

an opening extending vertically therethrough, as illustrated.

A frame 16 extends below the platform. A breaker plate 18 is supported in a horizontal plane below the rotary table. The breaker plate is adapted to be slidingly received at its opposite side edges in channels in the frame 16.

The breaker plate 18 includes an irregularly-shaped (i.e. non-circular) central opening 18A therein which is adapted to engage the drilling bit 20 when the bit is carried on the lower end of a drill string and the drill string is raised. This is illustrated in FIG. 3. Then when the string 24 is rotated in the direction of the arrow (while the drill bit is prevented from rotating by breaker plate 18) the drill bit is unthreaded from the lower end of the drill string. This is done quickly and efficiently.

A sub member 22 is threaded onto the lower end of the drill string 24 and then the drill bit is threaded onto the lower end of the sub. In other words, both the upper and lower ends of the sub member are threaded.

The rotary table 12 is shown partially cut-away in FIG. 1. The opening 12A which extends vertically through the rotary table has a non-circular cross-sectional configuration (e.g. it may be polygonal and may have 6, 7 or 8 sides, for example). The upper portion of the opening may be fitted with an insert or quill so as to provide a smaller opening 12B, if desired. This opening may be square, for example. The kelly 25 is engaged by the square opening 12B when the drill string is lowered. The kelly is a conventional means for transmitting rotary motion from the rotary table to the drill string.

The sub 22 includes a portion which is non-circular so that when it is threaded onto the lower end of the drill string 24, and the drill string is raised, the sub 22 is slideably engaged by the rotary table (either by opening 12A or opening 12B, depending upon the size of the sub). For example, sub 22 as illustrated in FIG. 1 includes multiple notches 22A around its periphery. These notches are such that they will allow the sub to slidable engage opening 12B in the upper portion of the rotary table. If the sub has a much larger diameter it may be provided with additional notches in a manner such that it will engage the larger opening 12A in the lower portion of the rotary table. In other words, the sub configuration can be modified so as to match the cross-sectional configuration of the opening in the rotary table so that the rotary table will engage the sub and cause it to be rotated in the desired direction when attaching or detaching a drill bit to the lower end of the sub.

The length of the sub and the mounting position of the breaker plate on the rig are related. When the drill string is raised so that the bit proceeds into the opening in the breaker plate the sub must be at a position such that the sub is engaged by the rotary table. This then allows the rotary table to engage and rotate the sub while the bit is held rotationally secured in the breaker plate. This condition must exist for both attaching and detaching the bit.

In order to thread a drill bit onto the lower end of the drill string, the bit may be placed on the ground under the lower end of the drill string. After the drill string (with attached sub) is rotated sufficiently to begin threading onto the drill bit, the drill string can be raised until the bit engages the opening 18A in breaker plate 18. Then the drill bit is restrained against rotation while the sub is rotated by the rotary table.

The breaker plate is preferably planar, as illustrated. The size and shape of the opening 18A may vary from one breaker plate to another so as to accommodate drill bits of different sizes. A slot 18B extends from the front edge of the plate 18 to the irregularly-shaped central opening 18A. This enables the breaker plate to be slipped into the grooves or channels 16A in the frame even when there is a drill string extending downwardly through the rotary table. A handle 18C on the breaker plate 18 facilitates insertion and removal of the breaker plate in the frame 16.

Using the breakout system of this invention the process of coupling and uncoupling a drill bit on the lower end of a drill string is greatly facilitated. The process is completed much more rapidly, safely, and efficiently than when done in the conventional manner using manual labor. It is also much safer than when using manual labor.

Other variants are possible without departing from the scope of the invention. For example, the type of rotary table used may vary, as desired. Also, the configuration and size of the sub member may also vary so long as it is capable of being engaged by the rotary table for rotary movement when the bit is engaged by the breaker plate.

It is also possible to adjust the position of the breaker plate in a manner such that the drill bit engages the opening in the breaker plate when the sub is engaged by the rotary table. The shape of the opening in the breaker plate may also vary, as desired, so long as it is capable of engaging the drill bit and preventing rotation thereof during coupling or decoupling.

What is claimed is:

1. A system for securing a drill bit against rotation in a drilling rig of the type having a rotary table with an opening therethrough which is smaller than said drill bit; wherein a drill string extends through said opening and is adapted to be rotated by said rotary table; wherein said system comprises:

- (a) a breaker plate having front, rear, and side edges and an irregularly-shaped central opening therethrough;
- (b) frame means carried by said drilling rig for supporting said breaker plate beneath said rotary table in a manner such that said drill string extends through said central opening of said breaker plate; and
- (c) a sub member having upper and lower ends, wherein said lower end is adapted to be connected to said drill bit and said upper end is adapted to be connected to said drill string; wherein said sub member is further adapted to be engaged by said rotary table for rotational movement when said drill bit is engaged by said breaker plate;

wherein said breaker plate includes a slot extending between said front edge and said central opening, thereby enabling said breaker plate to be inserted into or removed from said support means when said drill string is supported vertically by said drilling rig; wherein said irregularly-shaped central opening in said breaker plate is adapted to engage said drill bit and secure it against rotation when said drill string is raised to a point where said drill bit extends into said central opening and said sub member is engaged by said rotary table.

2. A system in accordance with claim 1, wherein said breaker plate is planar.

3. A system in accordance with claim 1, wherein said breaker plate is slidingly received in said frame means.