

Production stimulation of extractable resources using the Hydraulic Impulse Generator



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Foreword

Extraction efficiency of oil and gas in all countries is unsatisfactory today using well known industrial methods of the development and extraction.

For example, in the countries of Latin America and South East Asia the average reservoir recovery makes 24–27 %, in Iran – 16–17 %, in the USA, Canada and Saudi Arabia – 33–37 %, in CIS countries and Russia – up to 40 %, depending on structure of oil reserves and applied methods of development and extraction.

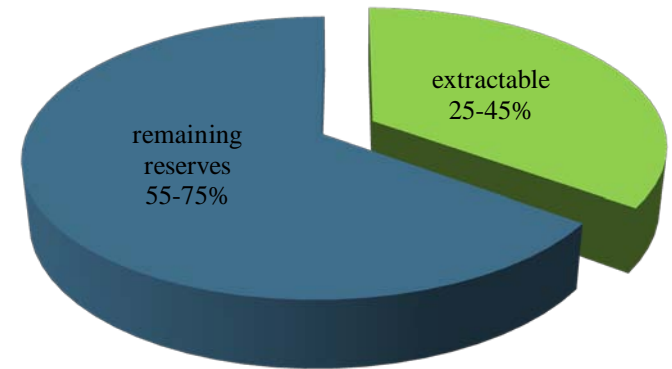
For increase of extracted reservoir with reduction of development terms and operation of gas and oil fields use various intensification methods of extraction which are not friendly to environment.

The most widespread intensification methods of gas and oil inflow:

- hydraulic fracturing treatment;
- hydrochloric treatment;
- detonation of blasting material in the layer.

The issue of the new intensification methods searching is essential at the present time.

Comparison of extractable and remaining reserves of oil



Application

Hydraulic Impulse generator is intended for increase of the minerals extraction efficiency by increasing fracturing of rocks by a way of pulsed influence of working liquid under the pressure to the layer .



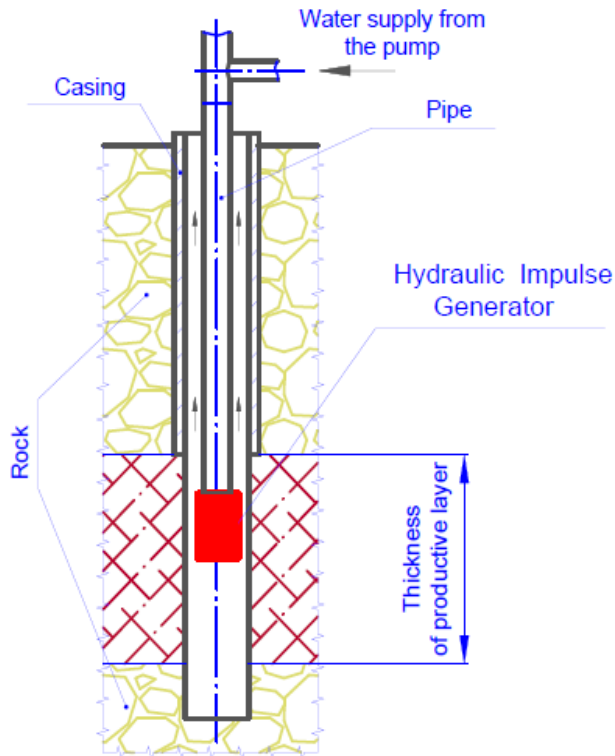
Field of application:

- Production stimulation and increasing of wells output for the following extractable resources as oil, gas, shale gas, sulphur, water and other;
- Coal-bed degassing;
- For other minerals extraction with caustic wash manner.

Applicable for the vertical and horizontal boreholes.

Hydraulic Impulse generator does not require essential expenses for implementation.

Generator operating principal



**Installation scheme of
Hydraulic Impulse Generator**

Hydraulic Impulse Generator is installed to the end of pipe range and placed in the vertical or horizontal well at the level of the productive layer occurrence.

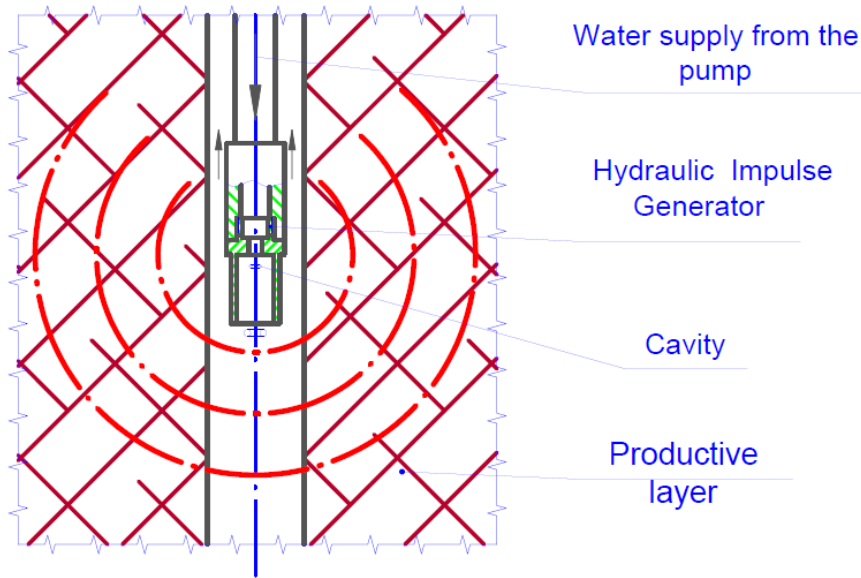
The water under the pressure is supplied to the inlet of the Hydraulic Impulse Generator by the pump through the pipe range.

