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Research Article

Development of a Technology for Creating a Water Shutoff Screen in an Oil-producing well

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ABSTRACT.

The technology includes shutting off a well, the oil-water level in which has blocked the lower holes of the perforation interval, removing the downhole equipment from the motherbore production string, installing a packer plug 1 m below the oil-water contact, injecting a grouting composition (for example, based on oil-well Portland cement PTsT-100) into the bottom interval of perforations with the subsequent creation of a water shutoff screen, feeding the assembly with cutter into the well, drilling the packer plug, pulling out the assembly with cutter from the well, and feeding the guide assembly with a through canal and an outlet hole complete with an anchor-packer device into the well using the drill string, pulling out the drill string leaving the guide assembly in the production string, and feeding a jet nozzle into the guide assembly using coiled tubing (CT) down to the outlet of the through hole of the guide assembly, cutting a hole in the production string wall by jets of sand-liquid slurry (SLS), then replacing SLS with OBM (oil-base mud), breaking the cement stone behind the production string by high-pressure OBM jets, and then breaking the water shutoff screen and the productive formation rock by displacing the jet nozzle in the radial direction to form an elongated radial branch. After forming the first radial branch, CT is removed from the well with a high-pressure hose and a jet nozzle, the guide assembly is rotated for 45 degrees in the same plane, and the same actions are performed in regards to the next radial branch, then subsequent radial branches are routed after turning the guide assembly for the next 45 degrees. After drilling radial canals in one plane of the formation, radial canals are drilled below this plane, but in the thickness of the existing water shutoff screen. After routing all planned radial branches, they are used to inject the water shutoff composition (WSC) to create a water shutoff screen along the radius, providing a spatial and long-term barrier to the OWC movement path, and the cement sleeve is left in the borehole cavity not higher than the water shutoff screen.

Keywords: Water cut, Bottom waters, Radial canal, Water shutoff screen.

INTRODUCTION

Increasing the efficiency of producing oil wells and recovering anhydrous industrial inflows are pressing issues. In order to eliminate the inflow of bottom water, especially during the operation of homogeneous reservoir units, water-proof screens are installed between oil-saturated and water-saturated parts of the formation. As a rule, the installation of such screens does not always have a significant effect due to the fact that the barrier reliability and length along the radius from the well axis are insufficient.Currently, there are many methods to conduct water shutoff works that have certain advantages and disadvantages [1-4].

METHODS AND RESULTS

The authors of the article propose a developed effective technological solution for creating a water shutoff screen in an oil-producing well by drilling radial canals in the formation plane and injecting a water shutoff composition [5-8].

The technology is implemented as follows (Figs. 1-8).

The well 1, which recovers oil from the productive formation 2 of the oil reservoir with bottom bedding of formation water 3, the oil-water level 4 in which has blocked the lower holes of the perforation interval 5, is shut down. Shut-down of oil production from the well stabilizes the inflow of formation water to the well 1 bottomhole and even reduces the level of fluid in the motherbore production string of the well 1 due to the return of a part of formation water through the perforations of the perforation interval 5 to the non-watered out part of the formation 2 outside the well. When the level of fluid in the well 1 stabilizes, the downhole equipment 6 is removed from the motherbore production string (Fig. 1).

