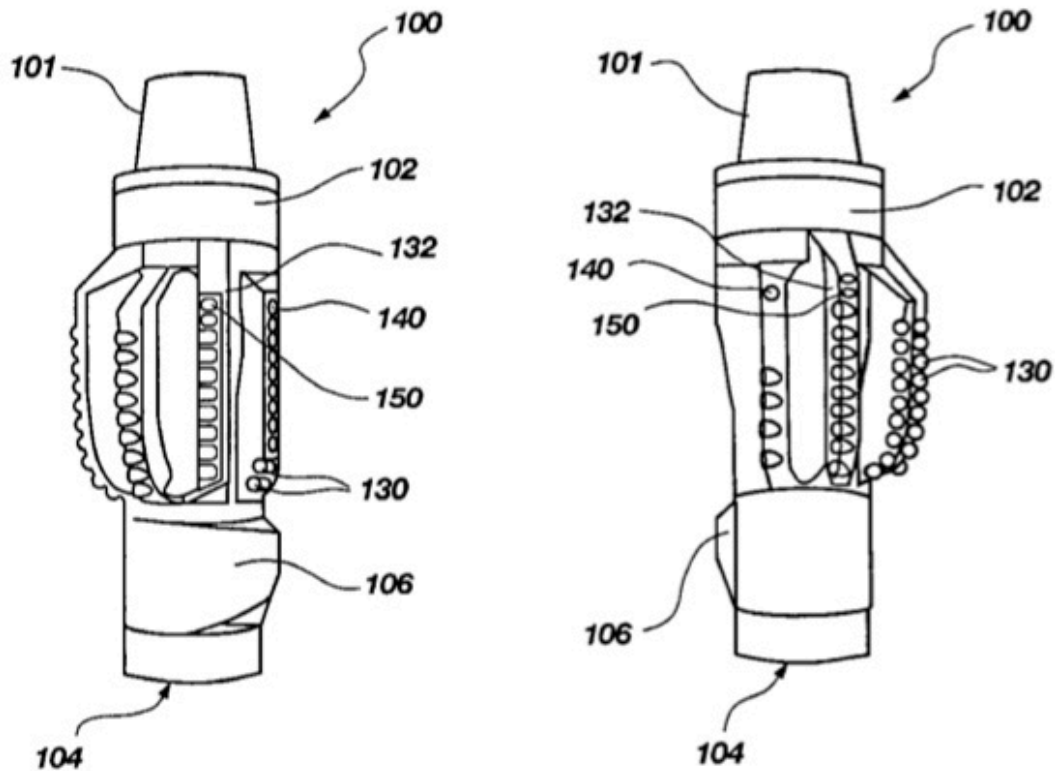




## The Evolution of the Eccentric Reamer 1963 to 2013

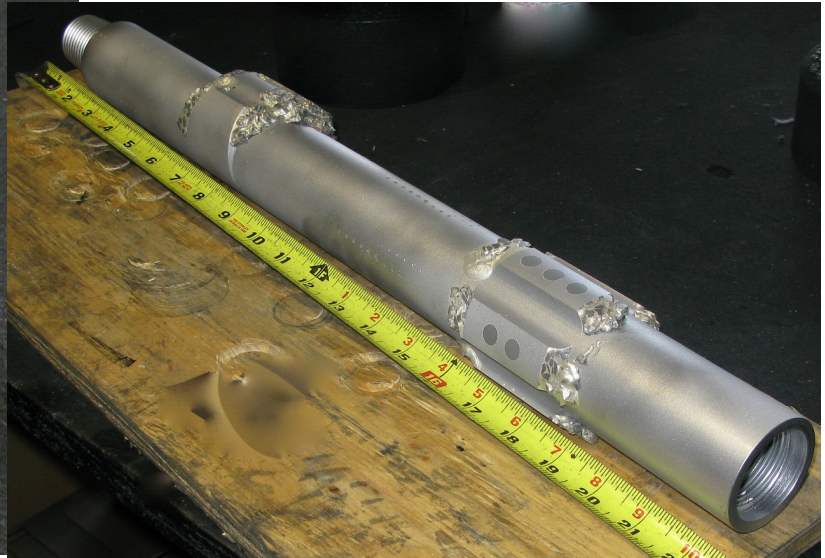


In 2004 Baker patented their “RWD” which has an eccentric portion that centers on guide (106) which acts as a guide in the original hole so the eccentric can enlarge the hole 360 degrees.

