METHOD FOR ANCHORING A DRILLING RIG IN PERMAFROST

Inventor: George Robert Jackson, R.R. 1, De Winton, Alberta, Canada

Filed: Oct. 16, 1972

Appl. No.: 297,859

U.S. Cl. .................................................. 175/57
Int. Cl. .................................................. E21b 7/00
Field of Search ....................... 175/57, 113, 162, 203, 175/230, 326, 108

References Cited
UNITED STATES PATENTS
1,481,219 1/1924 Miller ......................... 175/230 X


Primary Examiner—Geo. V. Larkin
Attorney, Agent, or Firm—Ernest Peter Johnson

ABSTRACT

A seismic rig first drills a shallow bore, about 10 feet deep, using its drill stem. The rig equipment is then used to set a retrievable anchor in the bore. The rig is moved and tied to the anchor. It is then in readiness to drill the main bore with increased penetration rate, since it is anchored.

1 Claim, 6 Drawing Figures
METHOD FOR ANCHORING A DRILLING RIG IN PERMAFROST

BACKGROUND OF THE INVENTION

This invention relates to a means and method for anchoring a drilling rig. The invention finds particular application in connection with a seismic rig. This type of relatively small, vehicle-mounted unit is conventionally equipped with mechanical pull-down means which lift part of the weight of the vehicle off the ground and transfer this weight onto the drill string, thereby increasing the weight on the bit which is attached to the base of the string. This is done to increase the penetration or drilling rate of the bit. Because the seismic rig usually drills only a shallow bore (e.g., 50 to 100 feet in depth), the weight of its drill string is relatively small; hence the use of the pull-down means, which can increase the drilling weight by several multiples, is usually necessary in order to achieve desirable drilling rates.

In recent years, oil exploration has moved into the Arctic regions of North America. It is now common to fly seismic rigs into this area in large cargo planes. The rigs being used have been drastically reduced in weight in order to minimize the load transported by air. The weight of a typical seismic rig operation in the Arctic is about 10,000 pounds. Since only up to about one-half of the rig's weight can be brought to bear on the bit, even with the use of the pull-down means, the maximum unassisted drilling weight for a rig of this size is only about 5,000 pounds.

One way to increase the drilling weight under these circumstances would be to anchor the rig to the ground and use the pull-down mechanism to provide the needed additional force. However, in the Arctic the stratum adjoining the ground surface is usually comprised of permafrost. In simple terms, permafrost is ice containing solids such as sand, clay and the like. This material is too hard for one to dig a hole by hand in order to bury a log or other anchoring means to which the rig could be attached.

SUMMARY OF THE INVENTION

It is therefore one object of this invention to provide a method and means for anchoring a drilling rig, such as a seismic rig, operating on permafrost or a like frozen material.

If an anchor is to be used, it is desirable that it be retrievable since the cost of flying an anchor for each bore to the work site would be greater than the amount which could be billed for drilling the bore. In this connection, we have found that the permafrost tends, with time, to freeze solidly around any motionless anchor which penetrates into it. For example, we have tried using an auger as an anchor; when the auger was to be removed, it would found to be solidly frozen into place and could not be retrieved.

It is therefore another object of the invention to develop an anchor which is adapted to overcome the problem of permafrost freezing around it.

In accordance with the method of the invention, the rig is used to drill an anchor bore of relatively shallow depth. A retrievable anchor is set in the anchor bore, preferably using the rig's drill string to carry out the installation. The rig is then adjusted so that its drilling axis is adjacent to but spaced from the anchor bore. Usually this will be done by moving the entire rig a yard or two over the anchor bore. The rig and anchor are fastened together and the relatively deep main bore is then drilled, using a pull-down mechanism to provide a drilling weight, on the bit, which preferably is in excess of the rig weight. When the main bore is complete, the anchor is retrievable, preparatory to moving on to the next drilling location. Preferably, the anchor is retrievable by moving the rig back over the anchor bore and using the drill string to collapse and remove the anchor.

