

presentation



*Processing of a well
bottom zone Integrated
physicochemical effect*

*(cracks formation methods using
pulsed-wave force)*

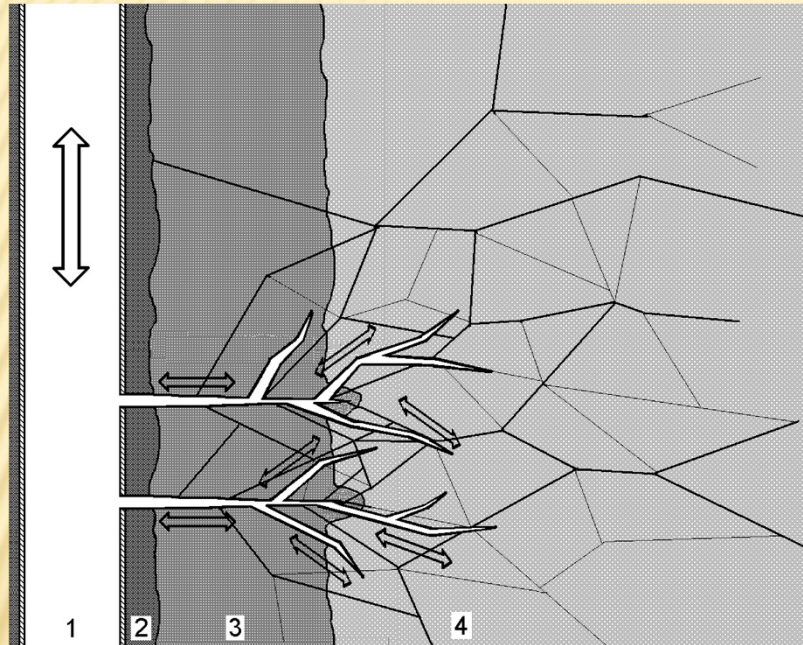
Patents for inventions

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- Patent RF № 2507390. Way of implementation of pulse hydraulic fracturing. A.Shipulin. 2014.
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- Patent RF № 2520115. Way of processing of a circumwell zone of a well. A.Shipulin, K.Kupavih. 2014.
- Patent RF № 2522327. Way of processing of a well bottom zone of a well. A.Shipulin, K.Kupavih. 2014.
- Patent RF № 2524583. Way of an intensification of production of natural gas from coal layers through wells. A.Shipulin, E.Yutyaev. 2015.
- Patent RF № 2540709. Way of shock and wave destruction of coal layer through the wells drilled from excavations. A.Shipulin, A.Meshkov, E.Mazanik. 2015.
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Necessity of permeability increase in a well bottom zone

The most popular (traditional) technologies of cracks formation in a bottom zone are torpedoing, traditional hydraulic fracturing, thermal treatment, application of chemical reactants. But these processes are long and very expensive. There must be more efficient and eco-friendly way of cracks network creation in a solid bed (hard formation) of a well. This method is to create a large number of short cracks. And using of reservoir pressure energy and liquid movement force is also desirable.

Basic principles (basic physics) of the technology



The technology basis is generation of strong pulsed force using principle of changing pressure. As a result one can get a lot more cracks in a layer than implying traditional hydraulic fracturing.

