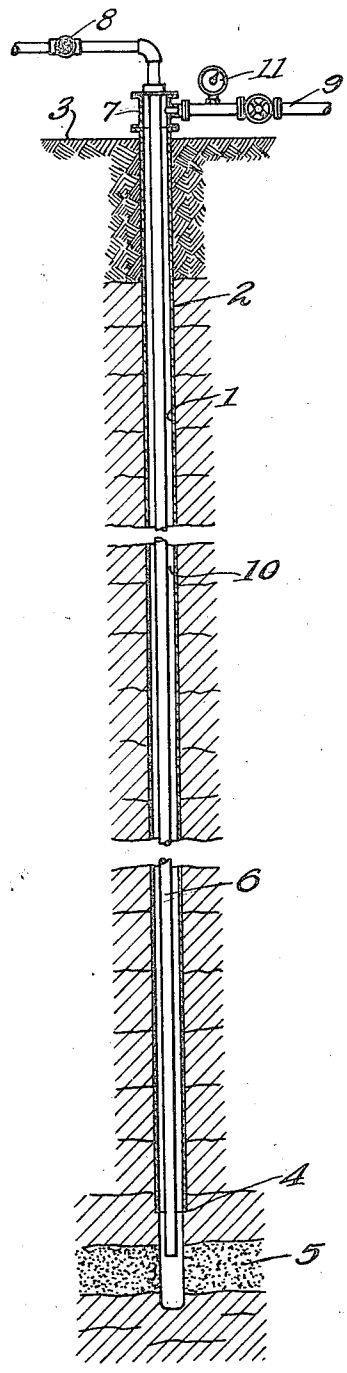
166-307

Search Room

Oct. 22, 1935. R. H. CARR ET AL 2,018,199

BALANCED PRESSURE METHOD FOR INTRODUCING ACID REAGENTS INTO OIL WELLS

Filed Oct. 21, 1932



Inventors
R. H. Carr
H. C. Humphrey
By W. S. McDowell
Attorney

166 WELLS
Search Room

Patented Oct. 22, 1935

2,018,199

UNITED STATES PATENT OFFICE

2,018,199

BALANCED PRESSURE METHOD FOR INTRODUCING ACID REAGENTS INTO OIL WELLS

Richard H. Carr and Howard C. Humphrey, Chicago, Ill., assignors to The Pure Oil Company, Chicago, Ill., a corporation of Ohio

Application October 21, 1932, Serial No. 638,949

5 Claims. (Cl. 166—21)

This invention relates to the treatment of deep wells, such as oil and gas wells, with acid reagents which react with the producing formations or strata of such wells to, at least, partially dissolve or disintegrate substances tending to obstruct the production of desired fluids from the wells and, in cases where the producing formation is disposed in part or in whole in limestone or other substances with which the acid reagents will react, to increase the porosity or pore area thereof leading to the well bore, whereby to provide for a freer and less restricted flow of fluid into the producing region of the well.

Such acid treatment of wells has been found to be effective in revivifying wells whose production rate has receded or in improving the output of certain newly drilled wells. Difficulty, however, has been encountered in the practical application of the process in the matter of obtaining certainty in the delivery of the treating acid throughout desired areas of the producing formation, strata or stratum of a well. The usual method employed has been to deliver the acid to the producing stratum in the bottom of the well bore through the customary well tubing, and in this method reliance is placed on the weight of the column of acid in the tubing, or through the use of extraneously applied pumping pressures, to pass the treating reagent into contact with the fluid-producing sands or lime rock. This method has been found in certain types of wells to lack positiveness in assuring the distribution of the acid to the desired extent through the producing formation contacting the well bore and it is, therefore, a leading object of the present invention to provide a more positive method for introducing the reagent into such wells and their producing strata or stratum, especially when the well is producing fluid by its own flow, in order to overcome back pressures and to provide for the permeation of the acid reagent into the producing formation.

For a further understanding of the invention, reference is to be had to the accompanying drawing wherein the figure is a diagrammatic view, partly in vertical section, of an oil well provided with the customary tubing and casing by which the present invention may be practiced.

Referring more particularly to the drawing, the numeral 1 designates the customary casing used in lining a well bore 2, which extends from the ground surface 3 to a casing seat 4 located immediately above the producing formation or stratum 5 in the bottom of the well. This stratum may be of lime rock or sand, as is commonly found in most producing wells. Extending through the casing is the usual string of tubing 6, which extends below the casing into substantial registration with the stratum 5 or below the casing seat. The upper end of the tubing passes through the casing head 7, and is provided with a control valve 8, and the casing head itself is also provided with the usual valved outlet 9.

