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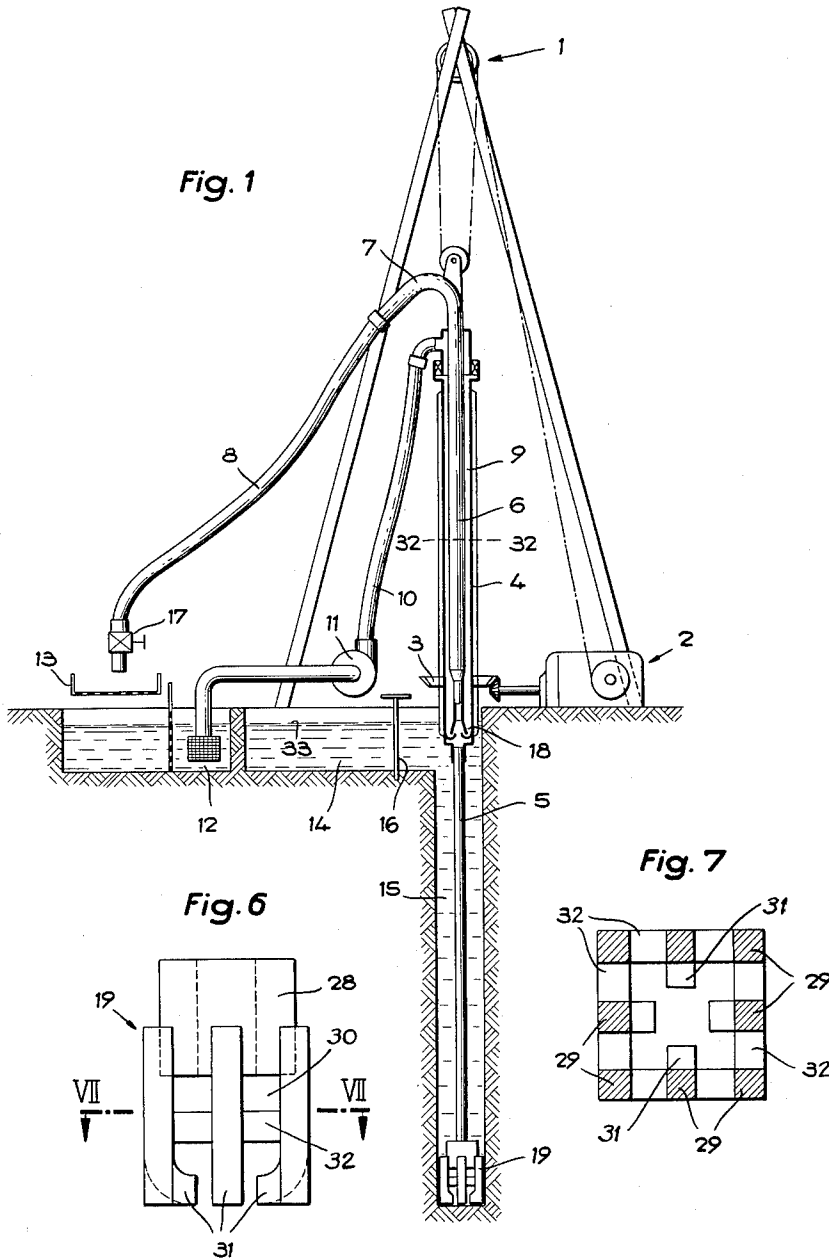
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DEEP BORING GEAR INCLUDING A WATER JET PUMP

