cones. One disadvantage of this design is that the bit breakers contact the drill bit arms at the lowest possible position, creating the possibility that the arms may be bent during the make-up of the tool joint, which destroys the drill bit. Another disadvantage of this design is that the bit breakers do not always accommodate the different cutting structures of the various design configurations, which can result in breakage of the cutting structure during the make-up of the tool joint. Another disadvantage of this design is that the bit breakers do not always accommodate extended nozzle designs, which can result in breakage or deformation of the nozzle during the make-up of the tool joint. Another disadvantage of this design is that the bit breakers are very heavy, making them physically hazardous and inconvenient to move. Another disadvantage of this design is that manufacturing costs are high as a result of the amount of material, machining, and welding required to build them. Another disadvantage of this design is that the bit breakers are large and bulky, requiring substantial storage space for each tool. Another disadvantage of this design is that it cannot be used to on fixed cutter bits.

The standard bit breaker for a fixed cutter bit is a U-shaped steel plate having a slotted opening sized for sliding engagement with the two parallel slots machined into the shank. These designs often include a safety bar to prevent the bit breaker from sliding off of the drill bit. One disadvantage of this design is that the open end of the tool reduces the tool's resistance to deformation, and widening. Another disadvantage of this design is that the safety bars are often discarded, making the tool more hazardous to use. Another disadvantage of this design is that it cannot be used on roller cone bits.

Since fixed cutter bits use different bit breakers than roller cone bits, a separate bit breaker is needed for every size in each design type. The total cost of manufacturing and inventorying the required number of bit breakers is substantial.

To address these problems, engineers have attempted to design bit breakers that can accommodate a wider range of drill bit sizes. In U.S. Pat. No. 4,495,840, Freitag and Smith disclose a bit breaker having a bottom engageable with the bottom of the bit, a top opening for lowering the bit into the bit breaker, and a pair of slidably mounted stop members for movement inward and outward relative to the opening. This design accommodates extended nozzle designs, and may accommodate drill bits of the next size tool joint. This design fails to accommodate fixed cutter bits, which now account for more than half of the total footage drilled worldwide. Another disadvantage of this design is that it requires a number of machined parts, which increases the manufacturing cost and reduces the reliability of the tool. Another disadvantage of this design is that it is bigger and heavier than conventional bit breakers.

Drill Bit And Make-Up/Break-Out Tool

In the preferred embodiment of the present disclosure, a generally square base has one open end, giving it a u-shape. The base is made of steel or other suitable material and is externally sized for placement in the rotary table of a drilling rig. A gate is pivotally attached at to one end of the open side of the base. A detachable connector such as a dowel pin secures the other end of the gate to the opposite open end of the base.

The base has a centered chuck-opening portion that is shaped to accommodate the cross-section of a roller cone drill bit. Two chocks integral to the base extend into the chuck opening. A third chock integral to the gate also extends into the chuck opening. When the gate is positioned adjacent to the open-end of the base, the three chocks form a symmetrical configuration of protrusions that align with the alternating recesses and protrusions found in the cross-section of a roller cone bit. Thus, when the tool is placed on a roller cone drill bit, the alignment of the chocks between the arms of the drill bit prevent rotation of the drill bit in either direction relative to the tool. Retaining slots formed between the arms of the roller cone bit engage the chocks to fix the vertical position of the bit breaker in relation to the drill bit. Similarly, a series of three equally spaced retaining slots are formed into the shank portion of the fixed cutter bit. The retaining slots engage the chocks to prevent rotation or movement of the drill bit in any direction relative to the tool, and to fix the vertical position of the bit breaker in relation to the drill bit. In this embodiment, the chucking system provides a bit breaker that is adapted for use on both roller cone bits and fixed cutter bits, and which is capable of performing without the many disadvantages of conventional bit breakers.

A significant advantage of the present disclosure is that it is the first bit breaker ever designed to be used for both fixed cutter bits or roller cone bits.

- Another advantage of various disclosed embodiments is that roller cone bits are engaged closer to the tool joint, thus reducing the possibility of bending the arms of the drill bit during the make-up of the connection.
- Another advantage of various disclosed embodiments is that no contact with the bit's cutting structure occurs, thereby accommodating any cutting structure design safely.
- Another advantage of various disclosed embodiments is compatibility with extended nozzles on roller cone bits. (Extended nozzles can be useful for optimal control of fluid flow, but can be damaged by some conventional bit breakers.)
- Another advantage of various disclosed embodiments is lower cost than conventional bit breakers as a result of savings in the material, machining, and welding.
- Another advantage of various disclosed embodiments is bit breakers with reduced size and weight. This provides a reduced risk of injury on the job.
- Another advantage of various disclosed embodiments is less likelihood of deformation and widening of the bit breaker (as compared to a conventional fixed-cutter breaker) during the breakout operation.

Other advantages of the present disclosure will become apparent from the following descriptions, taken in connection with the accompanying drawings, wherein, by way of illustration and example, an embodiment of the disclosed inventions are disclosed.

BRIEF DESCRIPTION OF THE DRAWINGS

The disclosed inventions will be described with reference to the accompanying drawings, which show important sample embodiments of the invention and which are incorporated in the specification hereof by reference, wherein:

FIG. **1A** shows a sample embodiment of the disclosed bit breakers, FIG. **1B** shows a sample embodiment of the disclosed roller-cone bit to be used with the innovative bit breaker, and FIG. **1C** shows the bit of FIG. **1B** retained by the breaker of FIG. **1A**. FIG. **1D** shows a sample embodiment of the disclosed fixed-cutter bit to be used with the innovative bit breaker. FIG. **1E** shows the bit breaker of FIG. **1A** in the open position.

FIG. **2A** shows a prior art fixed-cutter bit breaker, FIG. **2B** shows a prior art fixed-cutter bit.