## The Evolution of the Eccentric Reamer 1963 to 2013



Starting in 2002 Short Bit & Tool Co. used the BCS idea in several variations that were used in thru-tubing applications where milling of cement or scales under a no-go profile was required. Our BCS tools placed the concentric guide a length below the eccentric that was just longer than the no-go profile so that they drifted through it individually. Then the guide would cause the eccentric to center on the no-go diameter to mill a larger bore.



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## The Evolution of the Eccentric Reamer 1963 to 2013

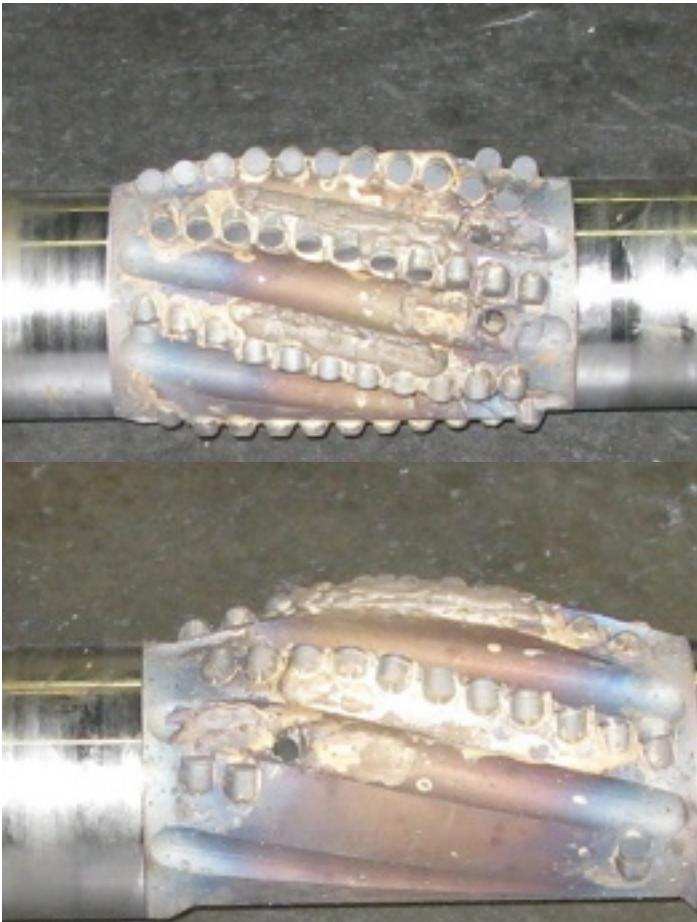


In July, 2009 QEP-LA asked us to convert a Hycalog Bicenter bit that they owned to a BCS by replacing the 5" pilot portion with a box thread. It was run between two concentric reamers (6") into a 6 1/2" drilled horizontal hole to open the hole to 7" using the 6" concentric reamers as a guide. It did ream the hole but almost got stuck several times.



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## The Evolution of the Eccentric Reamer 1963 to 2013



In August, 2009 Questar asked us at SBT to invent and build a BiCenter Sub (BCS) that would drift through 6" and open a 6 1/2" hole up to 7". Our BCS was NOT built like a bicenter drill bit which has cutter geometry facing down hole...ours was based on cutter geometry that would be free to cut sideways into the hole wall.

This was run first with a conventional concentric reamer and finally with a purpose built concentric PDC reamer CRS.

