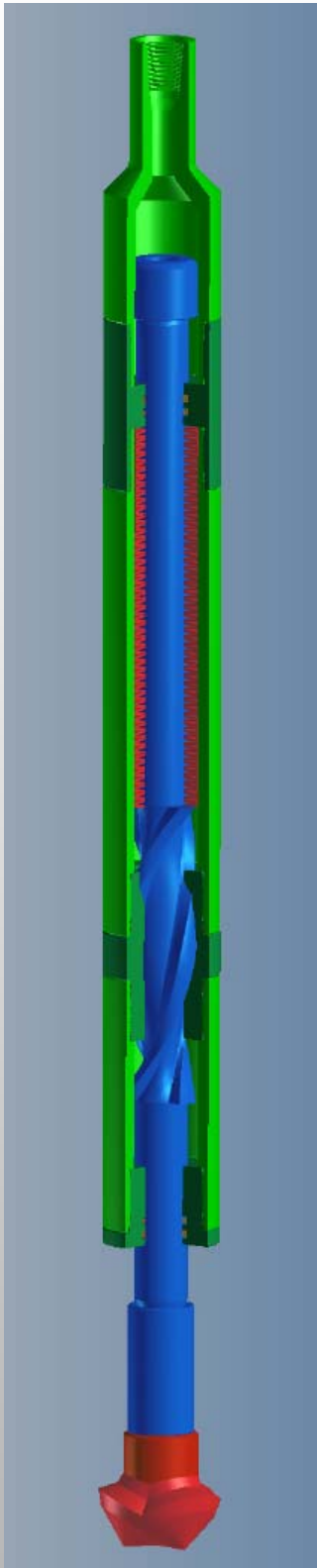


# TOCA-1: TORQUE CONTROL ASSEMBLY



The **CTS TOCA Torque Control Assembly** is designed to prevent over-torquing a drill bit during remediation or virgin drilling operations by **automatically retracting to unload the bit** when a torque obstruction is seen.

Mounted directly above the bit, the drill string loads the bit to any load desired from zero to a maximum set within the tool. The engagement between the outer Drive Body and Mandrel is a 3 lobe spline which helically spirals up at 45 degrees. When the bit hits the end or bottom of the hole, the Mandrel movement is stopped and the Outer Body continues to travel, compressing a specially designed stack of conical spring washers. A compression distance which might 4 inches in a particular situation (1/3 the total stroke).

As this relative movement occurred downwardly, the blue Mandrel and bit are literally rotated some because the engagement between the blue Mandrel and green outer drive Body is a three lobe spiral spline. When the drill motor or drill string starts to rotate, the torque delivered to the bit is transmitted through the helical spline compressing the stack of springs some more, i.e. up to 6" (1/2 of the total stroke).

**While drilling**, there is a **mechanical balance** of bit load and torque through the spline working against the spring load.

If the **bit** effectively **hits an obstruction** which tries to stop its rotation, the resulting **higher torque** works on the helical spline to **compress the stack of springs** some more, i.e. to 6 1/4". This effectively **momentarily unloads** the bit allowing it to get past the obstruction.

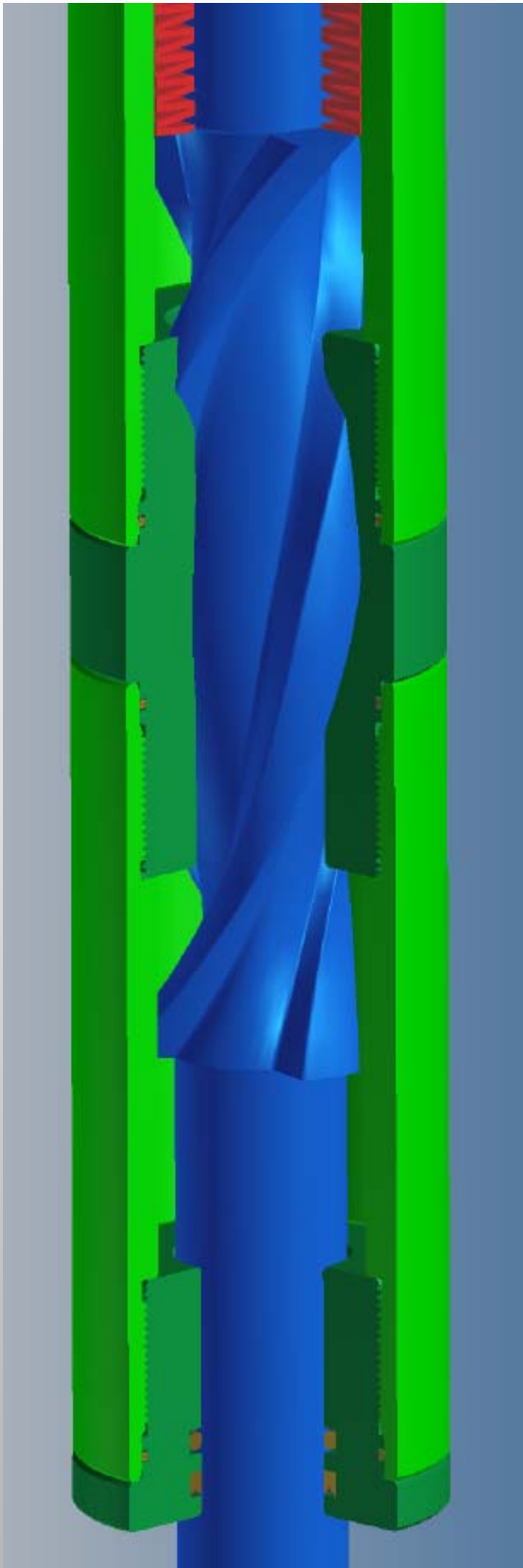
After the momentary unloading, the Torque Control Assembly **returns to the force balance**, i.e. 6" rather than remaining at 6 1/4", so that drilling can continue as before.

PATENT PENDING

**CRAWFORD TECHNICAL SERVICES, LLC.**

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The red conical or Belleville springs are stacked in series or parallel to provide the load rate desired for the job to be done.

Torque and rotation are delivered from the drill motor or drill string into the top of the outer green section at the top.

Torque and rotation go through the darker green section called the Drive Body into the blue Mandrel Spline Section.

The blue Mandrel delivers the torque and rotation to the bit at the bottom.

The CTS Torque Control Assembly has a 12" stroke and is set such that the minimum drilling load seen gives 2" of stack of springs compression and the maximum drilling load gives 9" of stack of springs compression. This means that the operator does not have to be cautious regarding the load applied to the Torque Control Assembly such that it will work, **it will work the same in any loading situation** which can be applied to it.

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