Dec. 26, 1944. R. L. BINKLEY 2,365,858

METHOD FOR USE IN EARTH DRILLING OPERATIONS

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FIG. 1.

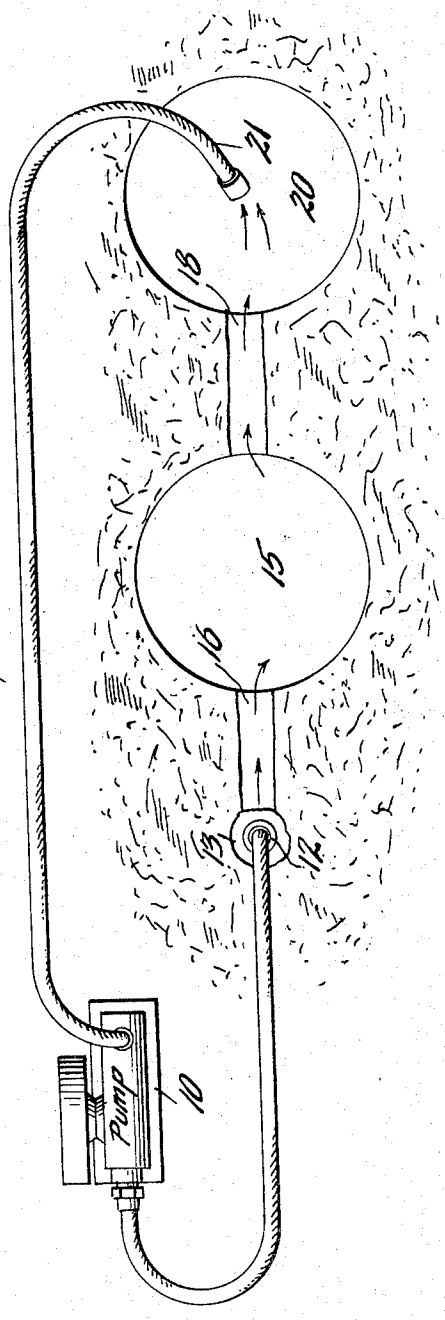
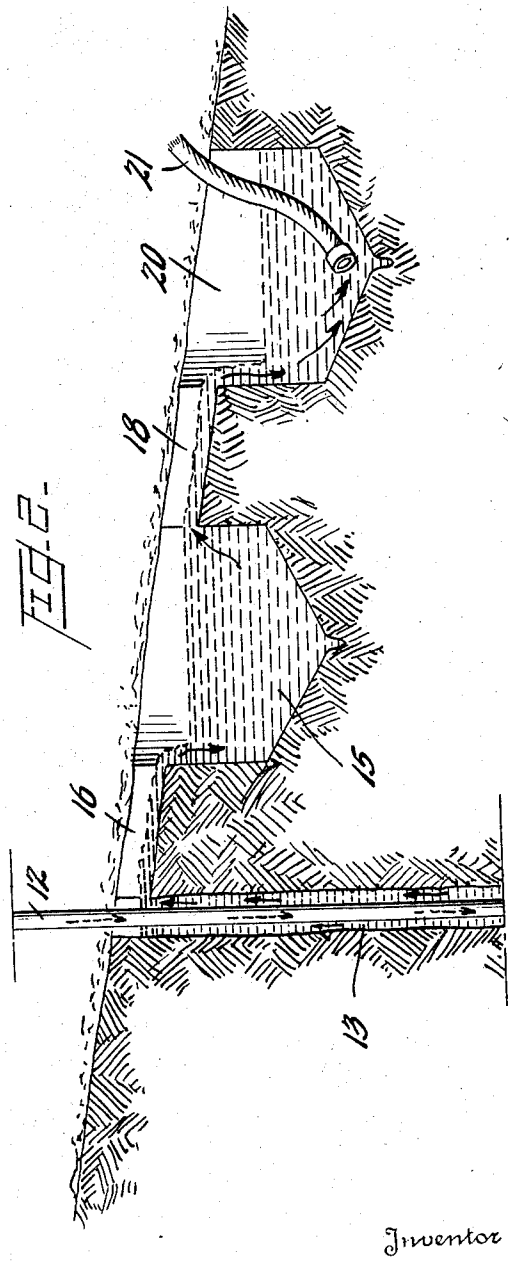


FIG. 2.



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FIG. 3.

