

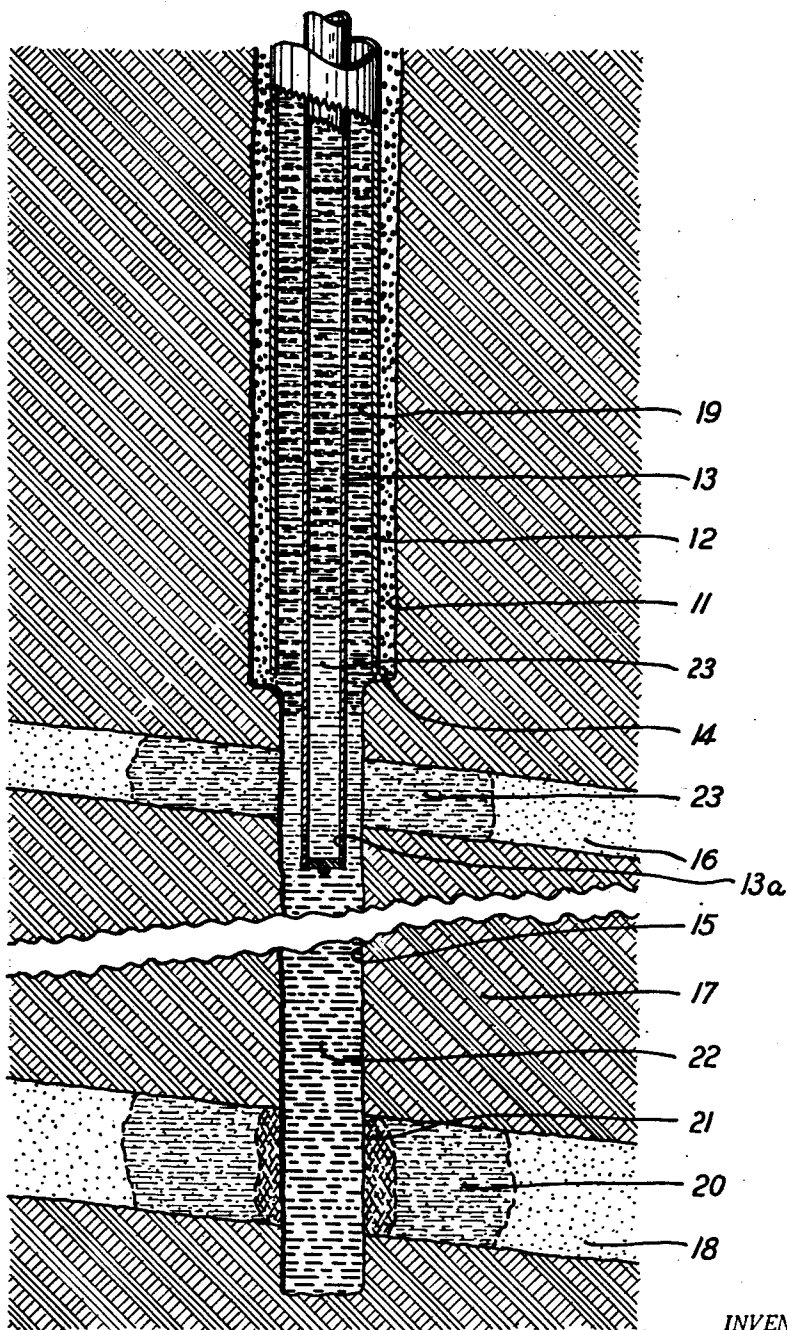
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ACID TREATMENT OF WELLS

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ACID TREATMENT OF WELLS

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3 Claims. (Cl. 166—21)

This invention relates to the acidizing of oil wells and more particularly to means and methods for treating separated earth formations with acid.

5 In the acidizing of oil wells it often happens that two or more layers of oil-bearing formations are separated by some rock or sand which does not bear oil. If all of these strata are treated with acid undesirable results are obtained, in that the non-bearing formation is rendered porous with the oil-bearing formation, and this often results in water being mixed with the oil or otherwise interfering with the desired increased production of the well.

10 It is an object of the present invention to provide novel means and methods for treating the formation of an oil well in such a way that only the desired portions thereof are rendered more porous or subjected to the action of the reagents.

15 It is another object of the invention to devise novel means and methods for plugging one oil-bearing formation while another adjacent thereto is subjected to acid or other reagent.

20 Other objects and advantages reside in certain novel features of the reagents and methods used, as will be apparent from the following description taken in connection with the accompanying drawing, in which:

25 The single figure is a diagram representing a vertical cross-section of the earth and showing an oil well with two oil-bearing formations therein.

30 Referring to the drawing in detail, it will be seen that an oil well is there shown as comprising a bore hole 11 having a casing 12 therein and a tubing 13. The casing may be cemented in position, the cement being designated 14.

35 Beneath the lower end of the casing the well bore may extend into oil-bearing formation. This portion of the bore is designated 15 and is shown passing downwardly through an upper oil-bearing formation 16, a non-bearing formation 17 and a lower oil-bearing formation 18.

40 Assuming that it is desired to treat both the upper formation 16 and the lower formation 18 without causing acid or other reagent to attack the intermediate formation 17 the following method or process may be adopted:

45 The entire well bore, including the casing 12 and the tubing 13, is first filled with oil or other substantially non-compressible fluid. This oil is indicated in the casing 12 at 19.