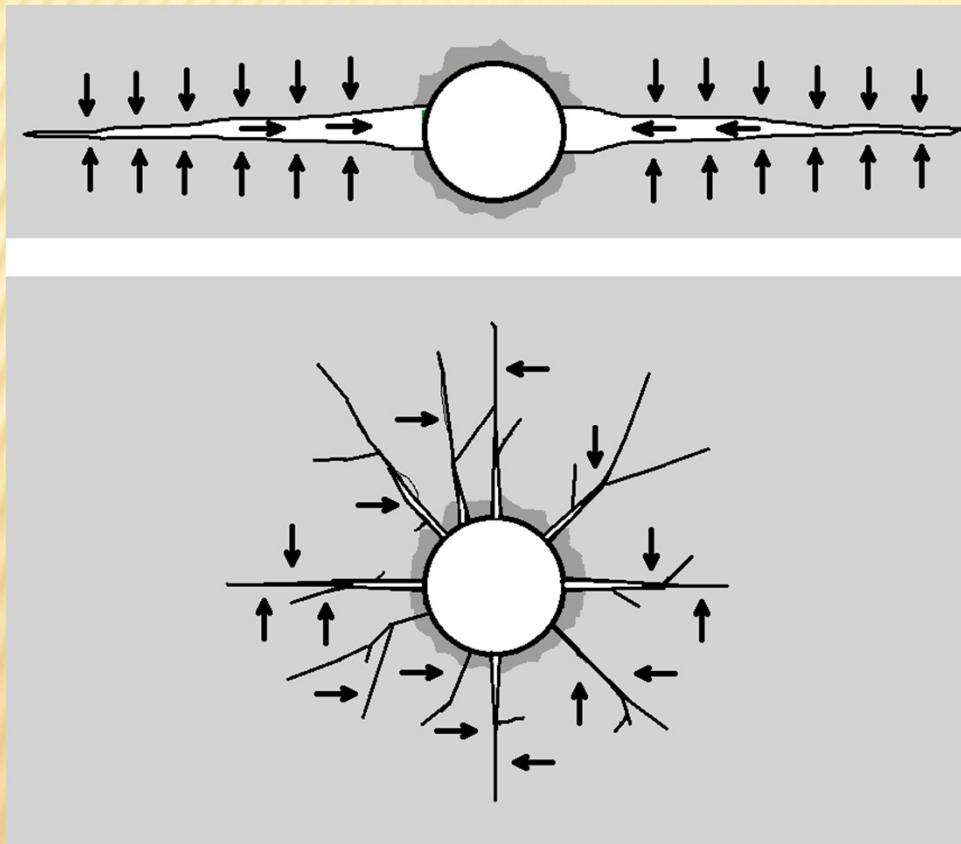
Hydroblow power

$$N = \rho C^2 V A,$$

ρ - density of borehole liquid;
 C - speed of distribution of a wave;
 V - liquid movement speed;
 A - section of a column of pipes.

By calculations hydroblow power on a face makes units of megawatts.

Advantages of pulsed hydraulic fracturing



Implementing the traditional technology of hydraulic fracturing based on principle of constant pressure leads to formation of a long length crack. This crack needs to be consolidated with proppant.

Implementing the pulsed hydro blows technology based on principle of changing pressure results in formation of several cracks going from a wellbore. Periodic cracks deformation leads to residual deformation; in this case proppant usage is not required. Fluid influx comes from all directions.

The technology can be used in slate oil production.

Advantages of pulsed hydraulic fracturing

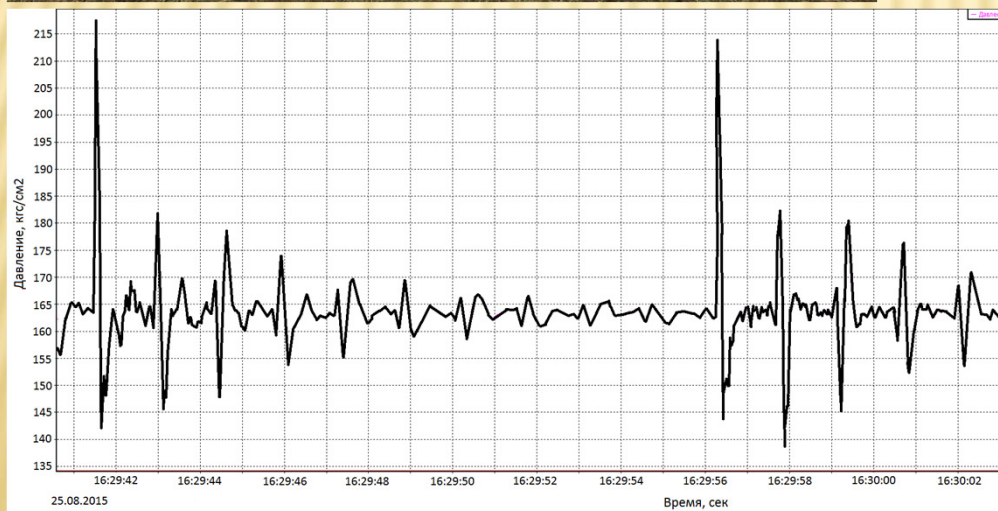
- ✘ Creation of high short-term pressure in a perforation area, which can't be created by stationary liquid current.
- ✘ Increase in water inflow from all direction evenly.
- ✘ Increase in layers acceleration performance.
- ✘ The regular movement promotes washout of a well-bottom zone.
- ✘ Regular crack deformation doesn't completely close a crack due to ground pressure.
- ✘ Chemical reactants aren't used.
- ✘ process of pulse hydraulic fracturing is operated by three parameters: pressure rate and at the expense of the size of pressure and duration of its exposure.
- ✘ the technology is efficient and eco-friendly.

