Dec. 20, 1932. R. H. CARR 1,891,667

METHOD FOR FACILITATING THE FLOW OF WELLS

Filed June 30, 1932

Fig. 1.

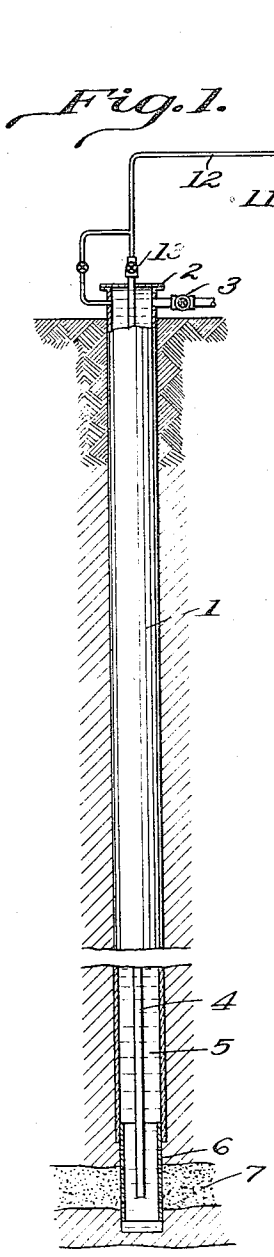


Fig. 2.

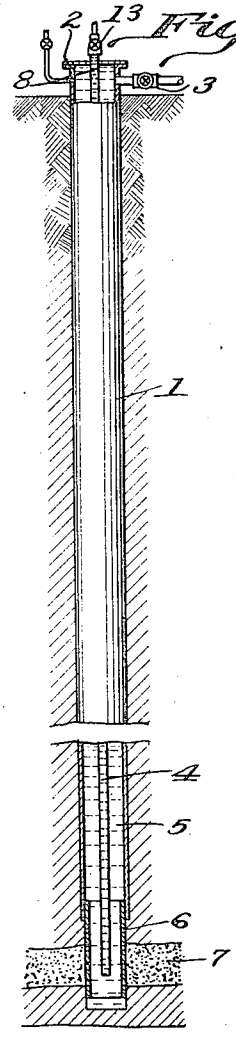
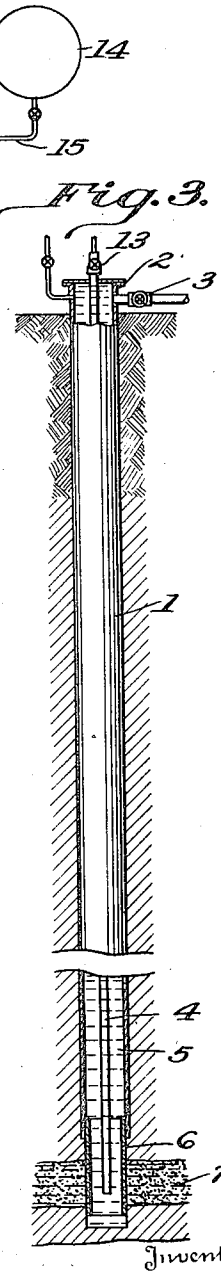


Fig. 3.



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UNITED STATES PATENT OFFICE

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METHOD FOR FACILITATING THE FLOW OF WELLS

Application filed June 30, 1932. Serial No. 620,179.

This invention relates to an improved method for facilitating or increasing the flow of oil, or other desired liquid, into the pumping or producing regions of subterranean wells, especially wells disposed in or producing from lime formations, and it is one of the outstanding objects of the present invention to provide an improved method for effecting the introduction of an acid reagent into the producing regions of such wells whereby to permit the reagent to react with the lime formation to at least partially disintegrate such formations or to increase the pore area to provide for an augmented flow of the desired liquid into the pumping region of the well.

This invention is a continuation-in-part of the disclosures set forth in my prior application, Serial No. 608,147, filed April 28, 1932.

In accordance with the present invention, a well is filled with oil, either by pumping the oil down through the tubing and up through the casing, or by pumping down through the casing and up through the tubing, either of which methods result in the filling of the well with oil and, further, eliminates any gas products which may have accumulated, thereby rendering the well hydrostatically filled and controlled. As soon as the well has been filled with oil, a predetermined amount of an acid reagent is introduced into the well through the tubing and after a sufficient amount of acid has been so introduced to fill the tubing, the casing head at the top of the well is closed. Since the well is full of oil, the acid, being a heavier substance than oil, cannot return upward to the annular space formed between the tubing and casing, the said space being occupied by the oil.

The next step in my process is to displace the acid from the tubing by pumping oil into the tubing. By this means, a sufficient amount of pressure is applied to force the acid from the tubing into the producing formation. A sufficient amount of oil is pumped into the tubing to insure complete displacement of the acid out of the tubing. As soon as the acid has been forced (pumped) into the producing formation, the tubing is shut in and the well left standing for the required period of time to permit complete reaction of the acid with the lime formation.

For a further understanding of the invention, reference is to be had to the following description and the accompanying drawing, in which the steps of my process have been diagrammatically illustrated. In the drawing:

Fig. 1 is a view in vertical section taken through an oil well disclosing the tubing and casing of the latter filled with oil;

Fig. 2 is a similar view disclosing the acid in the tubing of the well;

Fig. 3 is a similar view with the acid displaced from the tubing.

Referring more particularly to the drawing, the numeral 1 designates a casing of an oil well. The numeral 2 indicates the casing head, 3 the control valve therefor, 4 the tubing extending downwardly through the casing and spaced therefrom to produce an annular chamber 5 between the adjacent walls of the tubing and the casing. The bottom of the casing is provided with the usual strainer 6 which is disposed in the liquid producing region 7 in the bottom of the well bore.

