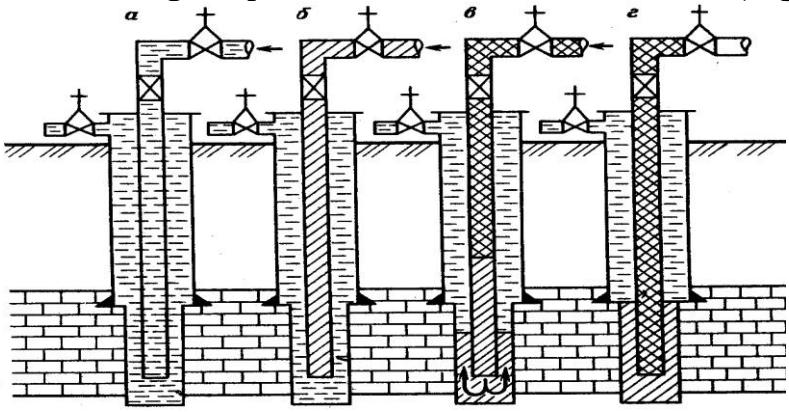
TECHNOLOGICAL SCHEMES OF ACID TREATMENTS

Dnipro University of Technology

Rybalko Serhiy Oleksandrovych
Supervisor: **cand.tech.science, PhD Khomenko Volodymyr Lvovych**

The following acid treatments are used in the fields:
1. Acid baths;
2. Simple acid treatments;
3. Acid treatment under pressure;
4. Thermal acid and thermal gas chemical treatments;
5. Foam-acid and thermo-foam-acid treatments;
6. Hydropulse acid treatments;
7. Acid blasting;
8. Clay acid treatments;
9. Carbon dioxide treatment.

Acid baths are the simplest acid treatments and are designed to clean the walls of the well and the bottom from the remnants of cement and clay crusts, corrosion products, resinous substances, paraffin, etc. Such cleaning helps to increase the area covered by the acid solution and prevents the formation of deposits in the pores of the rocks during subsequent processing. In wells that are in development after drilling (the wellbore is filled with water or oil after preliminary cleaning with a weak inflow of it from the reservoir), the technological process is carried out as follows (Fig. 1).



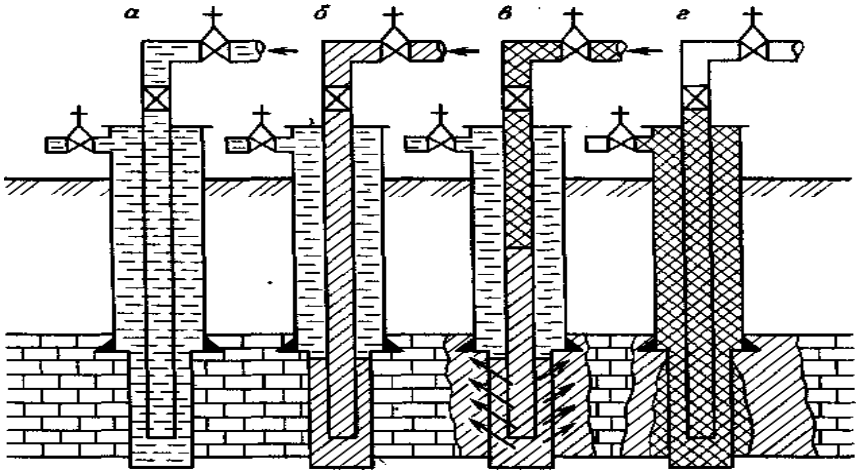
1 - water; 2 - acid; 3 - displacement fluid

Figure 1. Technological scheme (a - d) of the installation of an acid bath

Simple acid treatments are most often used to dissolve the contaminants introduced into the reservoir, as well as to increase the size of the pore channels by dissolving the carbonate rock.

The simple acid treatment technology is as follows (Fig. 2).

Oil is pumped into an oil production well through the tubing, and water is pumped into a water injection well until stable overflow through the annular space outlet (Fig. 2, a). With an open annulus, after oil or water, an acid solution is pumped into the tubing in the volume of the tubing and the annulus from the lower end of the tubing to the upper boundary of the treated formation or perforation interval (Fig. 2, b).