Filed Oct. 21, 1957

2 Sheets-Sheet 1



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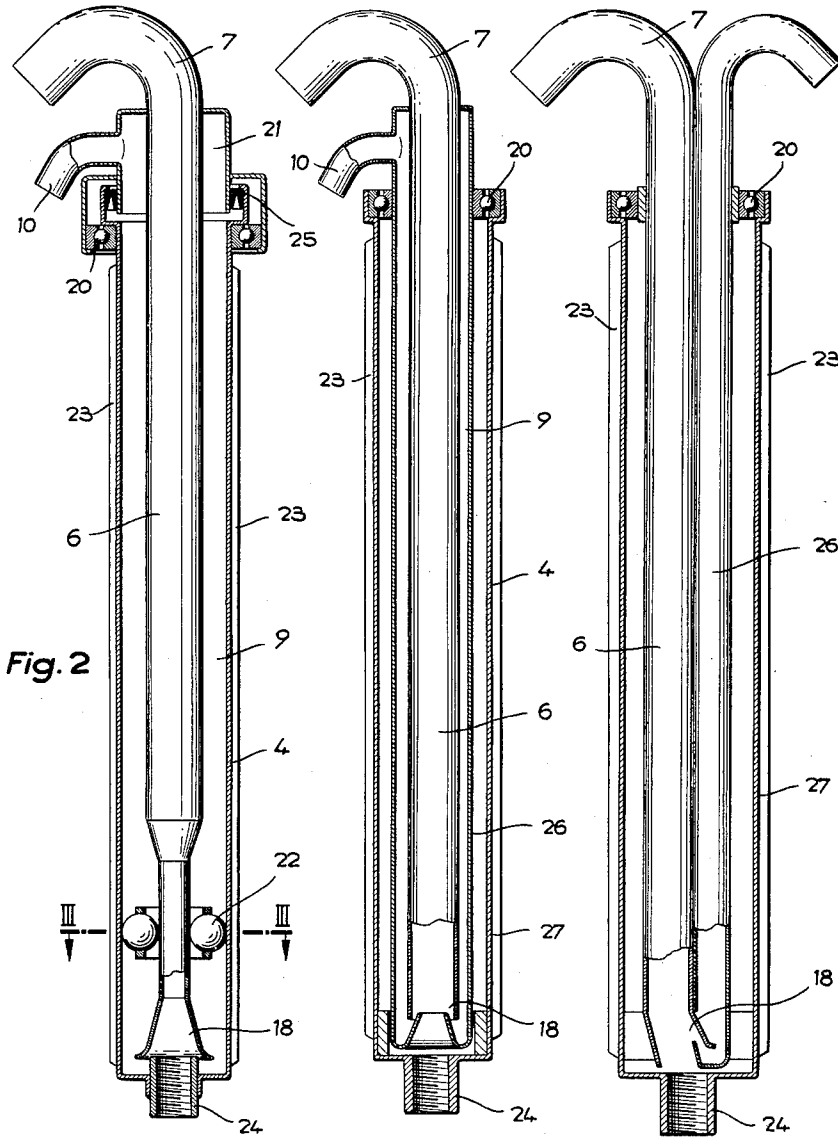


Fig. 2

Fig. 4

Fig. 5

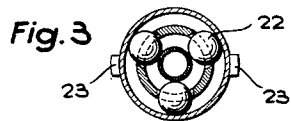


Fig. 3

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**DEEP BORING GEAR INCLUDING A WATER
JET PUMP**

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1 Claim. (Cl. 175—213)

The present invention relates to deep wash boring gear of the type utilizing a jet tube and casing including a water jet pump which circulates liquid through the system.

It is known in scavenging drill or wash boring operations to embed the tubes in a manner that a water jet pump is provided at the lower end of a double walled tube section which draws off the wash from the bore hole and raises the bore material through the center tube. This method of operation requires very expensive double walled boring gear which presents considerable difficulties in production as well as in keeping the terminal connections properly sealed.

In rotary boring methods it is also known to arrange a water jet pump or centrifugal pump at the end of the discharging conduit of the wash circulation. In such boring installations it was necessary to draw the wash by suction over the raised wash or flushing head in the manner of a siphon, so that the permissible low suction pressure for the operation of the wash shaft which was loaded with bore material had to be decreased to a fraction of atmospheric pressure in order to safely avoid interruption of the wash or rinsing column.

It is an object of the invention to avoid these shortcomings and to make it possible in connection with deep boring operations using suction circulation to obtain the greatest possible operating pressure for the washing or rinsing while utilizing normal boring gear.