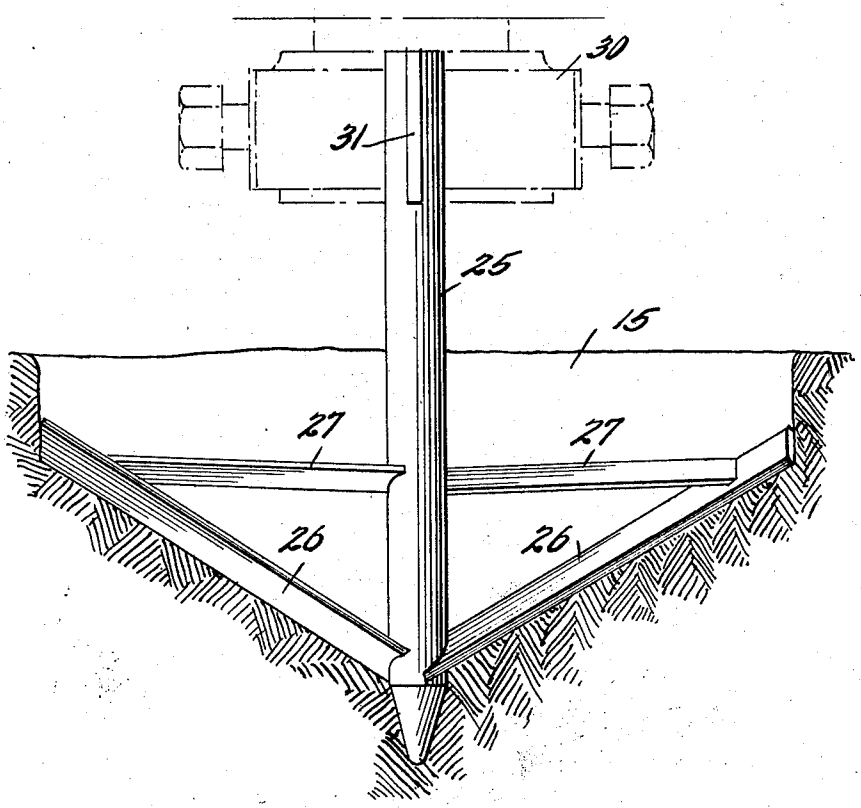


FIG. 5.

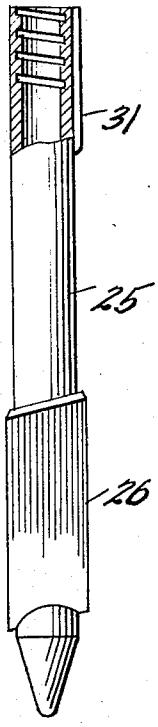


FIG. 4.

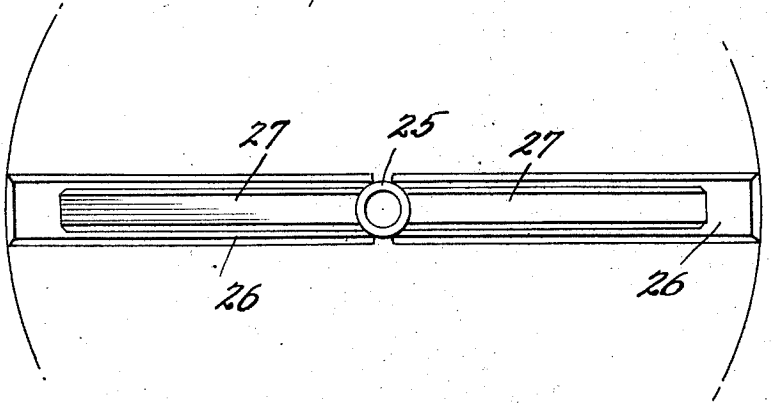
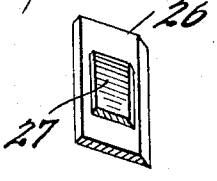


FIG. 6.



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Patented Dec. 26, 1944 2,365,858

UNITED STATES PATENT OFFICE

2,365,858

METHOD FOR USE IN EARTH DRILLING OPERATIONS

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Application July 6, 1943, Serial No. 493,654

2 Claims. (Cl. 255—1.8)

This invention relates to an improved method for digging and sealing slush pits such as are commonly used in drilling operations. It is an object of the invention to provide a method of the type described which can be practiced by the use of a properly designed tool adapted to be driven by apparatus commonly employed in drilling operations, for rapidly completing both the digging and the sealing against leakage of the pit walls.

