

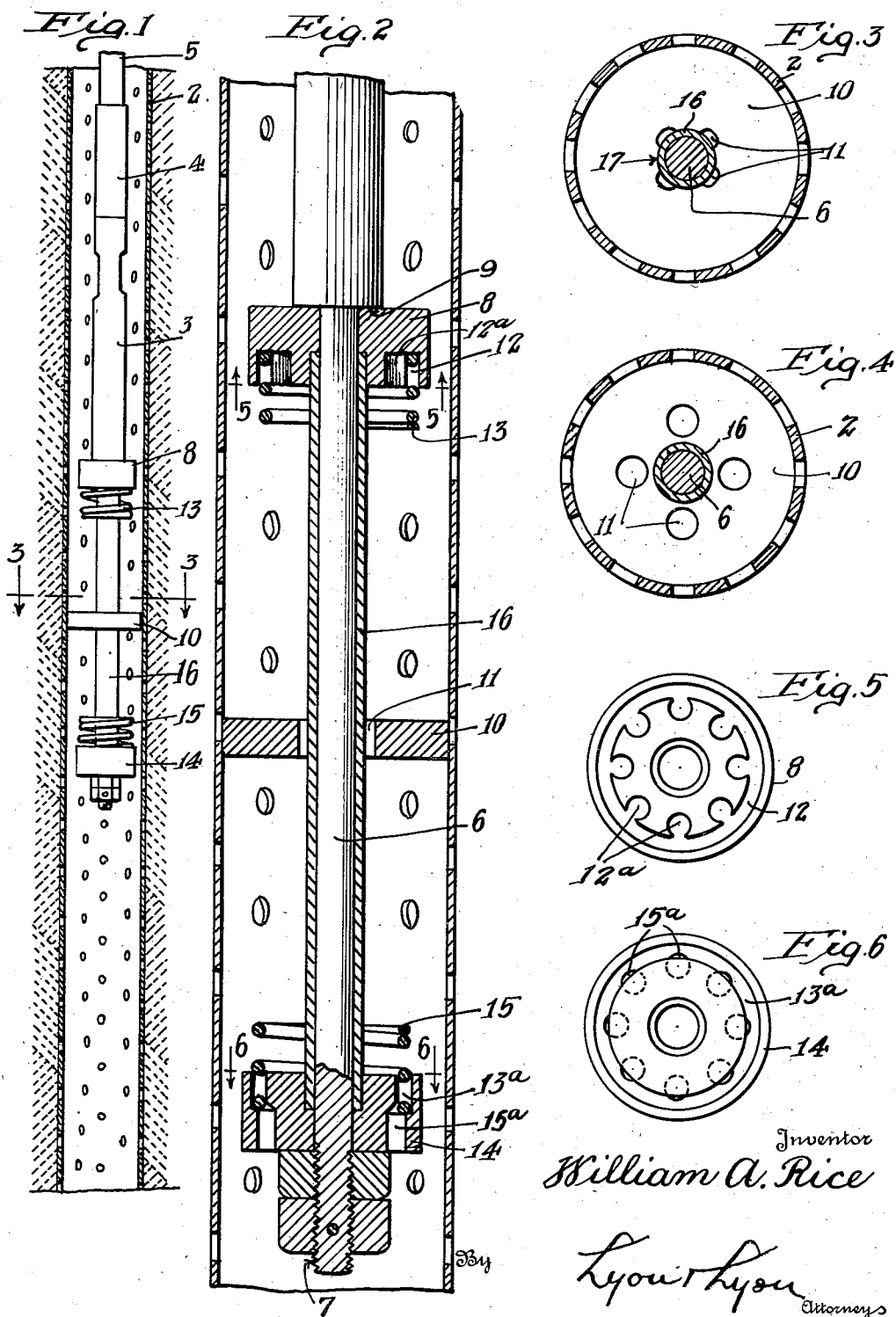
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APPARATUS FOR DEVELOPING WELLS

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APPARATUS FOR DEVELOPING WELLS

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4 Claims. (Cl. 166—20)

This invention relates to apparatus for developing wells.

Various apparatuses have been employed in the past for the purpose of cleaning a well of sand, clay, and the like, but these apparatuses have all generally relied on the principle of bailing or removing any sand or clay entering the well. In the apparatus of the present invention, a different and novel principle of operations is employed.

In accordance with the operation of the apparatus of the present invention, in place of attempting to clean the well by initially removing sand or clay from the well, the apparatus of the present invention depends on means to deliberately draw into the well pipe all of the sand and clay in the formation adjacent the perforated section of the pipe. This sand and clay is allowed to first settle into the well and subsequently may be bailed or otherwise removed from the well. The operations are continued forcibly drawing into the well casing sand or clay through the perforations of the casing and removing the same until all of the loose sand and clay in the formation surrounding the casing have been drawn into the well casing. By so conditioning the well, it is found possible for the well thereafter to be placed on production and produce a clean fluid without subsequent sanding of the well, at least for very substantial and unusual periods of time. It is also found that wells, the flow of which has greatly deteriorated from use, may be conditioned by the apparatus of the present invention through deliberately drawing into the well casing under forced conditions all of the loose sand and clay surrounding the casing and then removing the same from the well casing. The well will thereafter flow freely and produce a clean fluid frequently at rates exceeding the production of the well when it was first completed.