Example of carrying out pulse hydraulic fracturing

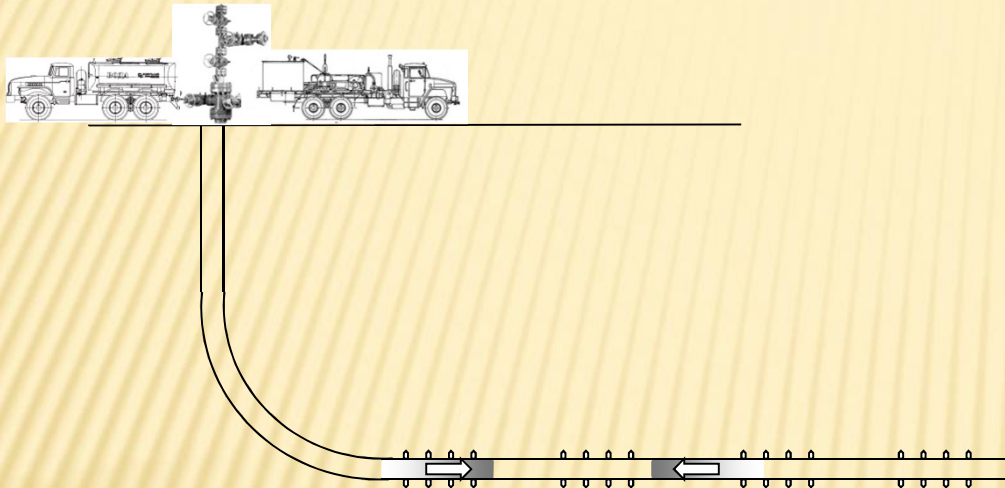


The most crack deformation we can get during the splits of the first second of pulsed pressure. The most influence is created by the first, the strongest hydro shock impulse.

Productivity and efficiency of this method is proved by the experiment. The pressure ratings in a well are shown in the chart.



Implementing pulsed processing of horizontal wells



Pulsed hydraulic fracturing allows creating high pressure differences in any place of a horizontal well; therefore it allows forming cracks in the specified interval. There are two options of hydraulic fracturing area indication: due to shock waves interference; putting a column of pipes with a wave reflector at the specified depth.