The invention relates particularly to a deep boring installation having a water jet pump for raising the boring yield through the boring gear and resides essentially in that the water jet pump is provided in the driving casing or kelly. In accordance with the invention the water jet pump produces a pressure above atmospheric pressure in the driving casing or kelly and a pressure below atmospheric pressure in the area below the driving casing and thus the greatest possible operating pressure is applied to the circulation of the wash. If in accordance with the invention, the water jet pump is provided at the lower end of a correspondingly long driving casing, then it is possible to maintain the point where the driving force for the jet pump is applied continuously below the flushing shaft in the bore hole and to further increase the applicable operating pressure on the flushing material if the jet pump is arranged below the level of the water in the flush pool.

According to a further important feature of the invention a closure member is provided in the discharge conduit behind the driving casing which provides for a very simple manner of operation with respect to the reversing of the wash or flushing circuit. If the closure member is shut off in the discharge conduit even for a short period of time the flushing course reverses immediately without change of the driving conduit and without change in the direction of pump operation. This type of operation is of substantial practical significance in wash boring or flush boring for the immediate elimination of clogging in the boring gear. The invention can preferably be utilized in rotary drilling operations combined with flushing and makes possible the use of suction boring even in narrow boring gear at great depths.

It is a further object of the invention to provide means which make the new system readily applicable to any existing boring installation without any changes other

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than providing a driving casing with a water jet pump. The invention is not limited to wash boring or flush boring but it can also be applied to dry boring.

Further objects and advantageous features of my invention will become apparent from the following specification with reference to the drawings which illustrate several embodiments of the invention and in which

FIG. 1 is a schematic illustration of a wash boring installation adapted to carry out the method in accordance with the invention.

FIG. 2 is a sectional view of an embodiment of a particular construction of driving casing or kelly in accordance with the invention.

FIG. 3 is a section taken along line III—III of FIG. 2.

FIG. 4 illustrates another embodiment of driving casing kelly in longitudinal section,

FIG. 5 illustrates a further embodiment of driving casing in longitudinal section, and

FIGS. 6 and 7 show an embodiment of a boring tool in side elevation and in a sectional view taken along line VII—VII of FIG. 6.

The illustrations show a boring tower 1 with a windlass and a prime mover 2 which drives the boring gear 5 by way of the turntable 3 and driving casing or kelly 4. The driving gear in the form of a kelly 4 in accordance with the embodiment of FIG. 1 is double walled and has a center tube 6 which is connected by way of the elbow member 7 to the discharge tube 8 which is in the form of a hose. The annular space of the kelly 4 is connected by way of the hose 10 to a pressure water pump 11, preferably in the form of a conventional centrifugal pump which draws in by suction from the flush pool 12, the flushed liquid being cleaned by one or more screens 13, or water. The flush pool 12 is connected by way of channel 14 with the annular space of the drill hole, although the channel 14 can be shut off by a slide 16. A shut off cock or valve 17 is provided on the end of the discharging tube 8.

A water jet pump 18 is arranged inside the driving casing 4, connecting the annular space of the driving casing 4 with the inner space of the center tube 6. As indicated in the drawing, the driving casing or kelly 4 is of such length that the water jet pump 18 is continuously below the level of the flushing shaft in the bore hole even for the highest position of the driving casing. The driving casing can also go so far below the level 33 that the working pressure which can be applied is increased beyond the theoretical suction depression or vacuum pressure which is a maximum of one atmosphere to several times that amount. If the height of the boring tower is insufficient for handling a driving casing or kelly of such length, it will be expedient to subdivide the kelly into two portions, for example in the plane 32—32, which are connected with each other by threaded means which can be released with respect to one another when the boring gear is reset.