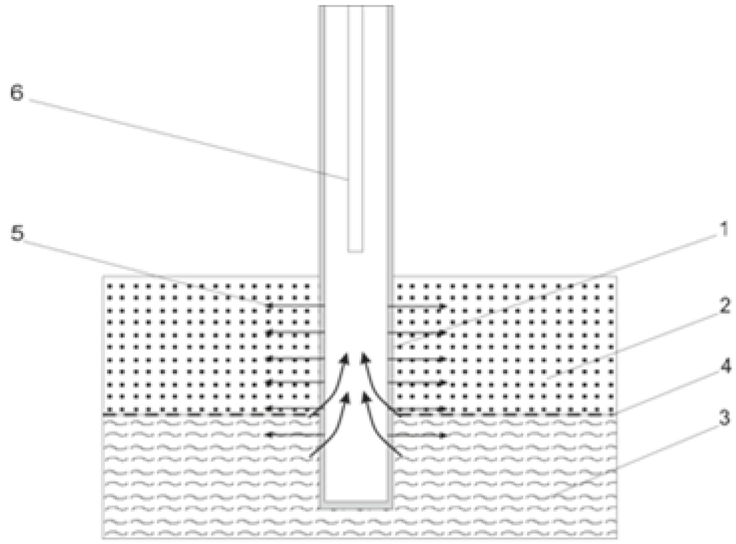

Fig. 1 Inflow of bottom water through the lower perforations of the well.1 – well; 2 – productive formation; 3 – bottom water;4 – oil-water contact; 5 – perforations; 6 – downhole equipment.

Instead, a packer plug 9 is fed into the hole down to 1 m below the oil-water contact 4 using the drill string 7 with a packer 8. The packer 8 is activated in the well 1; a grouting composition (for example, based on PCT-100) is injected into the lower interval of the perforations 5 with the subsequent formation of a water shutoff screen 10 (Fig. 2). After WOC and creating a resistant water shutoff screen 10, the assembly with a cutter 11 is fed into the well 1, the packer plug 9 with cement residues is drilled, and then the well is flushed out (Fig. 3).

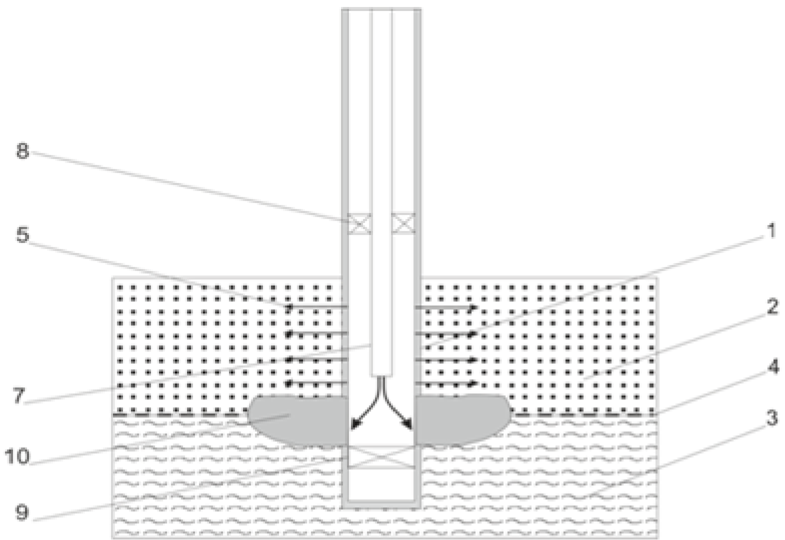

Fig. 2 Injection of a grouting composition at the OWC boundary.1 – well; 2 – productive formation; 3 – bottom water; 4 – oil-water contact; 5 – perforations; 7 – drill string; 8 – packer; 9 – packer plug; 10 – watershutoff screen.

