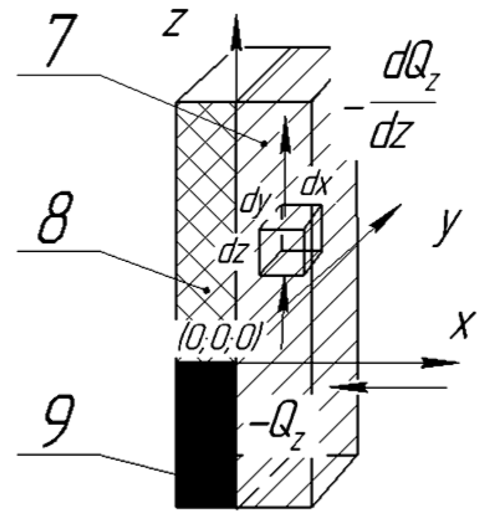


Fig.2 - Design model of borehole thermal protection module operation and elementary volume segment with sides dz , dx, dy

$$z = -\ln Q_z + C_1 \qquad (3)$$

Boundary conditions (4) allow to define C_1

$$\begin{cases} x = 0 \; at \; Q_z = -\frac{Q_P}{2} \\ x \to \infty \; at \; Q_z \to 0 \end{cases} \qquad (4)$$

The heat flow is equal to the module cooling capacity $Q_z = -\dfrac{Q_P}{2}$

Therefore

$$C_1 = \ln \frac{Q_P}{2} \qquad (5)$$

The calculate (3) and (5)

$$Q_z = \frac{Q_p}{2} \cdot e^{-z} \qquad (6)$$

Calculated to the equation (6) graphs the distribution of heat flow subject to the module cooling capacity and along the pipe shown in Fig.3

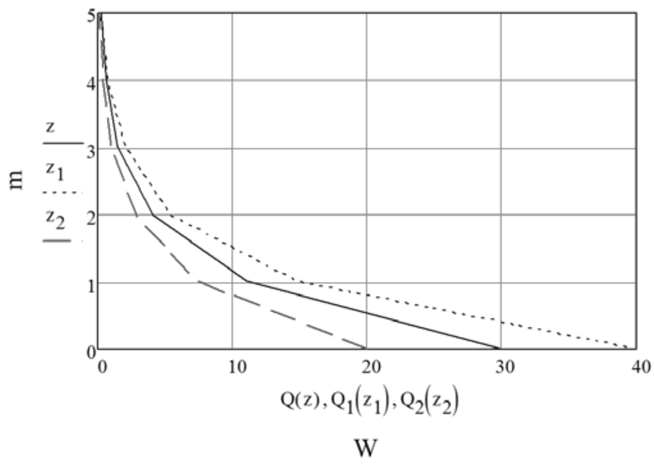


Fig.3 - Graphs the distribution of heat flow subject to the module cooling capacity and along the pipe

According to the equation (6) we can calculate distribution of heat flow from downhole thermoelectric device along the pipe in ideal case.

Conclusion

Present situation in the global petroleum industry demands improvement of equipment for maintaining sub-zero temperatures in frozen rock at construction and exploitation of oil and gas wells, which is becoming a burning issue now.

This article presents a mathematical model for heat flow distribution from downhole thermoelectric device along the pipe in ideal case.

However, this topic needs further experimental research for defining optimal operation parameters and assessment of thermoelectric module application efficiency.

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DEVELOPMENT OF ROBOTIC FIREFIGHTING SYSTEM FOR OIL AND GAS FACILITIES

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In the sector of oil and gas production, storage and transportation potential fire can spread with high speed and cause serious damage in a short period of time. Therefore, a rapid response to the occurrence of a fire outbreak can greatly reduce the possibility of damage from fire and to prevent the risk to human life and health. The goal of the project is to create the fire extinguishing equipment intended for fire extinguishing at oil and gas facilities at the beginning of fire origin. A fixed master stream nozzle with a stable rigid structure was chosen as the prototype of developed unit. An example of this device is shown in Fig. 1.

Fig.1 – A fixed master stream nozzle

Fire extinguishing system should be located in close proximity to a possible fire outbreak in order to have the capacity to start the liquidation of fire at the time of its origin. In this case, the system must have the following properties:

- remote or robotic control, because a person involved in the process of putting out a fire is subject to instant danger to life;
- powerful and compact drive for precision-guided fluid flow to the place of fire;
- control units of equipment should be protected from the effects of aggressive environmental conditions in order to continue the process of fire extinguishing as long as possible.

The latter requirement plays the key role in this fire extinguishing system, because the equipment with the unprotected controls will be exposed to thermal and mechanical deformation of the main units and quickly fail. The reason of this situation is the high temperature in the source of fire, as well as the possibility of detonation. Therefore, the main objective of the project is the development of control system of fire extinguishing equipment, which will be protected from external aggressive working environment factors.

When a fire occurs, the developed system should work in the following order:

1. The infrared radiation detection system reacts to the fire source;
2. The control unit with the help of communication system receives information about the coordinate of fire source;
3. The control unit sends information a command to the drive for aiming the master stream nozzle;
4. The master stream nozzle is directed to the fire source, according to the established coordinate.

The system of early fire detection using the heat flow sensors, distributed over the area of the protected object is supposed to apply as the fire detection system (Fig. 2). The use of these sensors can solve the problem of fire detection at an early stage of its spreading. Information received from the sensors allows to determine the coordinates of fire with given accuracy, spending minimal time to detect a fire and to transmit digital information to the control modules.

