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R. NEBOLSINE

2,375,865

APPARATUS FOR UNDERGROUND WATER STORAGE

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2 Sheets-Sheet 2

FIG. 4.

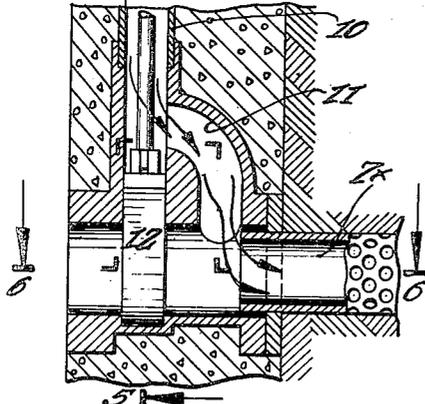
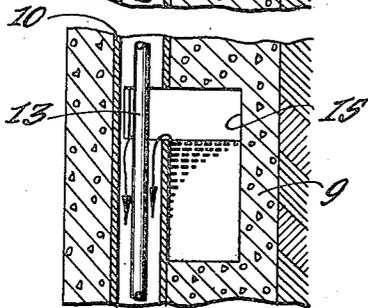
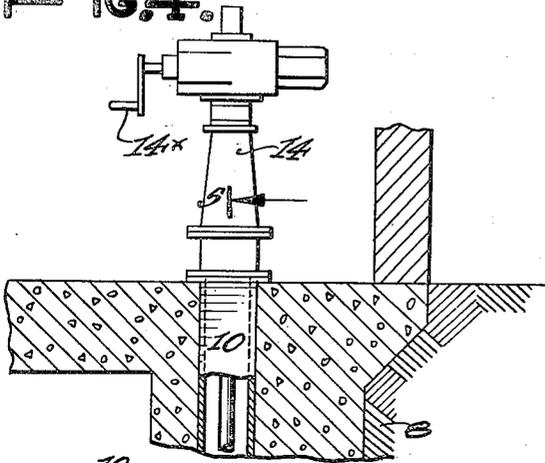


FIG. 6.

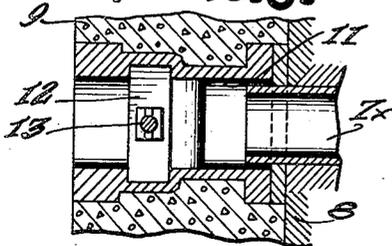


FIG. 5.

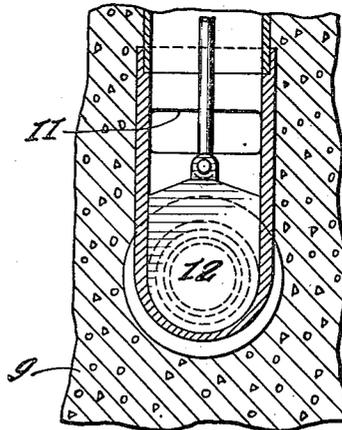
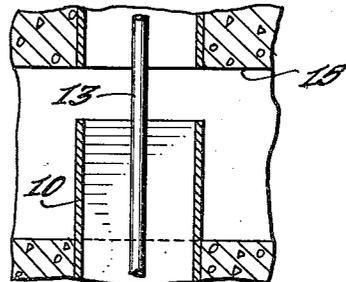
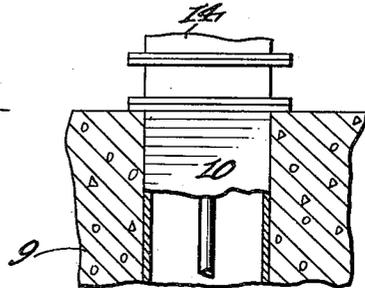


FIG. 7.



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APPARATUS FOR UNDERGROUND WATER STORAGE

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2 Claims. (Cl. 166-1)

It has heretofore been proposed to collect surface water such as stream flow or excessive water after heavy rains in arid regions and to convey the same to underground reservoirs installed with lateral conduits for widely distributing and storing water underground for later use, as in dry seasons, or, for more intensive requirements at any time, by pumping the water out of these reservoirs. An obstacle to such proposed installations is in the stoppage of the underground laterally disposed conduits and clogging of the porous adjacent soil or rock due to the accumulation of fine silt and other solid materials. Thus when the lateral conduits, hereinafter termed horizontal wells or well points, are casings provided with slots or perforations or the passageways are drilled in porous rock, these conduits or passageways with more or less rapidity become closed and thus prevent or substantially retard further supply of water to the underground formations and also return flow.

It is the object of the present invention to provide an apparatus for overcoming the aforesaid defects in the operation and structure of any such proposed installations.

The invention will be described with reference to the accompanying drawings, in which:

Figure 1 is a view in vertical section of an embodiment of the invention, employed in unconsolidated material.

Figure 2 is a horizontal section, partly broken away, on the line 2-2, Figure 1, looking in the direction of the arrows.

Figure 3 is a horizontal section, partly broken away, on the line 3-3, Figure 1, looking in the direction of the arrows.

Figure 4 is an enlarged view in sectional elevation, showing the valve control for one of the lateral passageways.

Figure 5 is a view in vertical section taken at right angles to the view shown in Figure 4, and on the line 5-5.

Figure 6 is a horizontal section on the line 6-6, Figure 4, looking in the direction of the arrows.

Figure 7 is a schematic view showing a modified installation as may be used in consolidated material such as sand stone or limestone.

Referring to Figure 1 of the drawings, I have indicated at 8 a relatively soft or unconsolidated formation which either throughout or in the lower sections may be porous.

Into this earth there has been formed an underground chamber. The depth of the chamber will be determined by the depth from the sur-

face of the ground or operating level to the level of the porous formation which is to be dealt with. Thus the chamber may be upwards of 200 feet in depth and may be less in accordance with the particular condition met with.