Turning now to the anchor itself, it comprises two basic components. The first component is a wing element which can be moved outwardly to the anchor bore wall to tightly abut or penetrate it. This component functions to lock the anchor to the bore wall. The second component is adapted to displace the wing element into and out of engagement with the anchor bore wall. The second component is designed to be inwardly spaced from the anchor bore wall; therefore it cannot be immobilized by the permafrost. If the wing element is frozen in place, the displacing component can break it free and collapse the tool.

The gist of the invention lies in taking advantage of the mechanical power of the rig to provide a separate anchor-receiving bore; fixing an anchor in the bore and connecting it with the rig to enable the pull-down to operate; and utilizing an anchor which can be positively collapsed to free it from the permafrost. By the application of the invention, a seismic rig weighing 10,000 pounds can bring a drilling weight of 15,000 pounds to bear on the bit, thereby greatly increasing the drilling speed capability of the rig.

DESCRIPTION OF THE DRAWING

In the drawing:

FIG. 1 is a perspective view of the anchor;
FIGS. 2 – 5 inclusive illustrate the operations involved - more specifically;
FIG. 2 shows the anchor bore being drilled;
FIG. 3 shows the collapsed anchor positioned in the anchor bore;
FIG. 4 shows the anchor after it has been expanded;
FIG. 5 shows the anchor in place and the drill string of the rig drilling the main bore;
FIG. 6 is a perspective view of the rear of a seismic rig, connected to the anchor, drilling the main bore.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to FIG. 1, the anchor 1 comprises a shaft 2 which is threaded at its lower end. Solid collar 3 and nut 4 are fixed to the shaft 2 at its end. A sleeve 5 is mounted on the shaft 2 beneath the collar 3. The shaft 2 is free to rotate within the sleeve 5. An internally-threaded travelling collar 7 is mounted on the threaded portion of the shaft 2. A pair of activating arms 8 are pivotally connected at their lower ends to the travelling collar 7. A pair of upper arms 9 are pivotally connected at their lower ends to the sleeve 5 and at their upper ends to the upper ends of the activating arms 8. A stop collar 10 is threaded on the lower end of shaft 2 to limit the downward movement of the travelling collar.

In use, the anchor 1 is dropped into the anchor bore 11. The rig drill stem 12, equipped with a socket (not shown), is fitted over the nut 4 and rotated. As the shaft...
2 turns clockwise, the travelling collar 7 moves upwardly, thereby causing the upper arms 9 to also move upwardly and outwardly into firm contact with the anchor bore wall. The drill stem 12 can be torqued up to firmly set the anchor in place. To collapse the anchor, the drill stem 12 is again connected with the nut 4 and rotated counterclockwise to cause the travelling collar 7 to move downwardly and pull the arms 9 out of contact with the anchor bore wall.

The anchor 1 has two features requiring special mention. It is to be noted that the displacing means, comprising the threaded shaft 2, travelling collar 7 and activating arms 8, are removed from the anchor bore wall — thus there is little likelihood of them becoming immobilized by the permafrost. In addition, the upper arms 9, or wing elements, are positively displaced from the expanded to the collapsed positions — hence they will be pulled free if frozen in place.

It is self-evident that various equivalents of the anchor 1 will occur to those skilled in the art. For example, one could use a hydraulic cylinder as the means for expanding the wing element. It is therefore to be understood that the scope of the invention is to be measured by the claims and is not to be restricted to the embodiment shown in the drawing.

The method of the invention can be easily understood with reference to FIGS. 4 – 6. It involves drilling a shallow anchor bore 11 with the rig stem 12, setting the anchor 1 in the bore 11, connecting the rig 13 to the anchor 1 by means such as the cables 14, and then drilling the main bore 15 using pull-down means (not shown) to apply force to the drill string.

1. A method of drilling with a seismic rig having a drill stem and bit, which comprises:
   - drilling a relatively shallow anchor bore;
   - setting a retrievable anchor in the anchor bore;
   - adjusting the rig so that its drilling axis is adjacent but spaced from the anchor bore;
   - fastening the seismic rig to the anchor; and
   - drilling a relatively deep main bore with the rig while maintaining, during at least part of the main bore drilling step, a drilling weight on the bit which is substantially in excess of the weight of the rig itself; and
   - retrieving the anchor.

* * * * *