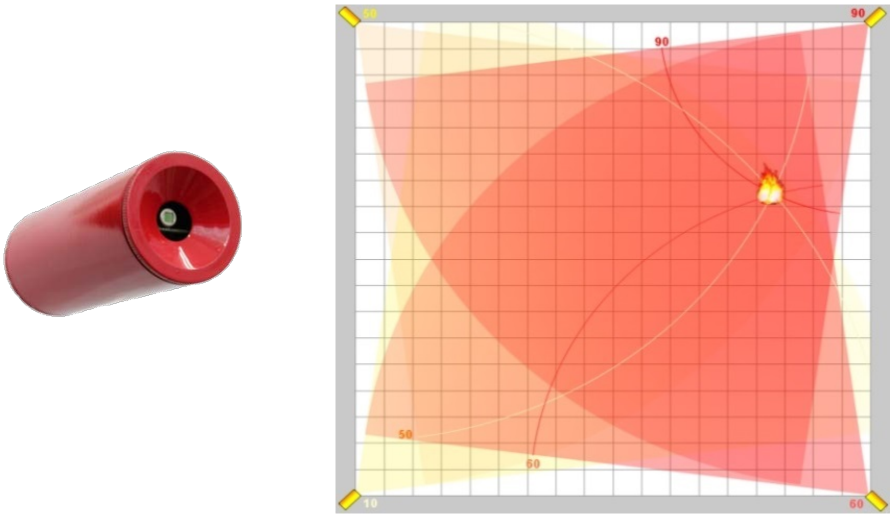

Fig.2 – The heat flow sensor

The structure shown in Fig. 3 has been developed in the process of modelling of robotized firefighting fixed master stream nozzle. It consists of a fixed master stream nozzle being able to change the direction of fluid flow by means of drives and control system located in a metal casing, highlighted in red. The drive consists of an electric motor which drives the eccentric two-stage gearbox, specially developed for this structure. Protection from high temperatures is provided by the fact that the vulnerable controls are located inside the metal shell and are cooled by water, which goes to a fixed master stream nozzle during firefighting. Due to compact drive, not having external vulnerable parts ensures continued operation of the plant, even after a small explosion in the fire source.

Thus, the following results were achieved during the fire-fighting system design:

1. The optimal solution to the problem of timely response to fire;
2. A maximum compact design of construction;
3. The optimum drive;
4. Reliable protection of vulnerable parts of control system.

Fig.3 – Proposed fire-extinguishing system design

The next stage of the project is the selection and optimization of the robotic fire-fighting system.

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PETROLEUM INDUSTRY: WELL CONTROL AND SAFETY

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Petroleum is the Source of life on Earth. Today, man is both master and slave of petroleum, which formed under the surface of the earth millions years ago. Man has long been aware of the existence of oil and he has fully realized its value and usefulness. No doubt the world's economy is based not on gold or political philosophies, but rather on the price of a barrel of crude oil. Today we depend on petroleum products not only for transportation, heating, and to generate electricity, but also for fertilizers and fabrics, plastics, medicines, paints and pesticides, and thousands of other items we take for granted every day. The search for petroleum has been conducted in practically every corner of the world, and oil and gas have been discovered in almost every country. In 2009, the Russia was the world leader in oil production. However very few people knows that an oil recovery not only profitable business but also very dangerous. Drilling process is accompanied by many dangers among which most serious complication is oil, gas and water show. Probably the most important concern during drilling is that the pressure which exists in any formation penetrated by the bit must be controlled at all times. Detailed well planning is the first step in preventing trouble while drilling. After drilling begins, constantly monitoring drilling variables, using appropriate equipment, and employing well-trained drilling crews can drastically reduce the chance of losing control of the well. A kick is an unscheduled entry of formation fluids in the wellbore, of sufficient quantity to require shutting in the well. A blowout is the uncontrolled release of formation fluid from a well, typically for petroleum production, after pressure control systems have failed. A blowout is a loss of control of kick. Blowouts can be surface blowouts, or underground blowouts. A surface blowout is an uncontrolled flow of formation fluids to the surface, while an underground blowout is an uncontrolled flow of formation fluids from one formation (the kicking formation) to another. If a kick is not recognized and brought under control quickly and properly, a blowout is a definite possibility. Loss of control of a kick, blowout, can be brought about for two reasons – equipment failure or human error. Almost all blowouts can be attributed to an error or series of errors on someone’s part. Even if our well control equipment fails, it is likely that we trace the cause of the malfunction to improper use, maintenance, testing, installation, or manufacture of the equipment – all errors committed by some person or persons. If a kick is not controlled, a blowout may occur so it is necessary to notice the signs of a kick. They are:

1. Drilling break
2. Mud pit gain
3. Flowing well
4. Show of gas, oil, or salt water
5. Decrease in circulating pressure (flow rate increase)
6. Pump stoke increase
7. Improper hole fill-up
8. String weight change (buoyancy effect decreases, and string becomes heavier)

A drilling break usually indicates entry into a higher formation pressure. When higher formation pressure is hit, the mud weight becomes underbalanced and the drilling rate increases, sometime dramatically, sometimes slightly. The mud logger will be calculating the rate of penetration and should notice the difference and report it.

Always keep the mud loggers and the drilling shack rigged up with an intercom to report any changes in the rate of penetration (ROP). Quick response with everyone notified can give more time to check for a kick. Normally, you will notice a showing of the ROP while you are drilling on the top of high pressure, which in some areas is called the cap rock. After you drill thought the cap rock, a faster ROP will be noticed, because the mud becomes underbalanced due to the higher formation pressure, allowing gas or oil to enter the wellbore.