Further water passes through the flowing channels of the Hydraulic Impulse Generator to the well at the level of occurrence of productive layer.

The powerful high-frequency pulsing stream occurs due to the pressure drop in the flowing channel of Hydraulic Impulse Generator.

Pressure pulses of liquid influence to the productive layer and increase its fracturing in rather big radius that promote more intensive escape of gas, oil and other minerals.

Operation description of Generator



Process scheme of hydrodynamic impact

Hydraulic Impulse Generator creates high-frequency longitudinal and cross waves of pressure, using for this purpose part of the energy of fed fluid flow as well as provides transformation of a stationary stream of fluid to the pulsing.

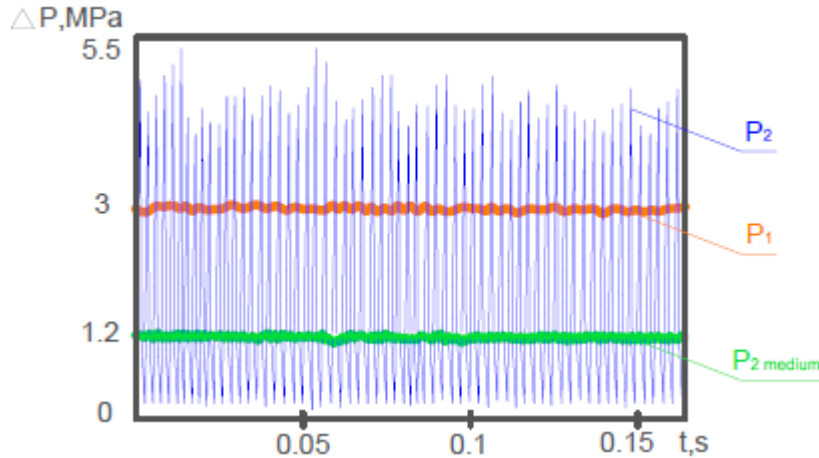
It occurs due to inner channel with a special profile in the body of Generator. This profile provides the existence of the regime of periodically stalling cavitation during the fed fluid is passing through this special profile.

In the specially shaped passage of Generator occurs periodic formation and growth of cavitation cavity. The abnormally high pressure is occurred in the fluid flow during the collapse of cavities with the large volume. Thus there is a hydrodynamic impact to the layer.

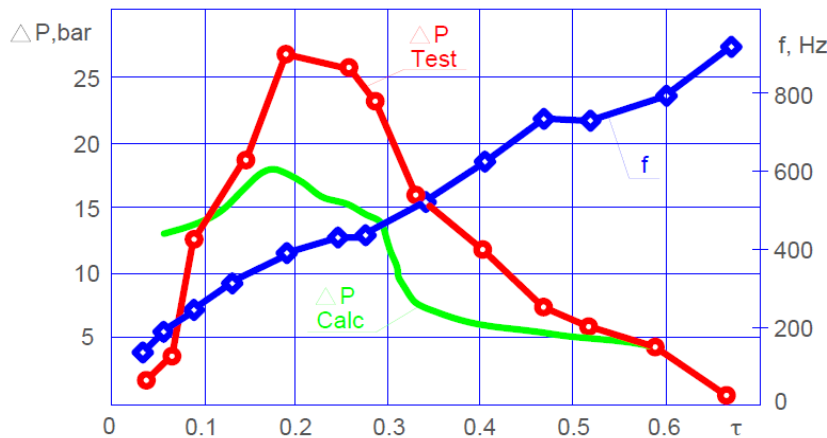
The longitudinal and cross waves of pressure is formed in the layer due to hydrodynamic impact to the rock. This waves stimulate the elastic (proper) vibrations of porous medium which cause the discontinuity and formation of pores and channel net as well as elimination of solid phase and filtrate from productive layer. This process provides the increase of well output.

Impulses frequency can be from 100 to several thousand Hz. This frequency is defined by geometrical parameters of the Hydraulic Impulse Generator and change in pressure in fluid passage of Generator which can be controlled accurately.

Testing



Fragment of Oscillogram of pressure fluctuations



Dependence of frequency and peak-to-peak motion from cavitation parameter

Lab testing.

Transfer process of pressure pulsation of liquid to the well wall was research at the hydraulic stand.

Oscillogram shows us the cavitation self-oscillations which was realized in hydraulic system with generator.

The maximum values of pressure in impulse is in ΔP_1 , 2.5 times more than feeding pressure.