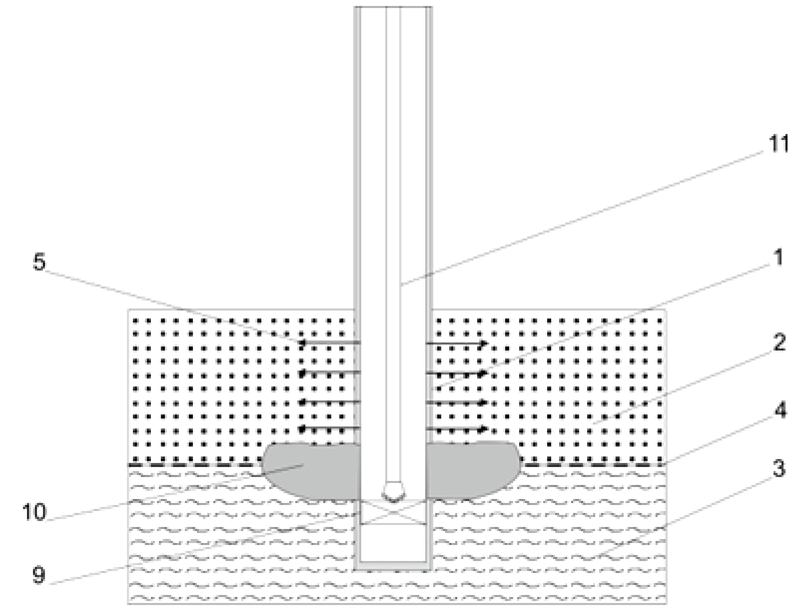

Fig. 3 Drilling the packer plug.1 – well; 2 – productive formation; 3 – bottom water; 4 – oil-water contact; 5 – perforations; 9 – packer plug; 10 – watershutoff screen; 11 – assembly of the drill string with the cutter.

After that, the guide assembly 13 with a through canal 14 and an outlet hole 15 complete with an anchor-packer device 16 is fed into the hole using the drill string 12 (Fig. 4). The anchor-packer device 16 allows installing, securing and sealing the guide assembly 13 in the production string of the well 1, while the guide assembly 13 provides the orientation of the equipment being fed in one of the formation 2 directions. The guide assembly 13 is fed into the flooded part of the productive formation 2 in the interval of the existing water shutoff screen.

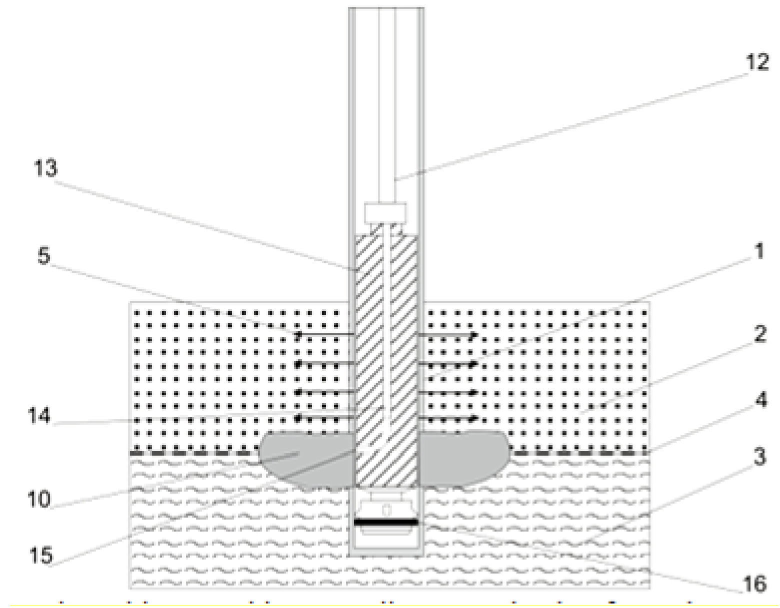

Fig. 4 Running in the guide assembly.1 – well; 2 – productive formation; 3 – bottom water; 4 – oil-water contact; 5 – perforation; 10 – watershutoff screen;12 – drill string; 13 – guide assembly; 14 – through hole;15 – outlet hole; 16 – anchor-packer device.

Thereafter, the drill string 12 is removed from the well, leaving the guide assembly 13 in the production string. A jet nozzle 19 is fed into the guide assembly 13 using coiled tubing 17 and a shifting high-pressure hose 18 down to the outlet 15 of the through hole 14 of the guide assembly 13. A hole 21 is cut in the production string wall by jets of sand-liquid slurry (SLS) 20, consisting of sand and hydrocarbon-based solution (Fig. 5).