An each type of preventer is a separate component of a BOP stack. Onshore, the BOP stack sits under the rig floor, bolted to the top of the surface casing. Offshore, the BOP stack is either at the bottom of the ocean at the mud line or above the water on the drilling rig platform. If the drilling rig is a floater, there are disconnecting devices at the seafloor that close off the hole when the riser between the drillship and the BOP stack is disconnected and the rig is shifted off location, as when a violent storm is forecasted.

Blowout is caused when a combination of well control systems fail – primarily drilling mud hydrostatics and blow-out preventers (BOPs) – and formation pore pressure is greater than the wellbore pressure at depth.

When such an incident occurs, formation fluids begin to flow into the wellbore and up the annulus and/or inside the drill pipe, and is commonly called a kick. If the well is not shut in, a kick can quickly escalate into a blowout when the formation fluids reach the surface, especially when the fluid is a gas which rapidly expands as it flows up the wellbore and accelerates to near the speed of sound. Blowouts can cause significant damage to drilling rigs, injuries or fatalities to rig personnel, and significant damage to the environment if hydrocarbons are spilled.

When all the controls described above fail, a blowout occurs. Blowouts are dangerous since they can eject the drill string out of the well, and the force of the escaping fluid can be strong enough to damage the drilling rig. Blowouts often ignite due to the presence of an ignition source, from sparks from rocks being ejected along with flammable fluids, or simply from heat generated by friction. (Rarely the flowing gas will contain poisonous hydrogen sulfide and the oil operator might decide to ignite the stream to convert this to less hazardous substances.) A well control company will then need to extinguish the well fire and/or cap the well, and replace the casing head and hangars.

Sometimes, blowouts can be so forceful that they cannot be directly brought under control from the surface, particularly if there is so much energy in the flowing zone that it does not deplete significantly over the course of a blowout. In such cases, other wells (called relief wells) may be drilled to intersect the well or pocket, in order to allow kill-weight fluids to be introduced at depth. (Contrary to what might be inferred from the term, such wells generally are not used to help relieve pressure using multiple outlets from the blowout zone.)

Failure to control well pressures can result at the very least in problems that impede drilling progress. At its most serious, failure to control formation pressures while drilling can cause loss of lie, destruction of equipment, and abandonment of the well. A well blowout can also damage the surrounding environment.

All of these consequences have caused great emphasis to be placed on the design and use of blowout control equipment, personnel training in well control, and regulations aimed at minimizing the chance of well blowouts. Because offshore blowouts are especially troublesome and a few incidents have been particularly dramatic, they have had considerable influence on industry and government efforts to prevent both offshore and onshore blowouts.

Making mistakes in a well control situation can be dangerous and can result in significant cost additions to any well project. Should things go terribly wrong, an uncontrolled blowout situation may be the consequence.

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FILLING STATION

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A filling station, gas station, fueling station, service station, petrol station, garage, gasbar, petrol pump or petrol bunk (India) is a facility which sells fuel and lubricants for motor vehicles. The most common fuels sold are petrol (gasoline in Canada and U.S.) or diesel fuel.

Fuel dispensers are used to pump petrol (gasoline in Canada and U.S.), diesel, CNG, CGH2, HCNG, LPG, LH2, ethanol fuel, biofuels like biodiesel, kerosene, or other types of fuel into vehicles. Fuel dispensers are also known as bowsers (in Australia), petrol pumps (in Commonwealth countries), or gas pumps (in North America).

In recent times, filling stations have also begun to sell butane and have added shops to their primary business; convenience stores are now a familiar sight alongside pumps. With the advent of electric vehicles and rechargeable battery operated cars, "gas stations" or "filling stations" will soon offer charging docks for these cars. In fact, certain stations in the United States and other countries already offer these services. The term "gas station" is mostly used in the Canada and United States, where the fuel is known as "gasoline" or "gas". In some regions of Canada, the term "gas bar" is also frequently used. Elsewhere in the English-speaking world, where the fuel is known as petroleum, the form "petrol station" or "petrol pump" is used. In the United Kingdom and South Africa the single noun garage is still commonly used, even though the petrol station may have no service/maintenance facilities which would justify this description. Similarly, in Australia, the term service station ("servo") describes any petrol station. In Japanese English, it is called a "gasoline stand". In Indian English, it's called a petrol pump or a petrol bunk. In some regions of America and Australia, filling stations often have a mechanic on duty, but this is uncommon in other parts of the world. Number of petrol stations worldwide As of 2007, there were 9,271 petrol stations in the U.K, down from about 18,000 in 1992. The USA had 121,446 filling stations (gas stations) in 2002 according to the Census. In Canada, the number is on the decline to about 14,000. In China, the number is on the decline to about 30,000. In following countries number of stations is rising. Turkey - 12,139 petrol stations (2008) Mexico - 8,200 PS (2008)

Nigeria has perhaps 4,700 PS (2007) South Africa - around 6,500 PS Kenya perhaps has 1,300 PS Tanzania - 1,000 Malawi – 500 China – 30000

History of filling stations: the first places that sold gasoline/petrol were pharmacies, as a side business. In fact, the first gas/petrol station was the city pharmacy in Wiesloch/Germany, where Bertha Benz refilled the tank of the first automobile on its maiden voyage from Mannheim to Pforzheim and back in 1888. Since 2008 a Bertha Benz Memorial Route commemorates this event.