In drilling operations it is common practice to pump water downwardly through a hollow rod line to the bottom of the drill hole for effecting the removal of solid material from the hole, the water flowing upward in the hole and being drained off into a slush pit in which the solid material may settle, so that the water may be recirculated. Frequently, more than one slush pit is employed, the first pit overflowing into another in which final separation of solid material is effected, in order that the recirculation of incompletely settled water may be reduced to a minimum. This is an essential procedure in conducting drilling operations in arid regions in which it may be necessary to haul water many miles. It is also important in such regions to prevent loss of water through seepage through the walls of the slush pit and it is highly desirable to dig the pits and effect adequate sealing thereof in a minimum of time in order that the drilling operations may be conducted as rapidly as possible and with the least amount of manual labor.

In accordance with the present invention, it is proposed to perform the digging and sealing of the slush pits by a single tool which may be operated by apparatus ordinarily available where drilling operations are being conducted, for example by conventional drilling equipment. It is a feature of the invention that the tool employed for digging and sealing the pits is capable of performing both of these operations without removal from the drill or other driving apparatus, which may impart to the tool only the usual rotation and downward feeding of which such apparatus is capable.

The invention is preferably practiced by the use of a rigid tool comprising a rotatable and axially displaceable support or spindle and blades extending radially of the spindle, certain of the blades being provided with cutting edges and being inclined both circumferentially and radially so as to facilitate the cutting operation, the inclination or width of the blades being such that when water is introduced in the dug pit, and the tool is rotated rapidly, the mud which is formed is thrown forcibly against the pit walls and the bottom of the pit by circumferential force so as to form an effective seal by completely filling cracks or crevices through which water might seep.

Preferably, the tool is provided with separate sets of blades, one set being connected to the shaft at a point substantially spaced from the point of connection to the shaft of the other set, one blade of each set being further connected adjacent at its outer end to a blade of the other set to provide a truss structure affording utmost rigidity.

Further objects and features of the invention will be apparent from the following description taken in connection with the accompanying drawings in which:

Figure 1 is a view in plan of a hydraulic system suitable for use in a drilling operation and employing slush pits;

Figure 2 is a vertical section taken through the drill hole and slush pits of Figure 1;

Figure 3 is a side elevation of one form of tool suitable for use in the digging and sealing of the slush pits, the tool being shown in position in a partially dug pit;

Figure 4 is a plan view of the tool shown in Figure 3;

Figure 5 is a side elevation of the tool rotated 90° from the position in which it is shown in Figure 3; and

Figure 6 is a fragmentary perspective view of the end portions of a pair of blades, adjacent to their point of connection.

Referring first to Figures 1 and 2 which represent schematically a hydraulic system for use with conventional drilling apparatus, it will be observed that the water circulated in the system by the pump 10 is conducted downwardly in the drill rod 12 and, after flowing out at the lower end, passes upwardly through the drill hole 13. A slush pit 15 is shown adjacent the drill hole, a trough 16 being dug to convey to the slush pit the water overflowing from the drill hole. From the slush pit 15 the water is conveyed through a trough 18 to a second slush pit 20, from which it is removed through the conduit 21 to the pump 10 for recirculation through the drill and drill hole. The principal part of the solid material carried upwardly through the drill hole is deposited in the slush pit 15; some further settling occurs in the second slush pit 20, and the use of this additional slush pit prevents recirculation of unsettled water freshly discharged from the drill hole, so that the amount of solid material carried by the recirculating water is reduced to a minimum. Further slush pits may be employed if desired.

The present invention is not particularly concerned with the details of the hydraulic system, which is not claimed herein, but is directed to a method whereby the slush pits may be rapidly dug and effectively sealed by what is sub-

stantially one continuous operation. The preferred form of tool for digging and sealing the pits is illustrated more particularly in Figures 3 to 6 of the drawings to which reference will now be made.