In carrying out the principles in accordance with the invention in connection with wash boring operations the illustrated installation operates substantially as follows: The driving means 2 rotates the driving casing or kelly 4 by way of the turntable 3 in the usual manner while the tube 6 remains stationary and the upper connection of the tube 10 is connected with the outer mantle of the casing 4 to permit relative movement. The centrifugal pump 11 draws cleaned wash of water out of the wash pool 12 and forces this water through the tube 10 into the annular space 9 between the center tube 6 and the outer mantle of the driving casing or kelly 4. The water under pressure enters through the jet nozzle orifice of the pump 18 into the inner space of the center tube 6 where an upwardly directed flow of great velocity is imparted thereto causing it to draw along water or wash

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out of the boring gear 5. The wash and the yield out of the gear 5 rise in the center tube 6 and, mixed with the water, reach the wash pool 12 by way of the screen 13.

Should there be any clogging in the orifice, in the gear 5 or in the boring chisel 19, the shut off valve 17 can be closed, which causes reversing in the direction of the wash. The water from the pump 11 is then compelled to flow around the orifice 18 downwardly through the center of the gear 5 because it has no other path. The reverse washing or rinsing can be effective to eliminate any clogging that might exist. Thereupon the shut off member 17 can be reopened and the boring operation can be resumed in the usual manner in accordance with the method of the invention.

In the embodiment illustrated in FIGS. 2 and 3 the driving casing or kelly 4 is of double walled construction, as already explained schematically in FIG. 1. The outer mantle of the driving casing or kelly 4 is rotatably supported by means of the roller bearing 20 with respect to the wash head 21 of the conduit 10 and with respect to the center tube 6 by means of the ball bearing 22. The outer mantle of the driving casing 4 is provided with ribs 23 for engagement by the turntable 3. Furthermore the outer mantle of the driving casing 4 is provided with a stub 24 at its lower end which at its upper end freely enters the nozzle aperture 18, while its lower end is provided with a suitable threaded portion for connecting the boring gear 5. The gasket 25 seals the stationary wash head 21 against the rotating mantle of the driving casing 4.

FIG. 4 shows an embodiment of the invention in which a special seal of this type can be omitted. Here the driving casing or kelly 4 is provided with a triple wall, namely a central tube 6, a further tube 26 and an outer tube 27 which is rotatably supported with respect to the tube 26.

In the embodiment in accordance with FIG. 5 the tubes 6 and 26 are arranged parallel with respect to one another inside the mantle tube 27, which is likewise rotatably supported with respect to the two tubes 6 and 26. Also here the nozzle type connection between the tube 26 and tube 6 is indicated at 18.

The boring tool 19 illustrated by way of example in FIGS. 6 and 7 has a connecting portion 28 for engagement with the lower end of the boring gear 5. The boring tool proper is constructed in the manner of a screening basket or cage composed of individual bars 29. The bars may be square or have any other cross section. In accordance with the invention they are arranged in such a manner that the narrowest opening 30 between them is formed on the outside or that parallel walled entrance openings are formed. The distances 30 are so

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proportioned that the bars 29 permit only the passage of boring material which has a diameter which is smaller than the inner diameter of the hollow boring gear shaft 5. In the illustrated embodiment the bars 29 extend linearly at the corners while the intermediate bars between the corner bars are bent arcuately inwardly at their lower ends 31. The bars 29 which may be of rectangular or other cross section may be connected by reinforcing or bracing members 32. In accordance with the invention the bars 29 are arranged in a manner that between them and below members 32 spaces are provided which form the aforementioned narrowest openings 30.

Having now described my invention with reference to the embodiments herein illustrated, I do not wish to be limited thereto, but what I desire to protect by Letters Patent of the United States of America is set forth in the appended claim.

I claim:

1 An apparatus for deep boring comprising a hollow kelly, a hollow boring gear attached to the lower end of said kelly for rotation therewith, a hollow flush column extending downwardly in said kelly in spaced relationship thereto and forming a passageway between said kelly and said column, a swivel head connected to the upper end of said kelly and having a water intake, and a water jet pump having a member connected kelly above the lower end thereof, said member extending into the lower end of said flush column, pump means connected to said water intake for forcing water under pressure through said passageway, said jet pump and into said column, a stationary discharge means connected to said column above said swivel head, said kelly being movable relative to said column and said swivel head and shut off means connected to said discharge means for forcing the flow of water downwardly into said hollow boring gear.

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