In accordance with the process and apparatus of the present invention, the cleaning of the well is effected by means and operations performed so as to both force the fluid into the well casing through the perforations from the formation and also simultaneously to force the fluid out of the well casing to the formation through other perforations in the well casing so as to cause the fluid in the well casing to in effect circulate from within the well casing out in the formation and into the well casing. I thereby establish circulation of fluid such as will operate to draw into the well casing any of the loose sand and clay in the formation adjacent the perforations, and also to clean the perforations and

formations of clay and sand. Simultaneously, the clay or sand drawn into the well casing is passed from the apparatus to the bottom of the well, so that the sand or clay will not hamper the operation of the apparatus.

The present invention, together with various objects and advantages thereof, will best be understood from a description of a preferred form of an apparatus for cleaning wells embodying the invention, and for this purpose I have hereinafter illustrated, in connection with the accompanying drawing, such a preferred form of an apparatus embodying the invention.

In the drawing:

Figure 1 is an elevation showing the apparatus installed in the well hole indicated in a vertical section.

Figure 2 is an enlarged vertical section of the apparatus.

Figure 3 is a section on the line 3—3 of Figure 1.

Figure 4 is a similar section as in Figure 3 showing a modified form of disc.

Figure 5 is a section on the line 5—5 of Figure 2.

Figure 6 is a section on the line 6—6 of Figure 2.

Referring to the drawing, 2 generally indicates a perforated casing installed in a well hole. The perforations of such casing may, in the case of water wells in certain cases, extend to the surface of the well, or only portions of the casing may be perforated. Within the well casing is indicated a developing apparatus, which includes the body member 3 which is indicated as connected at its upper end by a coupling 4 to a means 5, such as drill cable or the like, which extends to the surface of the well and may be used for performing the desired reciprocations of the tool within the well casing, as later described. The body 3 of the tool is indicated as reduced at 6 to provide a rod-like member, the lower end of which is indicated as threaded at 7. An upper disc 8 having a central bore to fit over the rod-shaped section 6 of the body is positioned fitting against the shoulder 9 between the body part 3 and rod section 6 of the body. The disc 8 is a metal disc and in the operations of the apparatus is intended to serve the two-fold function of operating as a stop for a piston disc 10 and as a sort of valve head for inhibiting the flow of fluid through certain openings 11 in the piston member 10.

In case of tools operated in water wells, I generally find it unnecessary to employ springs

in connection with the disc 8. In case of tools intended for oil wells the disc 8 is preferably provided with a recess 12 receiving the end of a coil spring 13, which will serve to hold a piston member 10 away from the disc 8 in lowering and raising the tool. This spring, however, is designed to compress readily under the quick up and down actions in the operation of the device, so as to allow the piston member to seat against the disc 8. The recess 12 of the disc 8 communicates with certain somewhat circular shaped recesses 12^a, which serve to facilitate dropping of sand or gravel from the disc 8. At the lower end of the rod-shaped portion 6, there is provided a second disc 14 similar to the upper disc 8, and it is likewise preferably provided with a coil spring 15 and with a recess 13^a receiving the coiled spring. There are preferably provided passages 15^a through the disc 10 for any sand collecting in the spring chamber 13^a. The upper disc 8 and lower disc 14 are spaced a suitable distance apart, preferably in the neighborhood of two or three feet, and are so spaced by a sleeve 16 surrounding the rod 6 and abutting at its opposite end the discs 8 and 14. The discs 8 and 14 are preferably made to have an outer diameter such as to approach within a short distance, for example 1½ inches, of the inner face of the well casing 2.

The piston member 10, which is indicated as mounted between the discs 8 and 14, has an inner bore 17 to fit closely to the sleeve 16 and has an outer diameter such as to very closely approach and perhaps be pressed against the inner face of the casing 2. This member 10 acts in the nature of a piston in the apparatus and also as a valve for the control and passage of sand in a manner later to be described. For the purpose of passing sand, it is provided with openings 11 which are so disposed that said openings will be covered whenever the member 10 is brought against either of the discs 8 or 14. The member 10 is preferably made of some suitable packing material of proper design to render the same somewhat stiff or rigid—for example, heavy belting material of suitable thickness. The process of cleaning and developing wells embodying the present invention and the operation of the apparatus are as follows:

The apparatus is lowered into the well hole and the well casing preferably cleaned commencing with the top portion of the perforations of the well casing; only a portion of the well casing being cleaned at one time. Thus, in the preferred operation of the apparatus the device is lowered to about the level of the uppermost perforations of the casing 2. It is then reciprocated through a suitable stroke, such as a few feet, and in such reciprocating actions performs as follows:

At the commencement of the down-stroke the piston member 10 may be considered as resting against the lower stop disc 14, and at the commencement of the stroke the remainder of the apparatus is lowered while the piston member 10 moves but slightly until it contacts the upper stop disc 8. This motion causes some force to be imparted to the fluid within the well casing to force the fluid below the piston 10 out through the perforations of the casing into the formation and to draw the fluid from the formation through the perforations into the well casing above the piston 10, thereby starting the circulation of fluid out of the well casing, into the formation, and back into the well casing. When the upper disc 8

strikes the piston member 10 there is a considerable shock imparted to the fluid so circulating, due to the sudden acceleration of the movement of the member 10 and the closing of its openings 11 by the disc 8. Such shock is effective in breaking loose sand and clay which is clogging and closing the perforations of the well casing, and also effective in breaking away from the formation sand and clay which in later use of the well casing might become drawn into the well casing. The further movement of the apparatus during the down stroke is then carried out with a positive forced circulation of fluid below the piston member 10, out of the perforations of the casing 2, through the formation and back into the well casing through the perforations above the member 10. After a suitable down-stroke of the apparatus it is given an upward stroke, reversing the motions. During the first part of the up-stroke and while the piston member 10 is passing between the two stop discs 8 and 14, it will be seen that any sand or clay which has been brought into the well casing above the disc is now free and actually forced down through the piston 10 at its openings 11, where it can settle to the bottom of the well casing. When the member 10 strikes the lower disc 14 on the up-stroke there is again a shock or a blow imparted to the circulating fluid to facilitate a positive movement of any sand or clay around the perforations into the well casing below the piston 10.

The reciprocations of the apparatus are continued opposite the upper portion of the formation for a suitable period of time to fully draw into the well casing any sand or clay outside of the casing 2 which would otherwise enter the well casing in subsequent use of the well casing and to at the same time forcibly clean the perforations of any bridgements of clay and sand. If it appears that sufficient sand and clay has been brought into the well casing to render removal thereof desirable, the sand or clay so drawn into the well casing may be withdrawn by any usual or preferred type of sand bailer or other equipment. After this operation the apparatus may be again installed in the well casing and lowered to a succeeding lower portion of the well hole for cleaning the casing perforations opposite such portion of the well hole and the formation in such portion of the well hole of sand and clay. In other cases, it may be unnecessary to remove sand or clay from the well casing until completion of the cleaning operations, or only after successive depths of the well hole have been cleaned. The process is continued reciprocating the apparatus opposite each portion of the well hole to be cleaned until the lowermost portion thereof has been entirely cleaned. In certain cases, it may be desirable to make a further check on the cleaning of the well, in which case the apparatus is returned to the top of the perforated portion of the well casing and again operated with subsequent running of the sand bailer to determine whether the second operation of the apparatus is effective for drawing into the well casing any further sand or clay.

Following development of the well hole in the manner thus described, many advantages are thereby attained. For example, in connection with newly completed water wells the use of the process herein described is effective to enable a water well to be placed immediately on production. It will insure that the water withdrawn from the well hole is clean even in its initial operations. Moreover, the deterioration of the

pumps installed in the well for pumping sand and clay is thereby completely avoided. Furthermore, the capacity of the well is materially increased over what its capacity would otherwise be. Likewise, old water wells the flow of which has been in the course of time materially reduced or in some cases practically stopped can be developed by the process and apparatus of the present invention to the point where the well may produce with good capacity clean water frequently at rates exceeding the original production of the well. Likewise, in connection with oil wells which have become sanded and the flow of which has been retarded for these reasons the well may be cleaned of sand and production again established with marked advantages.

It is particularly noted that the operation of the apparatus of the present invention is effective not only in cleaning the perforations of the casing and cleaning sand out of the well casing, but is also effective in working back into the formation surrounding the well casing so as to effectively draw from a considerable area outside of the well casing all of the loose sand and clay which later operation of the well might cause to enter the casing. In this way, the development of the well insures a long free flow of fluid into the well casing.

While the particular apparatus herein described is well adapted to carry out the objects of the invention, it is to be understood that the apparatus of the present invention is capable of considerable modification, and the invention includes all such modifications and changes as come within the scope of the appended claims.

I claim:

1. A well developing apparatus, comprising a

body member mounting spaced stops, a piston member slidably mounted by said body member for movement between said stops, said piston member having by-pass openings adapted to be closed by contact between said piston member and said stops.

2. A well developing apparatus, comprising a body member having a rod-like portion, stop discs mounted at opposite ends of said rod-like portion, a piston member slidably mounted by said rod-like portion and adapted to move into contact with said stop discs, said piston member having openings therethrough for passage of sand or clay which openings are arranged to be closed upon engagement with either stop disc.

3. A well developing apparatus, comprising a body member having a rod-like portion, stop discs mounted at opposite ends of said rod-like portion, a piston member slidably mounted by said rod-like portion and adapted to move into contact with said stop discs, said piston member having openings therethrough for passage of sand or clay to be closed by engagement of said piston member with either stop disc, such stop discs having spring means for cushioning the impact between the piston member and said stop discs.

4. An apparatus for developing well holes, comprising means for mounting a piston member within the well hole, said means including means for maintaining stop members spaced apart to be brought into alternative striking action with said piston member, said piston member being movably mounted on said means between said stops and having sand and clay by-pass ports arranged to be closed on contact between said piston member and either of said stops.

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