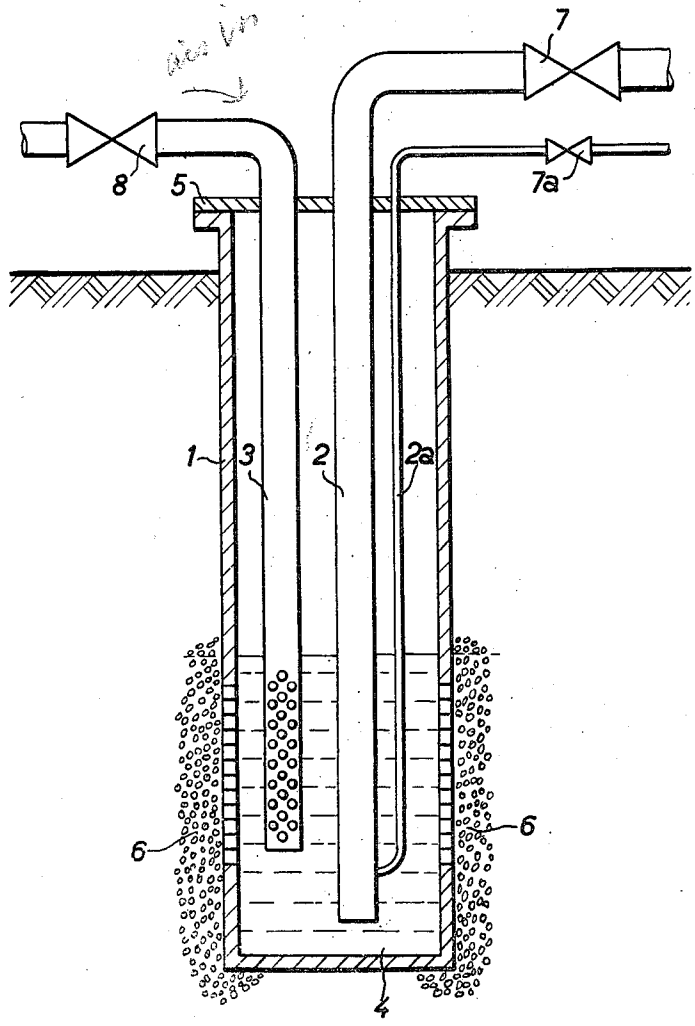
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METHOD FOR FORMING AND RENEWING WELLS

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METHOD FOR FORMING AND RENEWING WELLS

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The present invention relates to a method of and a device for forming, maintaining and renewing wells; more particularly the invention concerns the treatment of strata and filter beds surrounding a well bore for the purpose of facilitating flow of fluid.

After making a well and delivering filter gravel into the borehole the well has to be cleaned from sand and mud which is achieved by pumping. Adequate formation of the strata adjacent the filter bed so as to secure operation of the well without interference by sand for a number of years is attained only by pumping. For this purpose there has been used up to the present the well-known air-lift pump which apart from delivering water or oil, gives rise to an adequate formation about the well bore on account of its pulsating manner of action.

The production rate of wells which have been operated for prolonged periods, especially those frequently worked at the upper limit of their capacity, is gradually decreased even if the flowing conditions of the ambient oil or water bearing strata have not changed. Such decline or production is believed to be due to the clogging of the filter medium or to an increase in density of the strata in the vicinity of the filter bed which may have various reasons. The afore-described drawbacks can only partly be overcome by the use of an air-lift pump.

It is an object of the present invention to provide a method of forming wells of high capacities. Another object of the invention is to start, maintain and increase the flow of wells by loosening accumulation in the filter pack and the producing strata. Further objects will become apparent as the following description proceeds.

In accordance with the present invention an especially suitable earth formation is achieved by intermittently causing the fluid in the strata surrounding a well bore to flow back, i. e. in countercurrent to the normal direction of flow. Such intermittent backflow of fluid is effected by producing in the borehole of a well an excess pressure by means of suitable pressure media. The normal inflow of fluid into the borehole is prevented by the excess pressure which forces the fluid to flow back, i. e. away from the well bore. In consequence of the intermittent backflow of fluid the producing strata about the well bore are loosened and the loosened sand and mud particles are substantially removed in the following pumping operation. It has proved to be of particular advantage to employ a pressure gas, for instance air, which by conducting it to the bottom of a well, forms, for instance with the water of the pump sump, a mixture of gas and water under pressure which migrates into and blows through the adjacent strata.

The present invention may be carried into effect by locating in the well casing an air-lift pump and a scavenging duct which is perforated at its lower part, and introducing gaseous material, for instance air, under pressure, into the scavenging duct. When the air-lift pump is at rest and the well casing hermetically sealed, the mixture of gas and water formed in the sump of the well is forced to migrate into the surrounding strata

through the well tubing which is perforated at that part adjacent the oil or water bearing strata. The compressed air expands laterally away from the well bore and draws the major part of the small-sized particles, mud and fine sand, from the gravel pack. By releasing the pressure in the scavenging duct and rendering the air-lift pump operative the backflow of fluid in the strata about the gravel pack is stopped and the normal inflow of fluid into the borehole is recovered. Any residual mud and sand particles are carried along by the normal flow of fluid and deposited at the bottom of the well bore from where they are delivered to the surface of the earth by inducing upward flow in the pump. By periodically repeating the afore-described procedure, the filter pack and the water bearing strata about the gravel are continually and thoroughly loosened and cleaned, permeability of the filter bed and the strata being thus improved.