The increase in automobile ownership after Henry Ford started to sell automobiles that the middle class could afford resulted in a greater demand for filling stations. The world's first purpose built gas station was constructed in St. Louis, Missouri in 1905 at 412 S. Theresa Avenue. The second gas station was constructed in 1907 by Standard Oil of California (now Chevron) in Seattle, Washington. Reighard's gas station in Altoona, Pennsylvania claims that it dates from 1909 and is the oldest existing gas station in the United States. Early on, they were known to motorists as "filling stations". Standard Oil began erecting roadside signs of their logo to advertise their filling stations.

A typical filling station: most filling stations are built in a similar manner, with most of the fueling installation underground, pump machines in the forecourt and a point of service inside a building. Single or multiple fuel tanks of varying sizes, dependent on the needs of the local market, are usually deployed underground. Local regulations and environmental concerns may require a different method, with some stations storing their fuel in container tanks, entrenched surface tanks or unprotected fuel tanks deployed on the surface. Fuel is usually offloaded direct from a tanker truck into the tanks through a separate valve, located on the filling station's perimeter. Fuel from the tanks travels to the dispenser pumps through a system of underground pipes. For every fuel tank, direct access has to be granted at all times. Most tanks can be accessed through a service canal directly from the forecourt.

Older stations tend to use a separate pipe for every kind of available fuel and for every dispenser. Newer stations may employ a single pipe for every dispenser. This pipe houses a number of smaller pipes for the individual fuel types. Fuel tanks, dispenser and nozzles used to fill individual car tanks employ vapor recovery systems, which releases the vapors into the atmosphere through a separate system of pipes. The exhausts are placed as high as possible. A vapor recovery system may be employed at the exhaust pipe. This system collects all the vapors, liquefies them and releases them back into the lowest grade fuel tank available.

The forecourt is the part of a filling station where the fueling operations are commenced. Fuel dispensers are placed on concrete embankments, as a precautionary measure. Additional elements may be employed, including metal barriers. The area around the fuel dispensers has to have a working and efficient drainage system. As fuel is regularly spilled on the ground, as little of it as possible should penetrate into the soil. Drainage canals in the direct vicinity of the fuel pumps drain all fluids into a waste container.

If a filling station allows customers to pay at the register, the data from the dispensers is transmitted wirelessly to the point of sale, usually inside the filling station's building, and fed directly into the station's cash register operating system. The cash register system gives a limited control over the fuel dispenser, and is usually limited to allowing the clerks to turn the pumps on and off, though the process is usually automatic. A separate system is used to monitor the fuel tank's status and quantities of fuel. With sensors directly in the fuel tank, the data is fed to a terminal in the back room, where it can be downloaded or printed out - a standard and regular procedure for larger chains, as this method has proven to be the most reliable and fail-safe. Sometimes this method is bypassed, with the fuel tank data transmitted directly into an external database. Some filling stations also include tire air pump and car wash zones with vacuum cleaners.

Types of filling stations: there are generally two types of filling stations in the US and Canada: premium and discount brands. Filling stations with premium brands sell well-recognized and often international brands of gasoline, including Exxon and its Esso brand, Citgo, Hess, Chevron, Mobil, Shell, Sinclair, BP and Texaco. Non-international premium brands include Petrobras, Petro-Canada, and Pemex. Premium brand stations accept credit cards, often issue their own company cards (a.k.a. fuel cards) and may charge higher prices. Many of them have fully automated pay-at-the-pump facilities. Premium gas stations tend to be highly visible from highway and freeway exits, utilizing tall signs to display their brand logos. Discount brands are often smaller, regional chains or independent stations, offering lower prices on gasoline. Most purchase wholesale gasoline from independent suppliers or from the major petroleum companies.

Modern gas stations have pay-at-the-pump capabilities — in most cases credit, debit, ATM cards, fuel cards and fleet cards are accepted. Occasionally a station will have a pay-at-the-pump-only period per day, when attendants are not present, often at night, and some stations are pay-at-the-pump-only 24 hours a day.

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УДК66.067.8

DEVICE FOR MAGNETIC FLUID TREATMENT

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This article describes the mechanism of the magnetic fluid treatment device, and a construction is given for the magnetic treatment of fluids which provides fluid handling efficiency in the magnetic field by increasing exposure time of the pulse of alternating magnetic field, the path length and residence time of the liquid in a magnetic field.

