Nov. 7, 1939. L. RANNEY 2,179,020

SHAFT CONSTRUCTION AND METHOD OF OPERATION

Original Filed June 7, 1935

Fig. 1

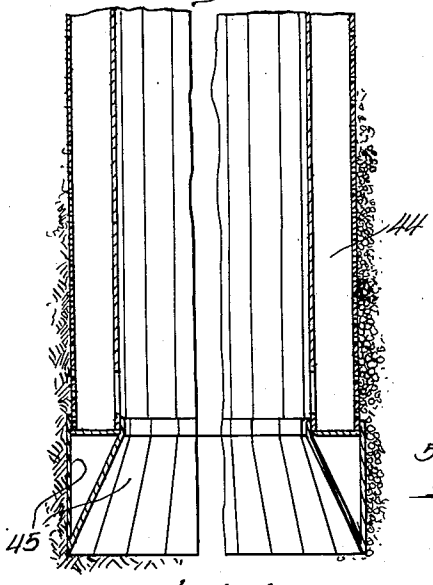


Fig. 2

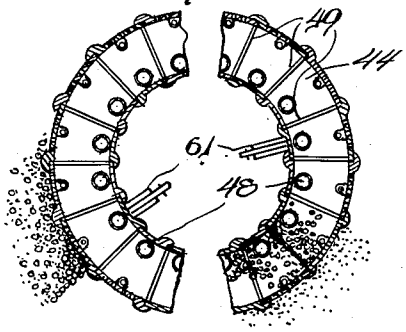


Fig. 4

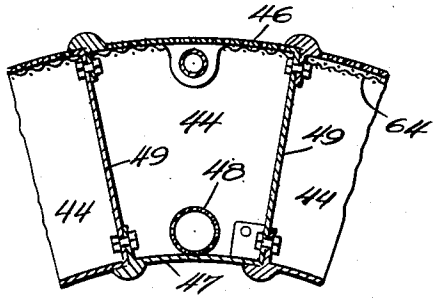


Fig. 3

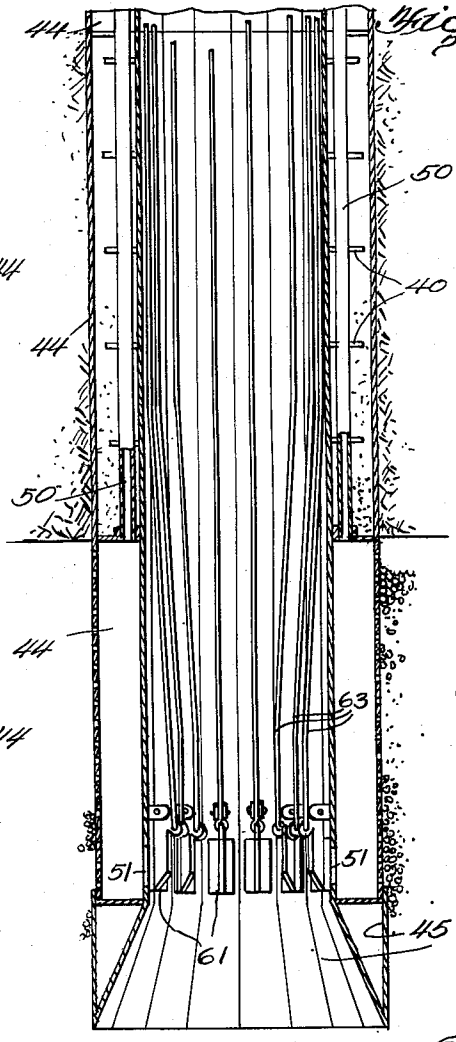


Fig. 5

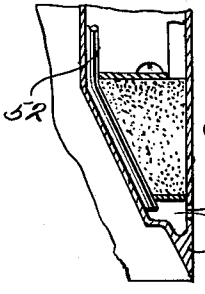


Fig. 6

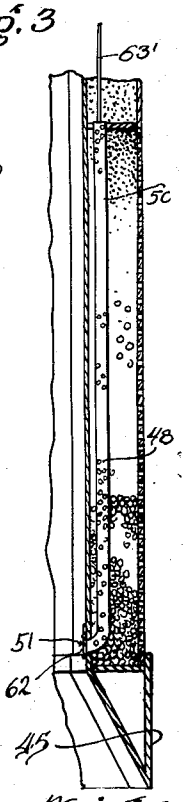
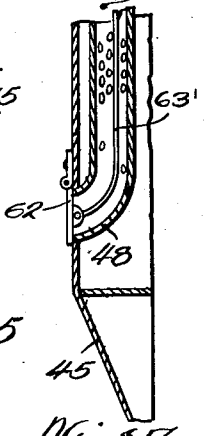


Fig. 7



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UNITED STATES PATENT OFFICE

2,179,020

SHAFT CONSTRUCTION AND METHOD OF OPERATION

Leo Ranney, Morro Bay, Calif.