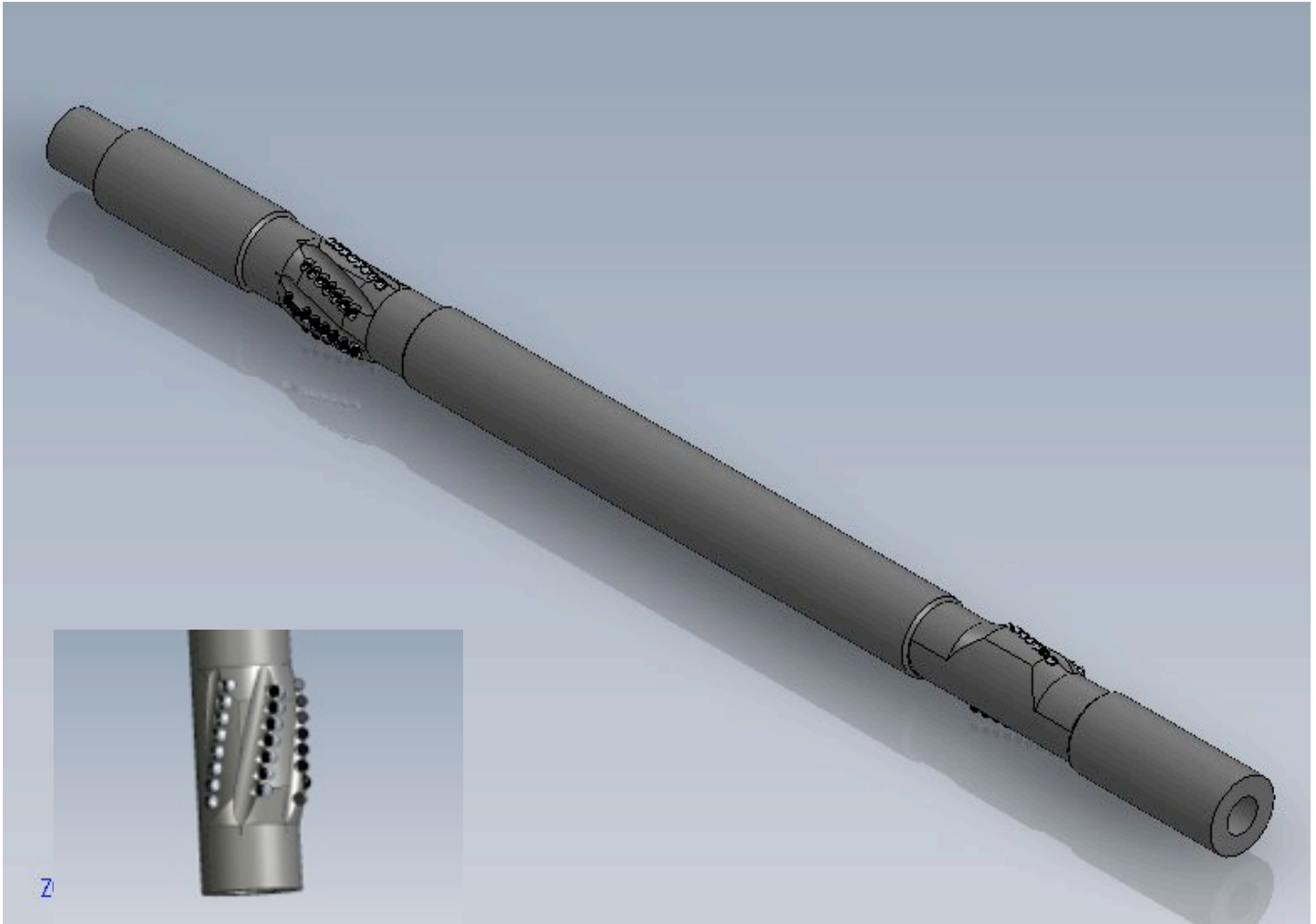
This basic design is still being used by QEP both in LA and the Bakken. This combination could not be run while drilling, only on a dedicated reamer run.



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## The Evolution of the Eccentric Reamer 1963 to 2013