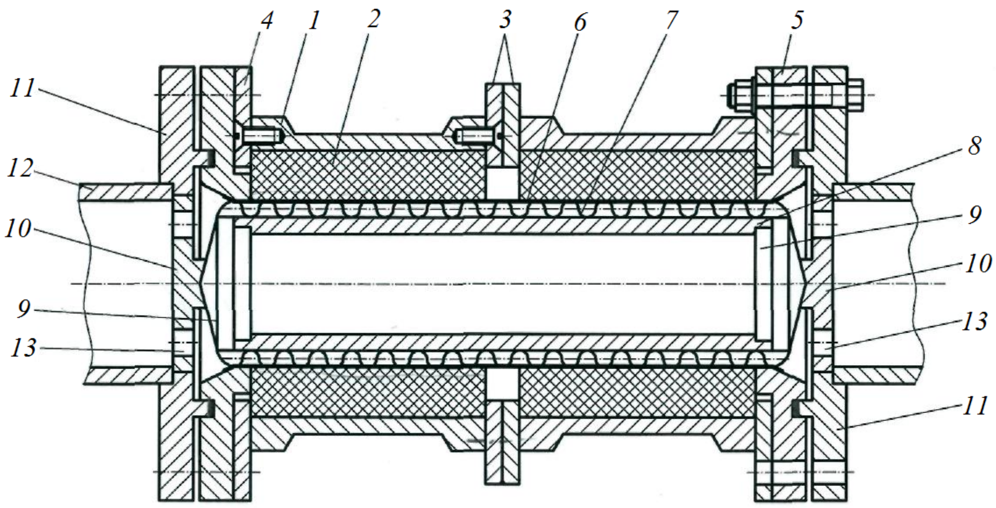
The impact of magnetic fields on water influences the behavior of mixtures, although the essence of these phenomena is not precisely identified. V. I. Klassen, famous scientist in the field of magnetic treatment of water, subdivides the available hypotheses into three main groups: colloidal, ionic and aquatic. It is assumed that the effect of magnetic field on water can destroy the contained colloidal particles, which are forming the centers of crystallization of impurities and accelerates their removal. For example, the presence of iron ions intensifies the emergence of crystallization centers and as a result – in formation of unstable sediment, which falls in the form of sludge.

Magnetic water treatment has been very effective in the fight against scum. Acceleration of mineral mixtures crystallization in the water under such processing leads to a significant reduction in the size of the scale-forming salts particles. As a result the process of crystallization practically stops and there are no particles on the walls of the apparatus and pipes.

The magnetic treatment has a positive impact on protection of water bodies from contamination in oil and gas industry. Thus, deposit water has no longer been dumped in rivers, and intermittent contact of these waters with the magnetic field eliminates the risk of pipelines clogging with salt deposits and allows them to be used in closed technological cycle.

In oil and gas industry the application of magnetic treatment are possible in several ways: suppression of asphalt-resinous and paraffin deposits (ARPD), scaling, preventing the formation of persistent emulsions and reducing corrosiveness of the pumping liquids.

Design of a new installation for magnetic liquid treatment is shown in Pic. 1 and can be used for magnetic processing of water and oil.



Pic.1 – Device for the treatment of magnetic fluid

Device for magnetic treatment of liquids operates in following way. The device is connected to a pipeline through which is transported a fluid subject to magnetic treatment. After mounting the devices to the windings of stators, it is supplied with alternating voltage, which generates in the stator core 2 rotating magnetic field whose direction can be changed by changing the phase of the voltage. Fluid is fed through the holes 13 of the stop 10 and flows through the spiral troughs of a corrugated cylinder 7, acquiring rotational movement. The rotational motion of the fluid may correspond with the direction of the magnetic field or counter it. The fluid flowing through the corrugated cylinder 7, exposed to repeated influence of the pulse of alternating magnetic field and long-lasting effects due to rotation and increasing the range of movement as goes into the main line through the holes 13 of the stop 10 that is installed in the flange 11. Selection of the operation modes of the device can be done by adjusting the flow of fluid, and changing the direction of rotation of the magnetic field.

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УДК [624. 584. 1]

FEATURES OF LEVITATION MELTING OF ALUMINIUM.

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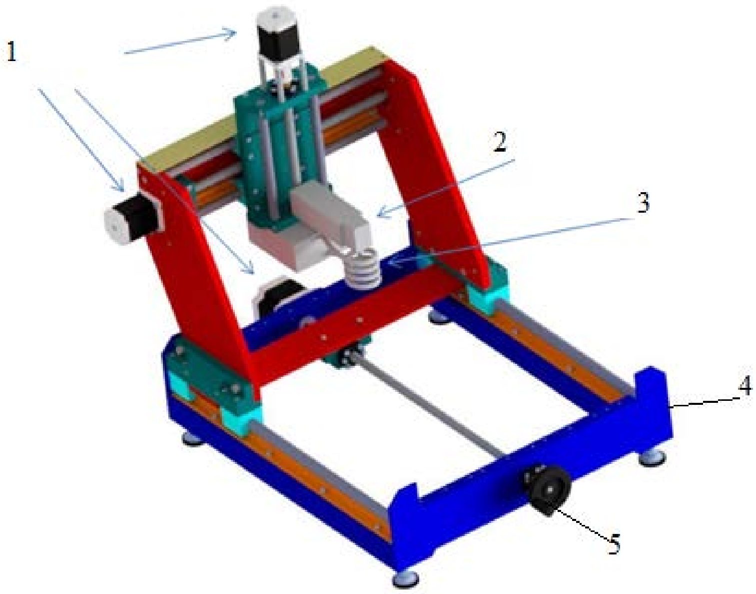
Levitation melting is applied for melting of metals in suspension with the help of magnetic field. The main physical principles in the explanation of this device are «electromagnet», «electromagnetic field», «induction currents».

In the figure 1 there is a scheme of the device for levitation melting of metals.



1 – stepper motor; 2 – batcher; 3 - levitation heater;
4 – frame; 5 – screw gear
Fig.1 – Scheme of the device for levitation melting of metals

Inductor in the form of copper tube (figure 2) specifies direction for induction current in levitation heater. Melting metal can't penetrate through working area of the device because a shape represents the coils that become smaller in diameter to the bottom of the inductor.

A copper tube of the inductor is not a heating element, it directs induction currents. Induction currents passing through the piece of metal not only hold it in a hover, but also heat it to the temperature 1400 ºC. Such temperature is enough to melt a metal.