In certain oil producing fields, this producing region is disposed in lime formation which obstructs and interferes with the desired flow of liquid into the producing region of the well bore. It has been proposed heretofore, as set forth for example in the patent to Frasch 556,669 to employ hydrochloric or muriatic acid as a means for attacking such lime formation whereby to effect its partial disintegration and hence to provide for an increased flow of oil into the bottom of the well. Considerable difficulty has been encountered heretofore in the matter of insuring the delivery of the acid reagent to the lime formation surrounding the producing region of the well, whereby to render this operation possible and under the control of the well operator. It is therefore to this improved method for introducing the acid into contact with the lime formation that the present invention is specifically directed.

In attaining this result, the well is first

filled with a liquid possessing a lower specific gravity than the acid reagent, oil being particularly suitable and economical for this purpose. In the filling of the well, the oil may be introduced either through the casing or the tubing, in either event, both the casing and the tubing are first filled with liquid in such a manner as to eliminate gas products from the well and to render it hydrostatically controllable.

Following this operation, a desired amount of the acid reagent is introduced into the tubing to substantially fill the same as indicated at 8 in Fig. 2. As shown in the drawing, the acid may be retained within a tank 9 provided with a valved outlet line 10 which leads to the inlet side of a pump 11, the outlet side of said pump being connected by means of a line 12 provided with a control valve 13 with the upper end of the tube 4. As soon as a sufficient amount of acid has been introduced into the tubing, the outlet valve 3 of the casing head is closed, and since the well is full of oil and the acid being a heavier substance than oil, the acid settles to the bottom of the well with the oil above the same, the escape of the oil being prevented by the closing of the casing head outlet.

The next step is to displace the acid from the tubing which is preferably accomplished by pumping an additional quantity of oil into the tubing. This oil may be withdrawn from an oil tank 14 and passed through a valved line 15 to the inlet side of the pump 11 and thence through the line 12 to the tubing. This results in the application of a sufficient amount of pressure to positively force the acid from the tubing into the lime formation as at 7, thus insuring complete displacement of the acid from the tubing. As soon as the acid has been forced into the lime formation, the valve 13 is closed and the well is left standing for a sufficient period of time to permit complete reaction of the acid with the lime formation. After this, the well may be produced in the usual manner to remove the desired liquid therefrom.

What is claimed is:

1. The method of treating oil wells having producing regions disposed in lime formations, which consists in filling the casing and tubing of the well with oil to eliminate gas pockets therefrom, introducing a chemical reagent into the tubing of the well and to displace the oil ordinarily contained in the tubing, confining the oil in the space provided between said tubing and casing to prevent the escape of the oil from said space, displacing the acid from the tubing by applying a liquid under pressure thereto, whereby said agent is disseminated in the lime formation of the well, and closing the outlets of the tubing and the casing for a sufficient period of time to permit the acid reagent to react with the lime formation.

2. The method of increasing the pore spaces leading to the bores of oil wells producing from lime formations, which consists in providing such a well with an outer casing and a tubing extending therethrough, the upper ends of the tubing and casing being provided with valve passages, filling the casing and the tubing with a column of oil in such manner as to substantially eliminate gas from the oil column, introducing a chemical reagent heavier than oil into said tubing, and closing the valve passage leading from the casing and applying pressure to the reagent in the tubing whereby to force the latter under such pressure into the pore regions of the lime formations.

3. The method for facilitating the flow of oil into wells disposed in lime formations, which consists in providing such a well with the usual casing and tubing, introducing into the well a body of oil either by way of the tubing or the casing to fill the tubing and the annular space formed between the tubing and the casing with said oil in such manner as to substantially prevent the presence of free gas in the oil filled casing and tubing, introducing into the tubing an acid reagent capable of reacting with lime to at least partially disintegrate the same and enlarge its pore area, and applying pressure to the reagent in said tubing to displace the latter from the tubing and to force the same into the lime formation.

4. The method for facilitating the flow of oil into the bore holes of wells disposed in lime formations, which consists in providing such a well with the usual casing and tubing, introducing into the well a body of oil either by way of the tubing or the casing to fill the tubing and the annular space formed between the tubing and the casing with said oil in such manner as to substantially prevent the presence of free gas in the oil filled casing and tubing, introducing into the tubing an acid reagent capable of reacting with lime to at least partially disintegrate the same, applying pressure to the reagent in said tubing to displace the latter from the tubing and to force the same into contact with the lime formations, and, during the application of pressure to the reagent in the tubing, retaining the oil against escape in the annular space formed between the tubing and the casing.

5. The method of increasing the pore spaces leading to the bores of wells producing from a formation soluble in a chemical reagent, which comprises in providing such a well with an outer casing and a tubing extending therethrough, the upper ends of the tubing and casing being provided with valve passages, filling the casing and the tubing with a column of liquid in such manner as to substantially eliminate gas from the liquid column, introducing said chemical reagent heav-

ier than the liquid and immiscible therewith into said tubing, and closing the valve passage leading from the casing and applying pressure to the reagent in the tubing whereby to force the latter under such pressure into the pore regions of the formation.

6. The method for facilitating the flow of wells disposed in formations soluble in chemical reagents, which comprises providing such a well with the usual casing and tubing, introducing into the well a body of liquid either by way of the tubing or the casing to fill the tubing and the annular space formed between the tubing and the casing with said liquid in such manner as to substantially prevent the presence of free gas in the liquid filled casing and tubing, introducing into the tubing a chemical reagent heavier than said introduced liquid and immiscible therewith and capable of reacting with the formation to at least partially disintegrate the same and enlarge its pore area and applying pressure to the reagent in said tubing to displace the latter from the tubing and to force the same into the formation.

In testimony whereof I affix my signature

RICHARD H. CARR.