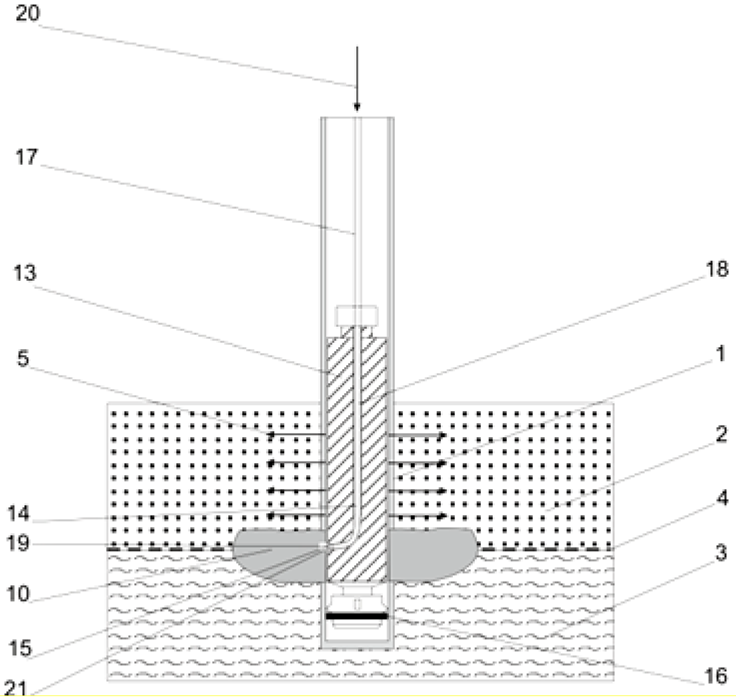

Fig. 5 Cutting the opening in the casing.1 – well; 2 – productive formation; 3 – bottom water; 4 – oil-water contact; 5 – perforation; 10 – watershutoff screen; 13 – guide assembly; 14 – through hole; 15 – outlet hole; 16 – anchor-packer device; 17 – coiled tubing; 18 – high-pressure hose; 19 – jet nozzle; 20 – supply of sand-liquid slurry; 21 – hole in the production string.

After cutting the hole 21 in the production string, SLS 20 is replaced with OBM 22, the cement stone behind the production string is broken by high-pressure OBM jets, and then the water shutoff screen 10 and the productive formation 2 rock are broken by displacing the jet nozzle 19 in the radial direction to form an elongated radial branch 23 (Fig. 6).

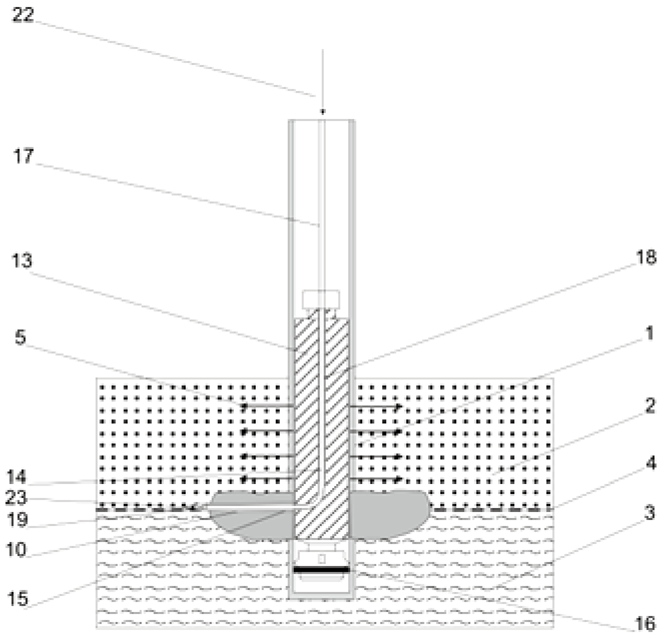

Fig. 6 Creating a radial canal.1 – well; 2 – productive formation; 3 – bottom water; 4 – oil-water contact; 5 – perforation; 10 – watershutoff screen; 14 – through hole; 15 – outlet hole; 16 – anchor-packer device; 17 – coiled

tubing; 18 – high-pressure hose; 19 – jet nozzle; 20 – supply of sand-liquid slurry; 21 – hole in the production string; 22 – supply of hydrocarbon-based solution; 23 – elongated radial branch.