The following problem:

In a process of aluminium melting, there will be formed an oxide layer and a slag on the surface. An amount of slag depends on the quality of aluminium.

It happens the increased oxidation of metal while aluminium remelting. There is a rule in aluminium industry: every one percent of contamination gives one percent of loss of metal at the exit from the furnace.

1 - copper tube; 2 - core
Fig.2 – Inductor

The temperature of metal is one of the most controlled factors for determination of level of slag. If the temperature of metal is more than 780 ºС, the speed of slag formation increases sharply, as in the figure 3.

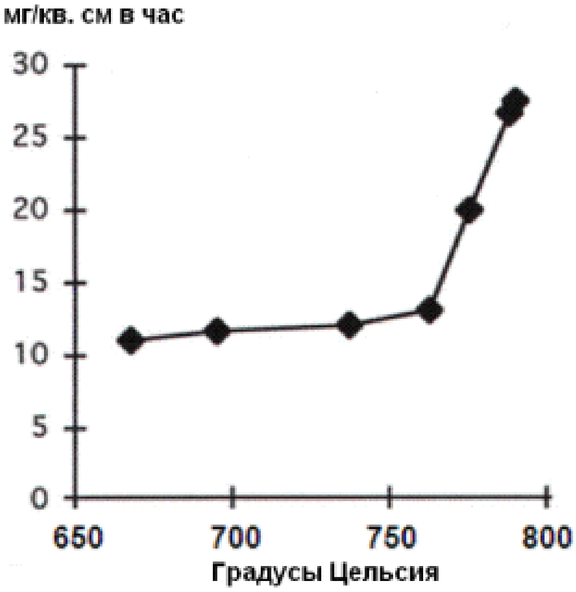


Fig.3 – Speed of slag formation

Cold water is the most widespread and having a cooling ability thing for aluminium alloys.

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УДК 735.29

CALCULATION OF THE POSSIBILITY OF A GASCAP USAGE AS A NON-COMPRESSOR GASLIFT SOURCE

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In this paper, the possibility of the new technology usage is calculated and the brief resume is given. In particular, it is a new way of non-compressor gaslift usage. The lack of mechanical parts means that there is no need for any maintenance throughout the complete life period of the field development. The innovation here is this connection of both gas lift and gas cap drive energy sources simultaneously.

The rough geological model has been developed, as presented in the figure 1.1.

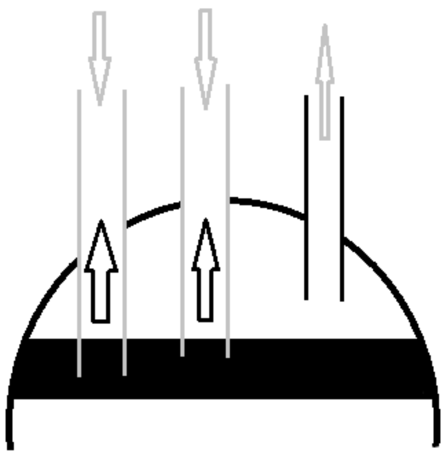

Fig.1.1

As the Fig. 1.1 shows, we make an additional gas well to take the free gas out and to put it through the annular between tubing and casing strings to create the gas lift in the oil wells. This can be possible with the right consideration of the depth of both gas lift valves and the TVD of the gas well.

The sources of fluid data could be tuned to match particular reservoir, but in this paper, typical values were chosen. These values were used later to create a model and a phase diagram of the black oil for oil and component model for gas, respectively.

Recently many pressure drop prediction methods have been developed [2].

According to the study of accuracy of pressure loss prediction methods, which is made by Lawson and Brill, the best correlations are those of Hagedorn & Brown and Beggs & Brill, but flow variables have a major effect. Another point is that B&G correlation was originally developed from the study of horizontal angle dependence. That is why Beggs & Brill correlation is chosen in my work [1].

Hydrodynamic model of the field is developed in regards to this data, using Schlumberger PipeSim.