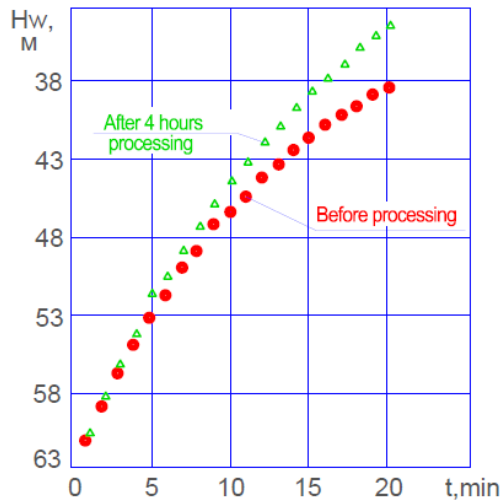
Nature of these fluctuations confirms the possibility of transformation of stationary stream to the pulsing.

Diagram shows us dependences of frequency and peak-to-peak motion at the pipeline wall from cavitation parameter for the inlet pressure in the generator is 40 bar.

The maximum value of pressure peak-to-peak motion at the pipeline in the section of generator outlet reaches 27 bar for cavitation parameter is 0,2.

Oscillation frequency is increasing from 100 to 900 Hz for growth of cavitation parameter.

Testing



Well filling diagram

Well	Processing time, hour	Dynamic level, m	Well output before processing, M ³ /h	Well output after processing, M ³ /h	Well output increase, %
1	4	54.5	3.48	5.70	165
2	9	40.0	1.15	2.41	200
3	7	26.0	10.7	13.3	125

Comparison table of wells output increase

Field testing.

Old water wells recovery was made according to the presented scheme above.

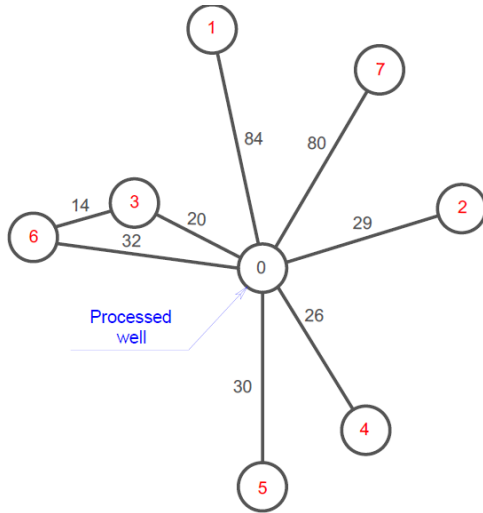
Comparison of well output before and after well treatment was carried out during testing.

During long time processing of the well the changing of well output was fixed discretely in certain time of well treatment.

Well output measurements was being carried out periodically during the formation treatment. Well output was being measured after pump had been stopped. Well output was defined by increase of static pressure.

Application of this method and device allowed to increase in 1,5 – 2.0 times the output of old water wells.

Testing



Wells arrangement scheme

№ of well	Level, m		
	Before testing	After 1 hour of generator working	In 24 hours after the completion of tests
1	18,0	19,32	19,30
2	18,0	17,46	17,30
3	35,0	34,35	34,00
4	17,0	18,59	18,60
5	19,5	17,12	18,70
6	30,5	28,5	29,60
7	19,6	19,1	18,85

Change of fluid level

Field testing.

Hydraulic Impulse Generator was tested at the sulfur fields during sulfur extraction by the method of hot water liqutation.

Before test water penetration of a wells was zero.

Change of fluid level has happened in the all wells located in the radial directions up to 85 m after treatment by Hydraulic Impulse Generator. (see table)

Measurement results showed that water intake of wells was about 4,8 m³/h.

Application of this way and the device allowed to increase filtrational properties of the sulfur-ore layer.

The main advantages of the Generator

- Simple design;
- The supplementary power source is not necessary;
- Readjustment of generator for the different well depth is not necessary;
- Long life of failure-free working time;
- Well treatment according to this technology allows to increase the output of wells in some times;
- Well treatment according to this technology allows to keep the well operational properly during 1 year;
- Expansion of longitudinal vibration upstream to pipe column does not exist;
- Movable and rotating details/parts of equipment do not exist;
- Limit on the well depth does not exist;



The main advantages of the Generator

Last world tendencies show us the severization of environment protection standards.

France, Germany, Bulgaria, Canada has already forbidden to use the hydraulic fracturing and other countries such as Sweden is planning to refuse it.



Hydraulic Impulse Generator is environmentally friendly, it works on the water or other fluids and does not demand the using of chemicals that harm the environment and contaminate groundwater



Offer

- Engineering service;
- Design and producing of Hydraulic Impulse Generator for the certain operating conditions;
- We are ready to demonstrate the capability and working efficiency of Generator in special operating conditions of customer ;
- It will include follow: development, design of Generator for conditions and equipment of certain customer company as well as producing and testing.

We need the following initial data for this:

- Diameter of well;
- The rate of flow and a pump head;
- Producing depth
- Reservoir thickness

Thank you for attention

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