In Figure 3 a partially dug slush pit 15 is illustrated, the tool being shown in the position which it occupies in the pit during the cutting operation. The tool comprises essentially a spindle 25 having a set of blades 26 extending generally radially of the spindle and connected rigidly therewith and a brace member 27 rigid with the spindle at points substantially spaced from the blade 26 and secured to the latter adjacent its outer ends, so as to form a truss structure. Adequate rigidity may be secured by welding the several elements of the tool together. In the preferred form of the device the brace members 27 are constituted by a second set of blades which are largely similar to the first set of blades as regards both structure and function. At its upper end the spindle 25 is received in a conventional drill chuck 30, and to insure rotation of the spindle with the chuck, the spindle may be provided with a splined portion 31 or may be irregularly shaped adjacent the upper end. Alternatively, the spindle, which is usually hollow, may be threaded internally at the upper end for engagement with a corresponding threaded member on drilling equipment or the like, or to receive a sub from the drill for additional support.

It will be observed from the drawings that the blades 26 are formed at their leading edge to provide a sharpened or cutting edge, the leading edge being that which precedes when the spindle 25 is rotated in a selected direction during the cutting operation. It will also be observed that the blades 26 are inclined upwardly from the leading edge or cutting edge to the trailing edge thereof, and are also inclined upwardly in a direction radially outward of the spindle 25. The circumferential and radial inclination of the blades is such as to facilitate the cutting operation and to insure that stones and other large solids will be forcibly thrown upwardly as the pit is dug. The inclination and the width of the blade are also such that considerable centrifugal force is applied to material encountered by the blade when the tool is rapidly rotated, and such that substantial downward thrust is applied to material encountered by the underside of the blade when the tool is rapidly rotated in a reverse direction.

As hereinbefore indicated, the brace member 27 may also be constituted by blades in which event they are preferably inclined circumferentially to an extent sufficient to facilitate the forcible ejection of solid material from the pit during the cutting operation, and may be formed at their leading edge so as to enable them to cut through roots and the like which may fall over the tool. One of the important functions of the members 27 is to strengthen and brace the cutting blades 26, and while the members may be inclined upwardly and outwardly from the spindle 25, the more nearly horizontal position in which they are shown in the drawings affords greater strength to the tool. The lower end of the nose of the spindle 25 may be pointed or sharpened to facilitate penetration of the soil.

When the tool is suitably chucked or otherwise supported on a drill or similar apparatus, and is simultaneously rotated and fed downwardly, the blades 26, aided by the members 27 serve to cut the dirt loose and to eject upwardly and discharge from the pit the larger particles of solid material, stones, and the like, so that a circular pit having smooth walls is formed. After the pit is dug to the desired depth, a small amount of water is introduced and rotation of the tool without axial displacement is effected, the tool being held in position sufficiently close to the bottom of the pit to permit the blade 26 to pick up loose dirt and mix the same with the water to form a heavy mud. The speed of rotation may now be increased so as to displace the mud radially outward by centrifugal force, the pressure thus applied being sufficient to fill all cracks in the circumferential wall of the pit. In order to apply the necessary downward pressure to the mud to fill the cracks in the bottom of the pit, the rotation of the tool may be reversed and the inclination of the blade is such as to apply sufficient force to completely seal the pit bottom with the mud. The tool may then be raised to clear the surface of the ground, and the drill moved to a new position for the digging of another pit or pits. After the digging of the last pit, the tool is taken off and by the application of the conventional drill to the rods, the drilling operation may be carried out in the usual way.

It is found that by means of the instant invention a very substantial saving of time and labor may be affected over previous methods of digging and sealing pits, much of which involves hand operations. Furthermore, pits dug and sealed by the present method, and with use of equipment similar to that illustrated herein, are much less pervious to water than when formed by other methods, owing principally to the high pressure with which the sealing mud is applied to the pit walls and bottom and to the uniformity of such application. It will be appreciated that the invention as claimed herein is directed essentially to the method and that any tool suitable for the practice of the method may be employed.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. In a method of digging and sealing slush pits for use in drilling operations, the steps which comprise rotating and axially displacing a cutting tool downwardly until a pit of the desired depth has been formed, introducing water into the pit, and thereafter rotating the tool rapidly without advance to form a sludge and to forcibly impel the sludge against the walls by centrifugal force to seal the cracks.

2. In a method of digging and sealing slush pits for use in drilling operations, the steps which comprise rotating and axially displacing a cutting tool downwardly until a pit of the desired depth has been formed, introducing water into the pit, rotating the tool more rapidly without advance, first in one direction to form a sludge and to forcibly impel the sludge against the walls by centrifugal force to seal the cracks, and thereafter in the reversed direction to impel the sludge against the pit bottom.

ROBERT L. BINKLEY.