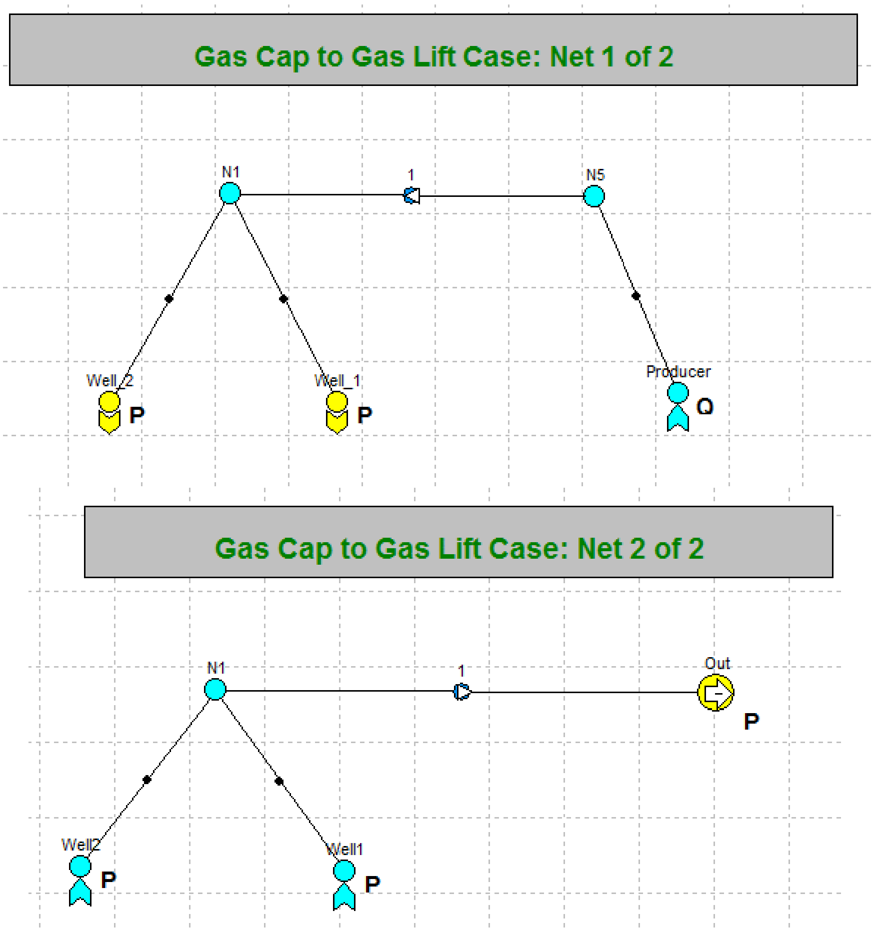

Fig. 1.2

The data of gas well – Pressure is equal to 68 bara, temperature is 75^{o}F, 1400 meters of TVD. Productivity Index is set to be 1.2*10^{-5} m3/day/atm.

Oil wells are equal in respect to parameters. PI is around 23 m^{3}/day/atm. The pressure is of 82 atma, 1500 TVD. 88^{o}C. Tubing inner diameter 89mm / casing 178 mm.

Therefore, since the parameters are of the same magnitude, the gas rate in gas lift valves are the same, accordingly, and equal to 0.44 mmscf/d.

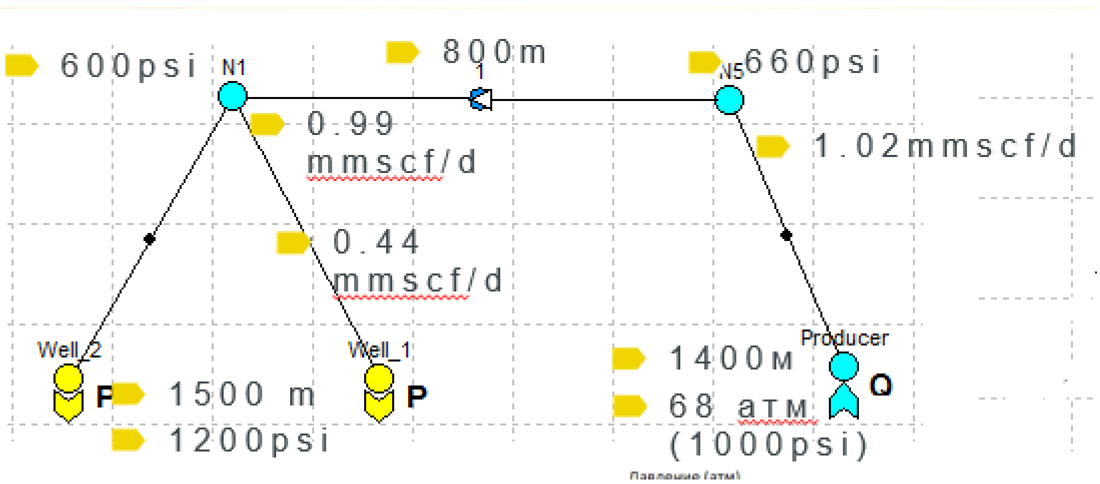

Fig. 1.3

The position of the gas lift valve is based on the pressure drop versus length of the pipeline dependence, as well as the diameter of this pipeline relation. Averagely, 2 atma of pressure drop per 1 km of pipeline happens.