The inner face of the chamber has been, in the embodiment illustrated, encased with a relatively thick concrete material as indicated at 9, the closed base being indicated at 9x. In the illustrated embodiment the chamber is circular in cross section and extending vertically through the concrete facing 9 are a plurality of vertical passageways or conduits 10 and each of the conduits 10 leading at its lower end to a valve casing 11 adapted to be controlled by a valve head 12. To each valve head 12 is connected an operating rod or stem 13 which passes upwardly through the passageways or conduits 10 and is connected in any suitable manner to operating mechanism generally indicated at 14. Any suitable means for raising and lowering the valve head 12 may be employed, the member 14 indicating at 14x a handle for manually actuating the mechanism. In actual practice, it will be desirable to effect the raising and lowering of each valve head selectively by power controlled through some automatic control means, such means not being, however, a part of the present invention.

Surrounding the passageways or conduits 10 is preferably a circular header or manifold indicated at 15, each passageway or conduit 10 being apertured at the header or manifold to receive a water discharge therefrom.

Communicating with the header or manifold 15 is an incomer pipe or supply line 16 which conveys the raw water supply either by natural gravity or pump pressure to the header or manifold. In practice, this raw water may first be treated to remove at least a substantial part of the suspended matter, or otherwise be treated.

The raw water discharges into the vertical passageways or conduits 10 and when the valve heads 12 are in lowermost position, as in Figure 4, the water will flow through a bypass in the valve casing at the side of the valve head, in each case, and thence into the appropriate horizontal well or well point, these latter being numbered 1x to 12x inclusive, in Figure 3. The horizontal wells or well points 1x to 12x will be casings when unconsolidated ground material lies at such areas, and perforated or otherwise formed, to permit the outflow and inflow of water, although, where in such areas the surrounding material is porous rock, the said horizontal wells

may consist of passageways drilled or excavated into that rock.

Vertically extending into the underground chamber A is a pump or suction column 17 which may be equipped with a screen 18, in Figure 1 there being indicated at 19 the base of a pump and at 20 an outlet pipe for leading the water to a place of distribution and use. Also leading downwardly within the said chamber is a pump or suction column 21 at the top of which is indicated the base of a pump 22, column 21 having an outflow pipe 23, for waste as later described.

The primary purpose of column 21 is to remove from the chamber water carrying suspended solids in a manner or at times of operation to be hereinafter explained.

The characteristic of my method is to successively reverse the operation of each horizontal well or well point to insure that none of the horizontal wells or well points or the adjacent porous formation will be progressively clogged with silt or other suspended matter. To that end the horizontal wells or well points may be taken in rotation, starting with 1x.

By reference to Figure 1, it will be seen that the valve head controlling the flow of water to horizontal well or well point 1x from the circular header or the manifold 15 has been raised, shutting off such flow and simultaneously opening said horizontal well or well point to the interior of the chamber A. The remaining wells or well points continue to receive the supply of water and this and the previous supply of water creates a static pressure which compels the flow of water through horizontal well or well point 1x into the chamber A. The water will, of course, rise above the intake end of column 21 and the operation of the pump applied to said column will control up to a certain point the rate at which the water is discharged through horizontal well or well point 1x into chamber A. This preferably should be for a short time, at a more intensive rate than the rate of flow into the ground formation from any single one of the horizontal wells or well points. When this operation of horizontal well or well point 1x is continued for a sufficient length of time to insure the desired result of cleaning out and flushing of the well or well point itself and the adjacent porous formation, the valve head for member 1x is moved downwardly and the valve head for a successive one of the remaining wells or well points raised to perform another operation similar to the one just described.

In practice it will be desirable to provide an automatic control for progressively and successively performing the described operation and this may readily be done electrically by means well known in the art of electrical valve con-

trols. It will be understood, however, that the control may be manual or mechanical, as distinguished from electrical, if desired.

In Figure 7 I have illustrated, somewhat diagrammatically, an embodiment which may be employed where the ground material is porous and consolidated such, for example, as sandstone or limestone. In such case a shaft will be sunk and the chamber provided by the shaft may be lined with concrete. In said figure, the chamber is shown at Ax, the concrete facing at 24, the surrounding consolidated material at 25, the passageway or conduits at 26 and the horizontal wells or passageways at 27.

In some cases it will be found unnecessary to encase the underground chamber with thick concrete walls and the vertical conduits or passageways 26 may be drilled directly into the porous rock or formed by casings or pipes extending to the operating level.

Having described my invention, what I claim and desire to secure by Letters Patent, is as follows:

1. An apparatus for underground water storage comprising a chamber sunk below the ground surface to an area at which the surrounding formation is porous so as to receive and store water, a plurality of lateral passageways extending into said porous formation from the said chamber, a plurality of upwardly extending conduits adjacent to the chamber, each conduit connecting at its base with one of said lateral passageways, a water header communicating with the upper ends of all of said upwardly extending conduits, a valve control for each lateral passageway adapted to selectively place the lateral passageway in communication with either its said upwardly extending conduit or with the said chamber, and means for withdrawing water and suspended material from the base of the chamber.

2. An apparatus for underground water storage comprising a chamber sunk below the ground surface to an area at which the surrounding formation is porous so as to receive and store water, a plurality of lateral passageways extending into said porous formation from the interior of the chamber, a water header in the chamber wall at an upper point of the chamber, means for conducting water downwardly from said header to each of said lateral passageways, a valve control for each lateral passageway and adapted to simultaneously open communication between the passageway and the interior of the chamber and shut off communication between the passageway and the header, means for withdrawing water and suspended material from the base of the chamber.

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