Original application June 7, 1935, Serial No. 25,482. Divided and this application December 21, 1936, Serial No. 117,098

8 Claims. (Cl. 166—1)

This invention relates to shaft construction and method of operation for recovering fluids from or supplying fluids to subterranean formations and for other purposes and has for its object to provide apparatus and method by which this may be carried out effectively and upon a commercial basis.

This application is a division of my application No. 25,482 filed June 7, 1935.

The invention includes apparatus and method for building and sinking shafts for general purposes and for recovering fluids from or for supplying fluids to subterranean formations comprising a plurality of vertical cells formed by sections which are arranged together to form a hollow shaft which is projected into the ground and has an outer wall that may be perforated, and spaced from an inner wall through which fluids passing the outer wall may enter or leave the interior of the shaft.

The invention also consists in apparatus and method according to the preceding paragraphs embodying the further features hereinafter described, illustrated and claimed.

In the accompanying drawing, wherein it is illustrated various possible embodiments of the present invention,

Fig. 1 is a semi-diagrammatic central vertical sectional view of the lower part of the shaft in its simplest form.

Fig. 2 is a semi-diagrammatic horizontal sectional view taken through the upper central part of Fig. 3 and showing only two valve mechanisms.

Fig. 3 is a vertical sectional view showing such parts of a modified shaft installation and cells as is necessary to fully understand the same.

Fig. 4 is a detail horizontal sectional view taken through one of the cells.

Fig. 5 is a detail vertical sectional view showing a portion of a modified cutting edge of the apparatus.

Fig. 6 is a detail vertical sectional view of the lower part of the apparatus modified for filtering.

Fig. 7 is an enlarged detail sectional view showing conventionally a form of valve actuating mechanism at the bottom of the shaft for controlling the flow of water to or from the center of the shaft.

In carrying the invention into effect in one convenient manner as illustrated in the drawing and as applied by way of example to the recovery of water, there is provided a double walled hollow shaft which is divided circumferentially thereof by webs or stays into a plurality of independent vertical cells **44** (Fig. 2) each of which may be built up from a plurality of sections superimposed upon each other as shown in Fig. 3 during the sinking of the shaft into the ground. The shaft may thus be composed of a plurality of vertical and horizontal sections each of which consists of circumferentialy arranged cells as above described and the cells of the lower shaft section may be provided with pointed shoes **45** to constitute, in the assembled position of the lower cell sections, the shaft driving shoe. Separate pipe **52** (Fig. 5) may extend down to the cutting edge of the shoe and connect with the opening **53** to permit jetting therethrough to facilitate sinking. Circumferential shelves **40** may be provided on which to load gravel or clay to facilitate sinking or to aid in sealing the space about the shaft. Each cell may be closed at the top and has double vertical walls **49**, Fig. 4, the outer wall **46** of which may be perforated to permit of the passage of water, while the inner wall **47** is imperforate except, for example, for an opening **51**, Fig. 3, preferably at the bottom of each cell through which water may be delivered either from the outer subterranean formations into the shaft, or from the latter into the subterranean formations according to whether it is desired to obtain water from or supply water to the subterranean formations. The outer wall **46** always remains in place after the shaft is sunk.

The sides **49** (Fig. 4) of the cells are imperforate except for bolt connections and are radial with respect to the axis of the shaft and the walls of each cell section may be bolted together, and each complete cell section may also be bolted to the next such section thereabove, and the sections of inner and outer wall bolted to the dividing webs separating the cells. Connected with the top of any cell may be a pipe **50** (Figs. 3 and 6) serving to receive a supply of water to backwash the cell when necessary and during which operation the cell opening **51** at the bottom (Fig. 6) may be closed by a suitable valve such as shown at **61** in Fig. 3 or at **62** in Figs. 6 and 7. By opening this valve during sinking, of the shaft or afterward, sand or gravel having passed through the perforations in the outer cell wall **46** (Fig. 4) may be admitted to the interior of the shaft. After the shaft is down, the contents of the cell may be emptied through the valve on the opening **51**, control of which may be by a valve stem **63** or **63'** extending upward to the surface. The content of the cell may be removed as shown in my prior Patent 2,057,69[illegible], changed or added to during the sinking operation or after by means of a submersible sand pump acting through the pipe **50**.

In sinking this double walled cellular shaft each cell section may be filled with fine sand or other suitable material which provides weight to sink the shaft, and when the shaft has been sunk to the required depth the openings **51** at the bottom of each cell (Fig. 3) may be opened

to permit the sand to discharge into the interior of the shaft from which it may be delivered to the surface by means of a submersible pump, for instance. When the opening or valve 51 is opened during the sinking operation, the removal of formation sand therethrough causes the shaft to straighten itself, by relieving earth pressure against the shaft on the low side, the bottom of the shaft veering toward the side from which sand is removed, as earth material is excavated from the same side in the shaft bottom. Preferably in sinking the shaft no attempt is made to remove water from the interior of the shaft, and in most cases the water is allowed to remain in the shaft after the sinking operation has been performed. To facilitate sinking operations water may even be added to that occurring within the shaft.