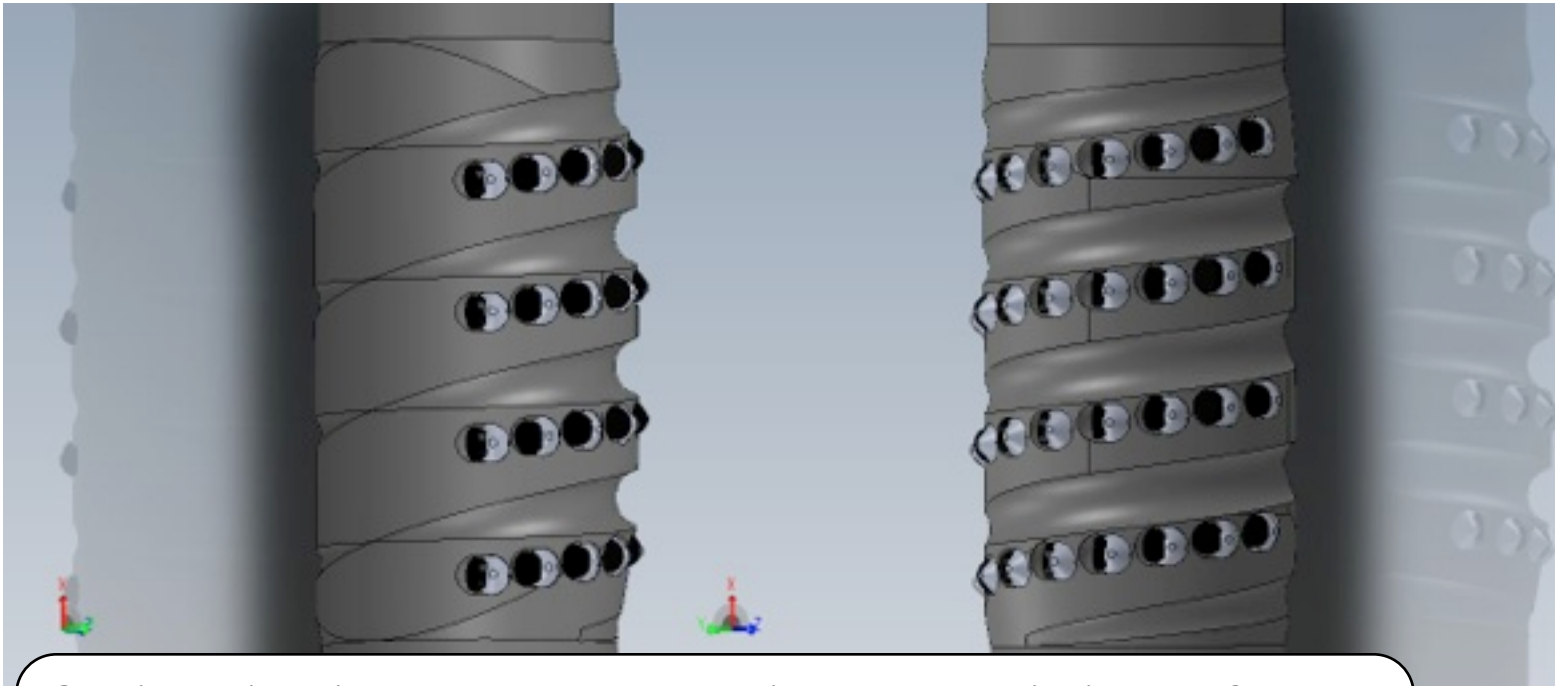


**In November, 2010 Bill Short, Richard Beggs, and Brad Beggs invented the TriCenter reamer. The TCR has no concentric reaming component. It has two eccentric reamer components that are offset 180 degrees apart. They rely on each other to act as a guide for the other to force side reaming opposing each other. It has been very successful in being run while drilling just above the directional drilling BHA.**

**In February, 2013 Short Bit & Tool Co. sold its patents pending 13/441,230 and 13/517,870 to 3C Reamers which is now owned by Hard Rock Solutions. SBT no longer makes the TriCenter Reamer. What exactly SBT cannot offer is two eccentric reamers that oppose each other.**

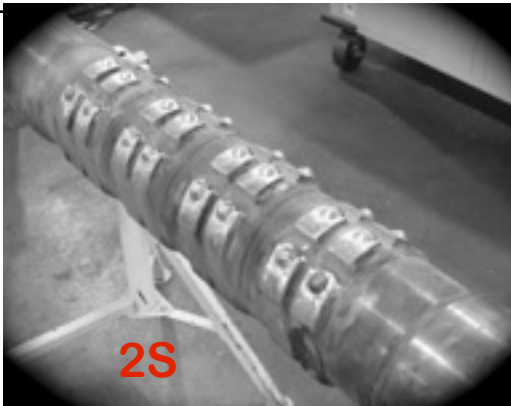
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## The Evolution of the Eccentric Reamer 1963 to 2013



SBT has taken the eccentric reamer to the next step. The limiting factor in the design of two opposing eccentric reamers is that they cause each other to torque against each other.

To eliminate that unwanted torque our new 2R/2S design uses one eccentric reamer (2R) that is run in conjunction with a non-reaming eccentric guide stabilizer that are in two five foot units. They are synchronized so that when run with 2S down and 2R up they are opposed, and when run 2R down and 2S up the are in line. In addition the cutters are aligned in circumferential rows that make a complete side cut without relying on adjacent cutters for complete coverage (like the older reamers).



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