1 - water; 2-acid; 3 - displacement fluid

Figure 2. Technological scheme of a simple acid treatment

Close the annulus, continue pumping the rest of the acid solution, and then the displacement fluid (Fig. 2, c). After the entire solution is forced into the formation, the mouth is closed and the well is left to react (Fig. 2, d).

Acid pressure treatments are designed primarily to act on tight reservoir intervals. To do this, the injectivity of high-permeability intervals is preliminarily limited by pumping a high-viscosity acid-in-oil emulsion. In addition, the acid, which is part of the emulsion, also performs useful work. The neutralization of this acid is much slower than the neutralization of a pure acid solution. This provides deeper acidizing of high permeability intervals. Exclusion of acid absorption by high-permeability intervals can also be achieved using a PRS-type packer.

Acid pressure treatments increase coverage of reservoir thickness by exposure to an acid solution and are used in oil production, water injection and gas wells, both open-hole and cased.

When applying this type of acid treatment, measures must be taken to prevent the formation of communication channels with an adjacent aquifer. To do this, it is necessary to correctly substantiate the pressure value for squeezing the acid solution into the formation.

In thermal acid treatment, the productive formation is exposed twice in one technological process: first with TCM, and then with a simple acid treatment or pressure treatment.

Thermochemical impact (TCW) - impact on the bottomhole and bottomhole formation zone with hot acid, obtained due to the release of heat during the reaction between acid and magnesium.

Thermal acid treatments are designed to dissolve paraffin and asphalt-tar deposits, to form dissolution channels in dolomites, to intensively dissolve contaminants in wells after drilling is completed, to clean the filter of water injection wells from corrosion products and other contaminants that are difficult to dissolve in cold hydrochloric acid and others

Thermogas-chemical impact - the essence of thermal gas-chemical impact (THCI) is to create a high short-term pressure as a result of the combustion of a powder charge in a liquid medium. Under the action of the pressure of powder gases,

the well fluid is forced into the formation, expanding the natural ones and creating new cracks.

Foam-acid treatments are used to influence productive formations composed of carbonate rocks, as well as sandstones with a high content of carbonate cement.

Foam - bubbles of gas or air in a liquid, separated by thin layers (films) of the same liquid. To obtain foam, in addition to gas and liquid, the presence of another substance is required - a foaming agent (surfactant).

Hydropulse acid treatments are used to create hydraulic impulses (hydraulic impulses) in the bottomhole formation zone. It consists in periodically pumping fluid under high pressure into the well through the tubing and quickly "relieving" pressure through the annulus (discharging the well). The value of the generated pressure should not exceed its allowable value for the given casing string.

When fluid is pumped in the bottomhole formation zone, existing or new fractures are formed. When the pressure is released, fluid flows from the fracture into the wellbore at high speed. With this liquid, polluting materials introduced there are carried out of the bottomhole zone.

Acid blasting is the impact on the bottom and walls of the wellbore with a jet of an acid solution emerging at high speed from a cone nozzle. The device with which acid blasting is carried out is called a hydromonitor.

The main purpose of acid blasting is to clean the walls of the wellbore and bottomhole from cement and clay cakes, the formation of new channels of dissolution in the carbonate rock. Therefore, acid blasting is mainly used in open hole wells.

Clay acid treatments - designed to impact on sandstones or sandy-clayey rocks, as well as on clay cake. The main condition for application is the absence or minimum content (up to 0.5%) of carbonates in the rock.

The amount of clay acid is selected empirically in order to prevent the destruction of the rocks of the productive formation. During the first treatments, it is recommended to use 300–400 liters of clay acid per 1 m of the formation thickness. If the layers are composed of fractured rocks, then the volume of clay acid for primary treatments increases to 800–1000 liters per 1 m of the layer thickness.

Carbon dioxide treatments are used in wells whose productive formation rocks contain calcium and magnesium carbonates, as well as in wells with asphalt-tar deposits. Carbon dioxide treatments are used in both oil producing and water injection wells.

Preparation of the well for treatment consists in flushing the bottomhole, determining the productivity factor, clarifying the water content, etc. In a water injection well, the injectivity is determined and the injectivity profile is built.

References

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