In practicing my process, in order to treat the producing formation 5 with acid, or other equivalent treating reagent, the valves 8 and 9 are closed, thus permitting the annular space 10 formed between the tubing and casing and also the interior of the tubing to fill with the produced fluid of the well. Preferably, a pressure gauge 11 is arranged adjacent to the outlet 9 in order that the operator may be informed when the pressures in the upper regions of the tubing or casing are substantially balanced with those of the producing formation, that is, when the pressures in the upper part of the well bore have reached a maximum. This could be readily observed since when the valves 8 and 9 are first closed, the pressures rapidly rise, as indicated by the gauge, however, when the balanced condition mentioned is reached, then the pressures are substantially constant and without material variation, disclosing thereby the condition of balance above set forth.

When this condition obtains, the acid reagent, which may consist of an aqueous solution of hydrochloric or other suitable acid which may be combined with relatively small quantities of a corrosion inhibitor such as arsenic acid, is introduced into the upper end of the tubing against the pressure of the well after which the valve 8 is again closed. The acid may alternatively be introduced through the casing. Since the reagent is heavier than the fluid produced by the well, and since the outlets of the tubing and casing remain closed, the said acid reagent by virtue of its greater weight, gravitates to the bottom of the well bore and distributes itself in the producing formation. As stated, the reagent possesses the ability to dissolve or disintegrate calcareous or other matter of which the producing formation may be at least in part composed and has the effect of attacking and dissolving limestone or other substances frequently encountered in such formations, thereby enlarging the cavity at the bottom of the well, or the channels and pores in the limestone or sand formation through which oil flows to the well. The acid in reacting upon calcareous rock, sand

or the like forms water-soluble salts which remain in solution and are removed from the well with the spent acid. The addition of arsenic acid or arsenic oxides or the like to the acid inhibits attack of the acid upon the metal surfaces of the casing and tubing.

Hydrochloric acid may be substituted in certain instances for hydrofluoric acid and it will be understood that the acid reagents may be of any suitable concentration. Also other suitable acids or treating reagents may be employed such as sulphuric acid, nitric acid or combinations of such acids.

By the method described, the well is rendered pressure balanced when the reagent is introduced therein, assuring the full and complete delivery of the reagent to the producing formation. Other methods of applying the principles of our invention may be employed instead of the one explained without departing from the spirit or scope of the invention as the latter has been defined in the following claims.

What is claimed is:

1. The method of acid-treating a deep well to increase fluid production therefrom, which consists in closing the upper ends of valved fluid passages leading from the usual casing and tubing of a well whereby to fill the casing and tubing with fluid under the pressure of the producing formation of the well, and following the substantial balancing in pressures between the producing formation and the casing and tubing, and, without release of such pressures, introducing an acid reagent into the casing to provide for the delivery of the reagent into contact with the producing formation.

2. The method of treating deep wells which consists in closing the upper ends of the well tubing and casing, permitting the well fluid to fill the tubing and casing until substantial pressure is built up therein, introducing a chemical reagent of greater specific gravity than the well fluid into the casing, said reagent being capable of reaction with the producing formation, and then closing the top of the casing until the reagent has completed its reaction with the producing formation.

3. The method of treating deep wells which consists in filling the well casing and tubing with well fluid until substantial pressure is built up therein, introducing a chemical reagent of greater specific gravity than the well fluid into the casing without releasing said pressure, said reagent being capable of reaction with the producing formation, and closing the top of the tubing and casing until the reagent has reacted with the producing formation.

4. The method of treating deep wells which consists in filling the well casing and tubing with oil until substantial pressure is built up therein introducing a chemical reagent of greater specific gravity than the oil into the casing without releasing said pressure, said reagent being capable of reaction with the producing formation, and closing the top of the tubing and casing until the reagent has reacted with the producing formation.

5. The method of treating deep wells which consists in at least partly filling the well tubing and casing with oil, thereafter introducing a chemical reagent into the well casing, said reagent being of a greater specific gravity than the oil and capable of reaction with the producing formation, and closing the top of the tubing and casing until the reagent has reacted with the producing formation.

RICHARD H. CARR.
HOWARD C. HUMPHREY.