After forming the first radial branch 23, coiled tubing 17 is removed from the well with the high-pressure hose 18 and the jet nozzle 19, the guide assembly 13 is rotated for 45 degrees in the same plane, and the same actions are performed in regards to the next radial branch. Then, subsequent radial branches are routed the same way after turning the guide assembly for the next 45 degrees. The optimal number of radial branches is eight, which provides almost complete coverage of the near-wellbore zone of the formation, although depending on the production string diameter and the length of the radial branches, this number may be bigger.

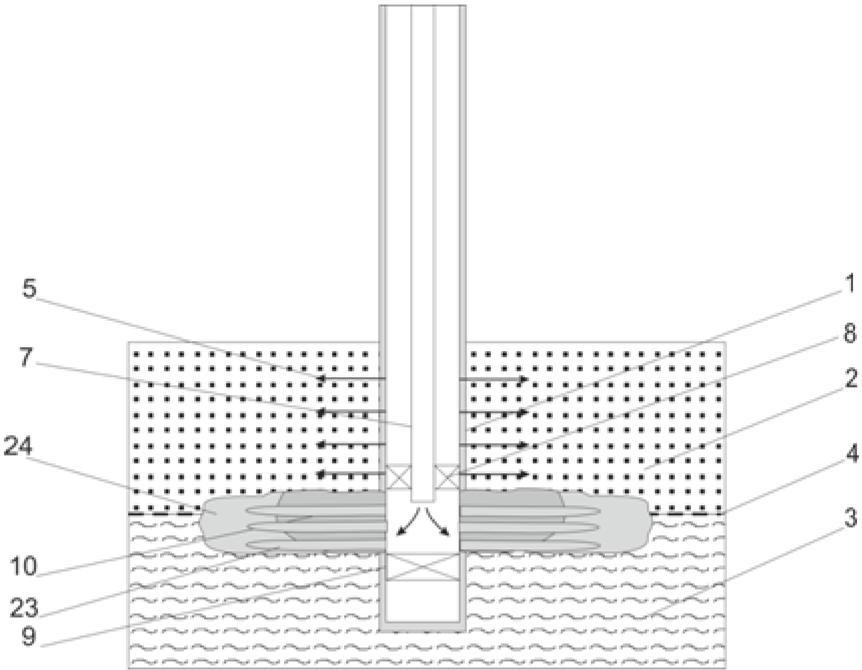

Fig. 7 Injection of a grouting composition through radial canals.1 – well; 2 – productive formation; 3 – bottom water; 4 – oil-water contact; 5 – perforations; 7 – drill string; 8 – packer; 9 – packer plug; 10 – watershutoff screen; 23 – elongated radial branch; 24 – second watershutoff screen.