If the water-bearing material opposite the shaft is extremely fine, running sand for example, each cell may be fitted with a perforated pipe 48 (which may serve as a backwash water pipe) or a continuation thereof as shown in Fig. 6. This pipe prevents the gravel filler in the cell from passing into the shaft. At the top this pipe is connected with or situated near the pipe 50 for supplying backwash water thereto. At the bottom the perforated pipe 48 may communicate with the outlet 51 at the bottom of each cell. Backwash pipe 50, when not aligned with pipe 48, may be used as a passage through which to remove material from or supply gravel or other material to the cell. Around the perforated pipe in each cell there may be placed mixed gravel or sized gravel which may be arranged so that the coarsest gravel is on the inside of the cell, next to the pipe 48, while the finest gravel may be on the outside of the cell, next to the perforated wall thereof. If desired a permeable material, such as cheese cloth screen 64 or the like, may be placed against the outer wall of each cell, on the inside thereof, before the cell is filled with gravel so as to hold the gravel in the cell and keep out the sand or like fine material. Or the gravel filling of each cell may be a uniform mixture of coarse and finer gravel.

As above indicated, this cellular type of apparatus may be employed to recharge the porous subterranean formation with water, for example, during wet seasons.

When recharging the subterranean formations with apparatus according to the invention, the water supply may be filtered by passing through sand filters, for example, and conducted to the central shaft down which the water is allowed to flow for discharge through the vertical cells under its own head, the water passing rapidly into the porous subterranean formations on account of the large distributing area provided by the apparatus. Should silt be carried into the gravel adjacent to the screens, the upper water supply may be shut off and the system allowed to produce for a time and this may be assisted by allowing a pulsating motion of the water within the cells, which removes the silt.

In cases where there is a bed of saturated sand or gravel near the ground surface, the cells may traverse more than one bed of water-bearing material, the beds being separated by impervious layers, the lower porous layers receiving and the upper porous beds exuding water.

Water delivered from the subterranean formations by the installations and methods according to this invention is clear, since it is already filtered by passage through the subterranean gravel and sand, while surface pollution is impossible since a seal is placed around the shaft above the water-producing stratum and adjacent to an impervious clay bed so that there can be no vertical communication between the collecting heads.

When backwashing the cells 44 the openings 51 at the bottom of all the cells, Fig. 3, except those on one or both sides of the cell being backwashed, may be closed so as to promote a flow of the backwash water from one cell outwardly through the perforations of that cell and inwardly through the perforations of one or both adjacent cells from which the water, together with the fine material carried along therewith, is discharged through the cell openings into the shaft, or removed to the surface by a suction pump extended downward through the opening in the top of the cell.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:

1. A continuous double-walled, segmental shaft, comprising a plurality of vertically superimposed cells attached together to form a circle with vertical webs dividing the cells and connecting the inner and outer walls of each cell together, the outer wall of each cell being foraminous, the inner wall of each cell being imperforate except for a closable valved opening therethrough into the interior of the shaft, the inner and outer wall of the shaft being built up of superimposed segmental plates attached together vertically and horizontally, an unobstructed vertically disposed longitudinal flow channel between the walls of each cell from any level in the cell to an opening in the inner wall thereof and thence to the center of the shaft, said shaft having at its lower end a shoe for penetrating earth formations in sinking.

2. A double-walled segmental shaft as claimed in claim 1, in which the inner wall and the two side walls of each cell are removable.

3. A double-walled segmental shaft as claimed in claim 1, in which each cell is provided with a vertical opening in the top thereof.

4. A double-walled segmental shaft as claimed in claim 1, in which each cell is provided with an inner tube.

5. A double-walled segmental shaft as claimed in claim 1, in which each valved opening to the interior of the shaft is provided with a stem extending to a point of accessibility.

6. A method of sinking a double-walled cellular circular shaft having an exterior foraminous wall as herein described, comprising building up the individual cells on the surface of the ground and as the shaft settles, filling the cells individually through the top thereof to any desired level with material heavier than water and of a consistency permitting it to be pumped from any cell at any time, reducing skin friction on the exterior of the shaft by allowing water to remain in the center thereof and by pumping water into the cells from whence it flows outwardly through the exterior wall, and excavating earth material from the interior of the shaft.

7. A method as claimed in claim 6, in which said heavy material is sand or gravel.

8. A method as claimed in claim 6, and removing said heavy material from the cells as desired.

LEO RANNEY.