FIG. **3A** shows a prior art roller cone bit breaker, FIG. **3B** shows a prior art roller cone bit, and FIG. **3C** shows the bit of FIG. **3B** retained by the breaker of FIG. **3A**.

FIG. **4** shows a radial cross-section of a sample embodiment, showing the chocks engage the slots.

FIG. **5** is an isometric schematic of a contemporary drilling rig.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The numerous innovative teachings of the present application will be described with particular reference to the presently preferred embodiment (by way of example, and not of limitation). The following description is presented to enable any person skilled in the art to make and use the invention, and is provided in the context of a particular application and its requirements. Various modifications to the disclosed embodiments will be readily apparent to those skilled in the art, and the general principles defined herein may be applied to other embodiments and applications without departing from the spirit and scope of the disclosed inventions. Thus, the disclosed inventions are not intended to be limited to the embodiments shown, but is to be accorded the widest scope consistent with the principles and features disclosed herein.

Referring to FIG. **1A**, which shows one example of the innovative bit breaker in a closed position, the reference numeral **300** generally designates a bit breaker tool, embodying features of the disclosed inventions. The bit breaker **300** includes a generally square, planar, U-shaped base **302** fabricated from steel or other suitable material. The exterior of base **302** is dimensioned to allow a slip fit insertion into the rotary table of a drilling rig (not shown). At the front of base **300** is a chuck opening **304**. Within chuck opening **304**, base **302** has a pair of inwardly facing base chocks **306**. A series of reliefs **308** are formed in base **302** to reduce the weight of tool **300**. Corner chamfers **310** are formed at the corners of base **302** to facilitate insertion and removal of tool **300** in the rotary table (not shown) and to further reduce the weight of tool **300**. Handles **312** are attached to base **302** to provide easy handling of tool **300**.

Seen in an open position in this drawing, a gate **314** is pivotally attached to one end of unshaped base **302** by a heavy-duty hinge **316**. Gate **314** has a gate chock **318** located on its inward-facing side. A gate lock **320** securely attaches gate **314** to base **302** at the end opposite hinge **316**. Gate lock **320** may be, for example, a retractable latch pin as illustrated. When gate lock **320** is engaged, as seen in FIG. **1E**, gate chock **318** and base chocks **306** are in equally spaced relation to each other and to the center of chuck opening **304**.

FIG. **1B** shows an example of a roller cone bit **330**, this one having extended nozzles **338**, suitable for use with an innovative bit breaker like that shown in FIG. **1A**. This bit has three slots **332** machined or otherwise formed in a horizontal plane at equal angular spacing about, and equal radial distances to, the centerline of roller cone bit **330**. Slots **332** are located between a threaded tool joint **334** and the cones **336**.

FIG. **1C** shows the exemplary roller cone bit **330** of FIG. **1B** engaged by the bit breaker **300** of FIG. **1A**. In this drawing, gate **314** has been closed and locked by latch **320**, so that chocks **318** and **306** are locked into slots **332** (which are obscured by the chocks) of bit **330**. In general use, a stand of pipe to be attached to or detached from the bit would be held in a fixed position while the rotary table, with bit breaker **300** attached, rotates.

FIG. **4** gives a further view of a roller cone bit held by the innovative bit breaker, with the top portion of the roller cone bit cut away at the top of slots **332** to show the chocks **318** and **306** engaged in these slots.

Shown in FIG. **1D** is a fixed cutter bit **350** which has been modified to work with the innovative bit breaker. This bit has three slots **352** machined or otherwise formed in a horizontal plane at equal angular spacing about, and equal radial distances to, the centerline of fixed cutter bit **350**. Slots **352** are located on shank **235** between a tool joint **354** and the bit head **356**. Bit **350** will fit into the bit breaker in a similar manner as does roller cone bit **330**, with slots **352** being gripped by chocks **318** and **306**.

Alternative Embodiment: Corner Chamfers

In an alternate preferred embodiment, corner chamfers are minimized, and side reliefs are added to substantially reduce the weight of tool. In this embodiment, the corner contact reduces the relative rotation and impact within the rotary table when torque is applied.

In another contemplated alternative, corner chamfers are large enough to remove at least 30% of the linear edge of the base, thus substantially reducing the weight of tool.

Alternative Embodiment: L-shaped Gate

In another contemplated embodiment, an L-shaped base is combined with a gate which is also generally L-shaped. In this embodiment too, the base and gate preferably have three chocks between them. In this embodiment, a single base can be used in combination with more than one gate to accommodate a larger range of bit diameters, resulting in manufacturing and material cost savings.

Modifications and Variations

As will be recognized by those skilled in the art, the innovative concepts described in the present application can be modified and varied over a tremendous range of applications, and accordingly the scope of patented subject matter is not limited by any of the specific exemplary teachings given.

For example, although the preferred embodiments have been described with reference to the rotary-tabled drilling rigs which are more commonly used (except in offshore rigs and very deep holes), the disclosed inventions can also be applied to top driven rotary systems as well.

In another contemplated embodiment, the gate chock is particularly customized in its geometry (as opposed to base chocks) to provide additional closeness of fit of the rock bit to the bit breaker.

In another contemplated embodiment, base chocks are replaceable, rather than being integral with the plate.

In another contemplated embodiment, the gate corner radii are reduced, to more closely match the back of the base to improve contact (reduce clearance rotation of bit breaker) when torque is applied. This can be done and still accommodate rotation of the gate against the pivoted end.

In another contemplated embodiment, relief indentations can be added along middle portions of the bit breaker's sides, instead of (or in addition to) the weight-reducing cutouts in the sides of the tool,

In a further contemplated alternative, replaceable chocks or sleeves can be combined with the disclosed embodiment to accommodate larger size ranges.

In a further contemplated alternative, the inwardly-pointing chock lobes can be azimuthally asymmetrical, so that the breaker plate would be turned upside down to change from makeup to breakout. (Again, this would require rig floor personnel to make this change correctly.)

In a further contemplated alternative, the number of slots on a bit can be a multiple of three, so that the bit breaker can engage the bit at more angular positions.