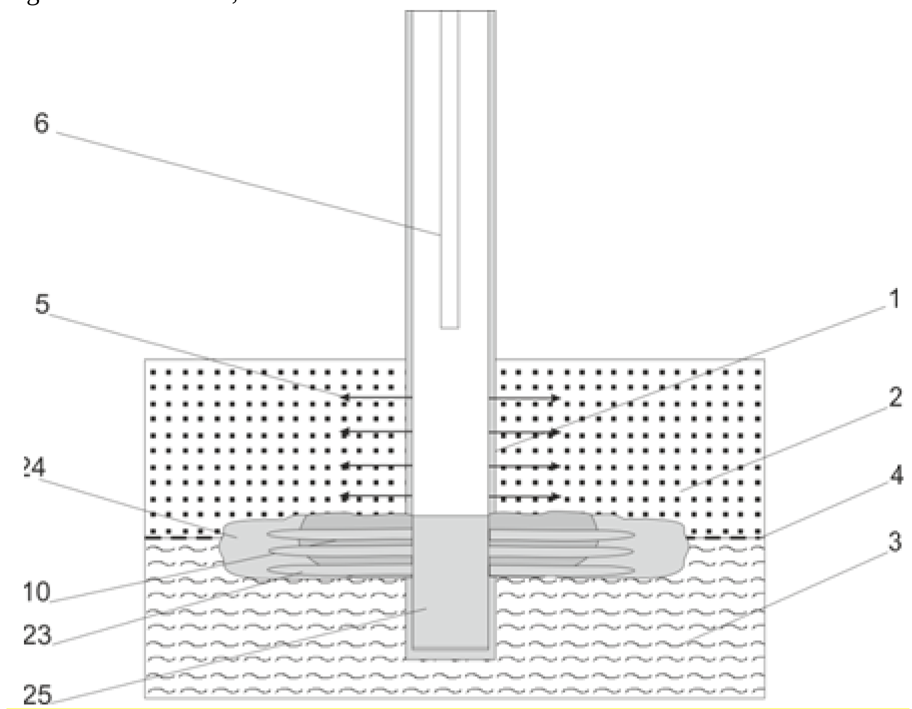

Fig. 8 Created watershutoff screen.1 – well; 2 – productive formation; 3 – bottom water; 4 – oil-water contact; 5 – perforation; 6 – downhole equipment; 10 – watershutoff screen; 23 – elongated radial branch; 24 – second watershutoff screen; 25 – cement sleeve.

After drilling radial canals in one plane of the formation 2, radial canals are drilled below this plane, but in the thickness of the existing water shutoff screen 10 by performing the operations described above. After routing all planned radial branches, they are used to inject the water shutoff composition 24 (Fig. 7) to create a water shutoff screen along the radius, providing a spatial and long-term barrier to the OWC 5 movement path, and the cement sleeve 25 is left in the borehole cavity not higher than the water shutoff screen.

At the end of water shutoff works, the well is left for the period of reaction of the injected compositions under pressure with the subsequent activation of inflow through the existing upper perforation interval 5. If it is necessary to intensify the inflow, the perforation, acid treatment activities, etc. may be reperformed (Fig. 8).

CONCLUSION

The technology for isolating formation water inflow in wells proposed by the authors allows increasing the radius, thickness and area of the water shutoff screen and increasing the anhydrous period of well operation.

REFERENCES

[1] D.S. Leontiev, I.I. Kleshchenko, Methodical aspects of diagnosing the causes of oil well flooding, News of Universities. Oil and Gas 2 (2015) 61-67.

[2] A.V. Bykadorov, On the effect of coning on the process of recovering reserves in massive reservoirs with bottom water, Science and Production 11 (2012) 71-75.

[3] S.A. Demakhin, A.G. Demakhin, Chemical Methods for Limiting the Water Inflow into Oil Wells: Textbook, Nedra, Moscow, 2010.

[4] I.I. Kleshchenko,D.S. Leontiev, V.A. Dolgushin, Zh.S. Popova, A.A. Ankudinov, On the installation of water shutoff screens in oil wells while coning the bottom water, Drilling and Oil 5 (2015) 30-31.

[5] D.S. Leontiev, I.I. Kleshchenko et al., Patent 2631512, Russian Federation, E21B33/13 (2006.01), E21B 43/32 (2006.01) E21B 43/11 (2006.01). Method for shutting off the inflow of bottom water in oil wells, 2017.

[6] Bulgakov, A. V., Babieva, N. S., Levanova, E. A., Gridyaeva, L. N., Erofeeva, M. A., Sokolovskaya, I. E., &Davidyan, L. Y. (2018). Specific features of psycho-emotional states of working women during pregnancy. Electronic Journal of General Medicine, 15(6).

[7] Ece, A., &Tünay, Z. (2018). Successful management of acute bismuth intoxication complicated with acute renal failure, seizures and acute pancreatitis in a child. Journal of Clinical & Experimental Investigations/ KlinikveDeneyselArastirmalarDergisi, 9(3).

[8] Rabbani, M., Bagherzadeh, N., &Rafiei, H. (2014). Calculating raw material and work-in-process inventories in MTO. MTS production, UCT Journal of Research in Science, Engineering and Technology, 2(3): 109-116.