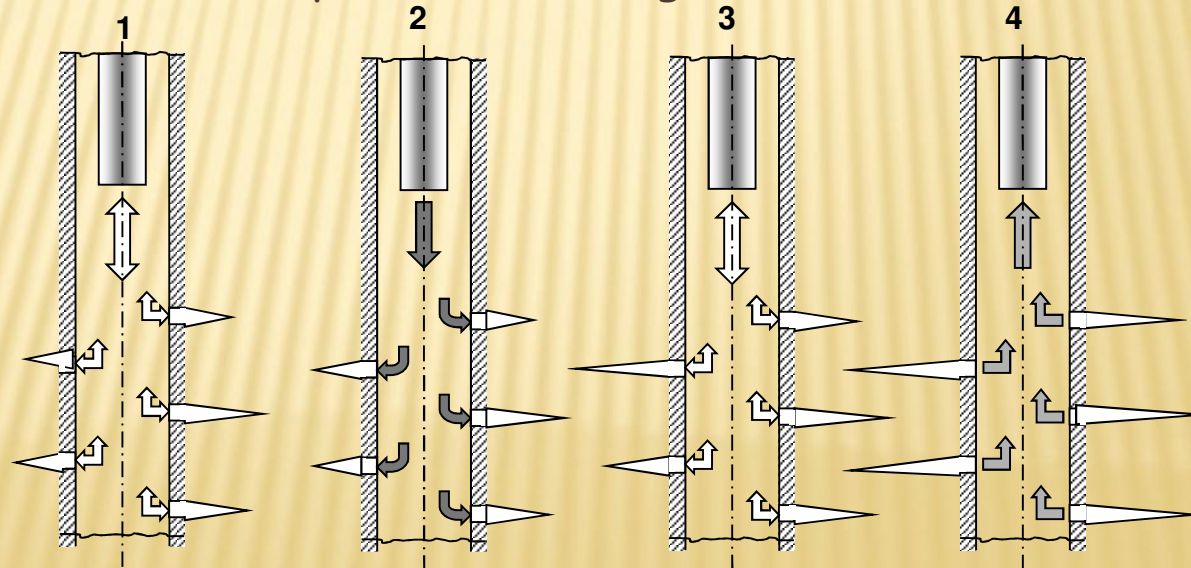
Washing-out of a well bottom zone layer using chemical reactants

Step 1. Extraction of mechanical, salt and hydrocarbon formations. (Cleaning up pores and cracks) This is necessary to provide the contact of acid with carbonate surface level of a layer)

Step 2. Chemical reactant injection.

Step 3. Shaking down a borehole fluid column to create equal distribution of chemical reactant, wash out formations, speed up chemical reaction and extract colmatants.

Step 4. Extraction of chemical reactants rests and reaction products using pulse-waved method with periodic flushing out of a well.



Testing results of borehole fluid inertia effect technologies



These technologies were tested and used by such companies as Bashneft, Tatneft, Udmurtneft, Belarusneft, Samaraneftegaz, Dagneftegaz, and by companies from China and Kazakhstan. All achieved good results.

Since 2007 the technology has been being used by Orenburgneft, and since 2010 - by Samaraneftegaz. They increased the well injection capacity by 120%.

According to the results of check analysis positive effect lasts 6-8 months.

Examples of using pulse stimulation technology



Injection wells processing without using the elevators in Belarus (September 2009), and with using discharge line effect in Sarapul (July 2009).

The use of shock off-loading method for well workover in the Samarskaya region (June 2011).



Results of gas-condensate wells processing in Dagestan

After the processing of flow well No. 16 in the Dmitrovskoe field there was a sharp increase in an outflow with oil and gas eruption.



Well processing results in the field of P.R. China in August, 2010



In China there was a difficulty in the well processing due to slowly crosslinking polymers formed inactive gel systems in layer cracks.

The use of shock off-loading method allowed extracting up to 45 m³ of formation fluid with high-molecular polymers. Besides, pumping down pressure decreased more than by 35% due to creation of additional fracture network.

Pulse-waved technology application

This technology is already developed. Now it is being calculated and patented for viscous oil production.

In 2014 in Kuzbass further technology development allowed extracting of methane from a coal layer. Then pulsed hydraulic fracturing was applied in a horizontal well.

Application areas for technology of wells pulsed processing with power fluid mass

- ✓ Pulsed hydraulic fracturing without use of heavy pumps and with small material investments.
- ✓ Chemical processing of a well bottom zone with the pulsing breed washout.
- ✓ Creation of a cavity store of oil in carbonate collectors around the well.
- ✓ Development of wells using hydrodynamic ways;
- ✓ Wave impact on a field to cause outstreach of the layer on the next wells.
- ✓ Use of pulse and wave technology for production of viscous oil.
- ✓ Hydraulic fracturing of coal layer for methane extraction.