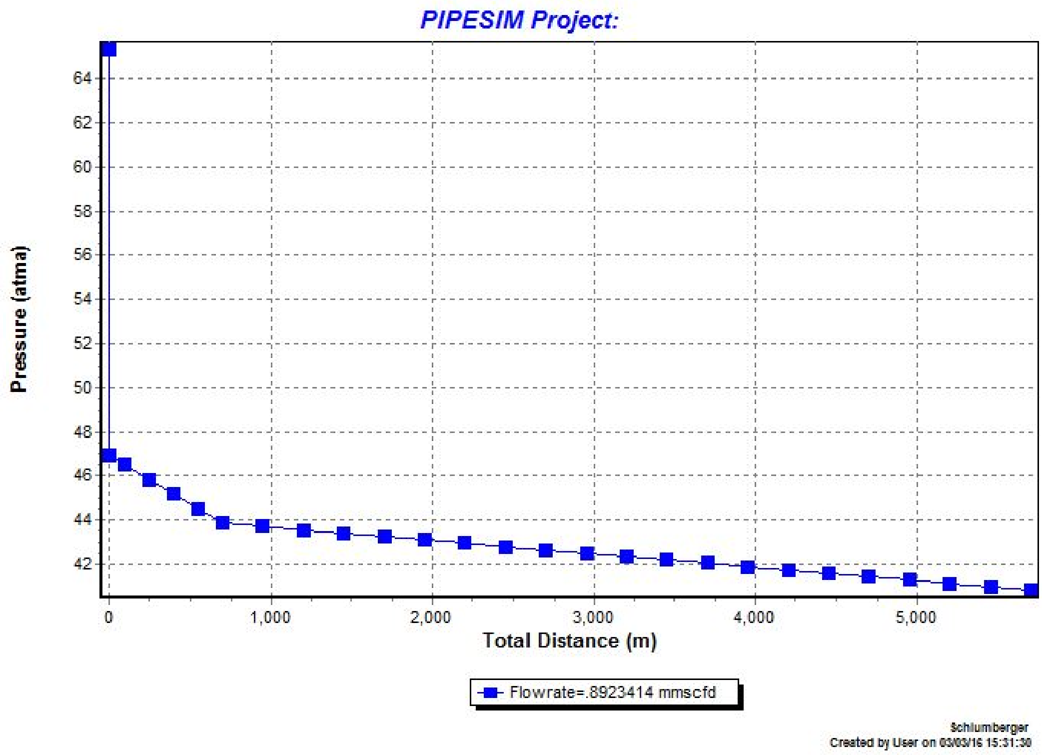

Fig.1.4

The solution to this hydraulic model is presented in Fig 1.5.

```
VertWell-Tubing
---- OUTPUT ----
Mass R = 5.940 kg/s
Liq R  = 558.650 sm3/d
Gas R  = 0.030 mmsm3/d
GLR    = 53.43 sm3/sm3
WCut   = 0 %
---- INPUT ----
Rate   = unset
FLUID = DEFAULT [Oil]
```

Fig.1.5

According to Bloomberg and NASDAQ, current exchange rate within the barrel of crude oil and the us dollar is equal to approximately 36 $/bbl. 30 API = 824 kg/m^3. Therefore, converting to tons, 558.65 tons/day per each well.

For the basis of economical calculation, the construction of a real oil well statistics with the depth of 3000-4000 meters were taken. The cost of price is dependent on TVD. The conversion coefficient into timing equivalent is set to be equal to 0.0133. For the drilling operations for 3000 meters depth well, since that, 40 days are expected. This amount of days is strongly connected to the salary of the vendors stuff. The coefficient here is equal to 1000000, i.e. one million of rubles per day. 40 days - 40000000 rubles. Additional expenses on cement slurry is fixed at 6000000 rubles, and for work of geophysicist – 5000000 rubles. Putting in place the random coefficient for various needs at around 15%, and value-added tax of 18% we will get around 80 millions of rubles. Since that, for the well of 1200 meters we would get 30851000 rubles or, approximately, 400000 US dollars (should be reconsidered due to ruble volatility)

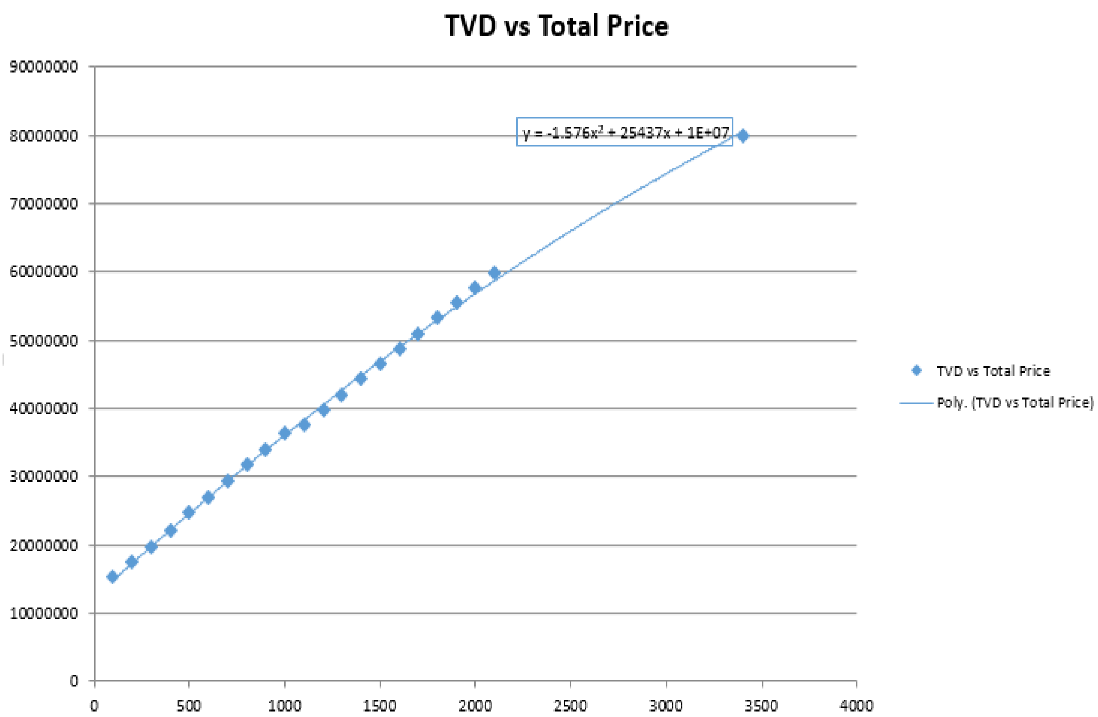

Fig.1.6

According to the calculations, the project will cover outlay within a week, including taxes.

Additionally it should be mentioned that changing the parameters of gas rate, gas well PI and static pressure could have a significant effect on total result. The technique for calculation them is found within this project, but no implicit mathematic relationships has been found yet.

In conclusion, in the research work, the new method of extracting oil is described, in particular, simultaneous use of both gaslift and gas cap drive. The economical foundation was provided, as well as the technique in which the calculation can be done for any type of reservoir matching this geology.

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