50 Acid, as for example hydrochloric acid, is then pumped into the tubing 13 by means of a pump not shown, and is forced downwardly through

the tubing 13. During this step the casing head at the top of the well is opened to allow the oil to flow ahead of the acid downwardly through the tubing and upwardly through the casing. This step continues until the acid reaches the lower end of the tubing 13. The casing head is then closed and the pumping continued, thus forcing the acid into the lower formation 18. This action takes place because the acid, upon entering the portion 15 of the well bore which is filled with oil, sinks under the action of gravity to the bottom of this bore and is accordingly forced under the pressure of the pump and the hydro-static column of liquid into the formation. It is also to be noted that the acid enters slightly below the producing formation 16. The oil above the lower end of the pipe 13 prevents the entrance of acid into the formation 16 at this time. To assist the acid in entering the oil properly, the lower end of the tubing 13 is preferably provided with a perforated section at the bottom, as shown at 13a, the lower end of this section being plugged.

25 After sufficient acid has been forced into the formation 18 in this manner, as diagrammatically illustrated at 20, a quantity of soap solution is forced into the lower formation 18, as diagrammatically illustrated at 21.

30 It will be apparent that if the formation 18 is calcareous in nature the hydrochloric acid supplied therethrough will soon react with the formation and produce a salt, as for example calcium chloride. As soon as the soap solution represented at 21 contacts with the calcium chloride in the formation 18 a precipitate will form, thus forming a temporary plug. In addition to the calcium chloride or other salt formed in the formation, however, it is desirable to add an additional quantity of calcium chloride to the portion 15 of the bore hole, this being diagrammatically represented at 22.

35 The quantity of calcium chloride added should be sufficient to fill the lower portion of the well bore up to a point just below the upper oil-bearing formation 16. In this way any subsequent acid forced through the tubing 13 will not come in contact with the formation 17 or the formation 18, these being blanketed off by the solution 22 which is held in position by the plug formed by the precipitate resulting from the reaction of the soap solution with the calcium chloride.

40 If now an additional quantity of acid is forced downwardly through the tubing 13 it will flow

into the upper formation 16. This body of acid is indicated at 23 in the drawing.

After the acid is allowed to remain in the upper formation for some time to react with it, the fluids may be removed from the well by pumping, swabbing or the like. It is to be noted that as soon as the pressure in the well bore is reduced the oil in the formations 16 and 18 will tend to flow into the well. In so doing, the oil will react with the calcium salts which constitute the precipitate of the soap with the calcium chloride to dissolve the same and thus remove the temporary plug 21.

The arrangement is such that the blanketing solution 22 may be of a low specific gravity and if desired water may be used for the blanketing solution in as much as there will be little tendency for the body of acid 23 to flow downwardly therethrough. It is desirable, however, to use calcium chloride since this reacts with the soap solution to form a more effective plug by precipitation. Regardless of what fluid is used for the blanket, it cannot travel into the lower formation 18 because of the presence of the plug 21 and merely remains stagnant during the treating of the upper formation 16.

It is of course within the purview of the invention to employ other than hydrochloric acid or to use hydrochloric acid which has been treated to increase its penetrating power into the formation, as disclosed in the co-pending application of Paul Menaul, Serial No. 96,457, filed August 17, 1936, for Treatment of wells, and it is also within the purview of the invention to protect the metal parts in the well during the acidizing thereof by some electrical means as, for example, that described in the co-pending application of Paul Menaul, Serial No. 77,945, filed May 5, 1936, for Method and apparatus for handling acidic solutions.

It is known that certain soap solutions combine with calcium chloride to form precipitates and that such precipitates may be used in treating an oil well to separate oil-bearing formations from water-bearing formations. This is disclosed in the patent to Vietti, No. 2,024,119. The present invention is not concerned with permanently separating oil- from water-bearing formations but with the provision of a temporary spacing blanketing solution between two or more oil-bearing formations. Various soap solutions may be used in accordance with the invention so long as the precipitate formed is readily soluble in crude oil.

While only one embodiment and/or method of practicing the invention has been described herein, it is obvious that various changes may be made without departing from the spirit of the invention or the scope of the annexed claims.

I claim:

1. The method of treating wells having separated formations bearing oil or the like which includes the steps of first treating the lower formation with an agent capable of reacting therewith to form a salt, then effectively but temporarily plugging said lower formation by supplying a substance thereto capable of forming an oil soluble precipitate with said salt, adding additional salt solution to the well above the plug so formed to fill the well up to a level near the next higher oil-bearing formation, treating the said higher formation with an agent capable of reacting therewith, dissolving the plug by bringing oil in contact with the precipitate thereof and removing the resultant fluids from the well.

2. The method of treating wells having separated basic formations bearing oil or the like which includes the steps of treating the lower formation with an acid to form a salt, supplying a soap solution to the lower formation to cause the forming therein of an oil soluble precipitate as the result of the reaction with said salt, adding additional salt solution to cause further reaction with the soap solution and additional precipitate and at the same time form a blanket between the lower formation and the next higher oil-bearing formation, treating the upper formation with acid, dissolving the precipitate in the lower formation by supplying oil thereto and removing the resultant fluids from the well.

3. The method of treating wells having a plurality of separated oil-bearing formations containing lime which includes the steps of supplying hydrochloric acid to one of said formations to form calcium chloride solution therein, then plugging said formation by supplying a soap solution to said formation to cause the forming of an oil-soluble precipitate therein as the result of the reaction of said soap solution with said calcium chloride solution, then treating another formation with hydrochloric acid by using the plug formed in the first mentioned formation as an aid in localizing the body of acid in the desired formation, dissolving the plug by supplying oil to the first mentioned formation and removing the resultant fluids from the well.

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