In the accompanying diagrammatic drawing which illustrates one embodiment of the invention by way of example, the figure is a sectional view of a well bore in which the filtering tube 1 is extended into the water bearing strata and is closed at the bottom 4. That portion of the casing adjacent the water bearing strata is perforated. The well shaft may also be lined with bricks. Pipe 2 which is open at the bottom, extended into the well bore and connected to the air intake 2*a*, is the stand pipe of an air-lift pump. The pipe 2 may also be used as the suction pipe of any other desired type of pump. The scavenging duct 3 is further installed in the well bore. Exclusion of air is secured by air-tightly leading all the ducts through plate 5 which hermetically seals the filtering tube 1. Back-flow of fluid is started by closing the slide valves 7 and 7*a* and introducing air under pressure into the scavenging duct 3 through slide valve 8. The excess pressure thus produced in the well bore forces the air-water mixture formed at the bottom 4 of the filtering tube 1 to migrate into the filter pack 6 and the surrounding strata which are thus loosened. By closing the slide valve 8 and opening the slide valves 7 and 7*a* water is delivered to the surface through the stand pipe 2 by the action of the air-lift pump; water is again allowed to flow into the well bore. Together with the inflow of water fine, residual materials are drawn from the strata which have been loosened by the previous blowing action of the mixture of water and air. The alternate flow and backflow of fluid is continued until the water delivered to the surface no longer shows a marked turbidity or no longer contains noticeable amounts of sand or mud. Delivery of water may also be effected by means of an ordinary pump, however, the pulsating action of the air-lift pump has proved to be especially suitable for formation and recovery of circulation.

The increase in the production rate of a water well achieved according to the invention amounts to 20–300 percent depending upon the local conditions. The herein described method can also successfully be adapted to improve the production of seepage wells after the pore spaces and channels of the filter pack have become clogged with mud or oil. Furthermore, the invention offers the possibility of withdrawing sand from wells even in such cases where the previously known methods failed to be successful.

The herein described method may not only successfully be adapted to start anew and to increase flow of failing wells or to maintain wells in flowing condition, but is particularly suited for forming new wells. Under certain conditions, for instance in the case of strata of sand or gravel, it is practicable according to the invention to withdraw smaller and smallest soil particles from each water bearing stratum areally and to allow or to facilitate the inflow of fluid into the well bore areally. Another advantage achieved according to the invention consists in that

the costs of building new wells are substantially reduced on account of the improved production rate which permits of making less deep-going well bores or boreholes of a smaller diameter.

Though the method and device of the invention have been described with specific reference to water wells the invention is by no means intended to be restricted thereto but may also successfully be adapted to start, renew, maintain and increase the flow of oil wells, brine wells and mineral water wells. According to a special embodiment of the invention the production of a well can still further be increased by addition of suitable chemical substances which are capable of dissolving or loosening the strata and filter packs clogged with sand, mud or other materials. Chemical substances suitable for said purpose are, for instance, inorganic acids, such as hydrochloric acid, sulfuric acid, nitric acid, and hydrofluoric acid; furthermore, some organic acids forming water soluble salts, for instance oxalic acid and acetic acid. Solvents, especially organic solvents, for instance alcohols, hydrocarbons and chlorinated hydrocarbons, are likewise suitable to bring about the desired effect. Further suitable chemical substances are oxidizing agents, for instance potassium permangeanate, hydrogen peroxide, oxygen and substances splitting off or yielding oxygen. The loosening effect of the oxidizing agent in the strata and filter packs is not only due to the dissolution of the materials clogging the strata and the gravel but also to a partial combustion and to an increase in temperature and pressure occurring by introducing the said oxidizing agents. Furthermore, it is practicable to use mixtures of the substances suitable according to the invention. The aforesaid chemical substances may be added to the fluid present at the sump of the well bore either before or during introduction of the pressure material.

We claim:

1. A method of increasing the flow of liquid in wells which comprises introducing a gaseous pressure medium into the lower portion of a sealed, perforated, well-casing containing liquid therein, said gaseous medium being introduced in short, rapid pulses to produce a rapid, alternating flow of a mixture of gaseous pressure medium and liquid through the perforations of the well-casing into the surrounding earth strata to form a mixture of liquid and residual materials and to return said mixture of liquid and residual materials from the earth strata into the well-casing, halting the introduction of said gaseous pressure medium into the well-casing, thereafter withdrawing the mixture of liquid and residual materials from the well-casing, and periodically continuing the above cycle of operations until the liquid withdrawn from the well-casing is relatively free of residual materials.

2. The method of claim 1 wherein compressed air is employed as the gaseous pressure medium.

3. The method of claim 1 wherein acids are added to the liquid in the well-casing before it flows into the earth strata.

4. The method of claim 1 wherein oxidizing agents are added to the liquid in the well-casing before it flows into the earth strata.

5. The method of claim 1 wherein organic solvents are added to the liquid in the well-casing before it flows into the earth strata.

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