

Center Rock Inc. Oil & Gas Technology

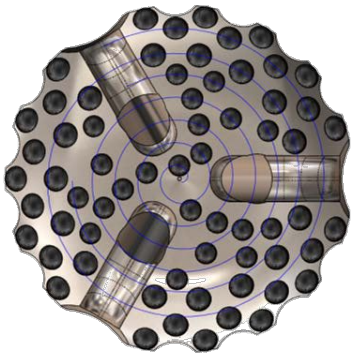
Center Rock Inc. [The Company](#)

Center Rock Inc., with facilities in Berlin, Pennsylvania, manufactures downhole bits, hammer parts, and specialty drilling products that are used by leading oil & gas drillers, foundation and construction companies, quarry & mining contractors, as well as geotechnical, geothermal and water well drillers around the globe.

Center Rock was launched into the global spotlight during the Chilean Mine Rescue in 2010 when the company and two of its members played such a pivotal role in the rescue. Brandon Fisher (Center Rock Founder) and Richard Soppe (Senior Drilling Application Engineer) traveled and worked side-by-side with the rescuers in Chile until everyone was brought to the surface utilizing Center Rock engineered products.

Center Rock Inc. Oil-Gas Technology

Center Rock was incorporated in 1998 and began as a supplier of oilfield products and service. From day one, Center Rock has continually developed innovative solutions to reduce costs, improve reliability, and enhance the performance of bits and hammers used in underbalanced air-percussion drilling. The following are examples of some recently developed products.



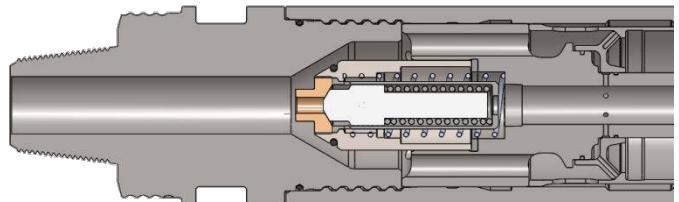
Spiral-faced Bit (patent-pending)

It is well known in the industry that it is easier to chip a piece of rock from a flat rock surface as opposed to a cratered or dimpled rock surface. A flat or near-flat surface provides more area for fracture planes or stress cracks to generate a rock chip. And, until the spiral face bit was conceived by Center Rock Engineers, all downhole hammer bits had inserts placed on concentric rows creating an axisymmetric trough from which chips are broken. This is not the most efficient way to break rock. Center Rock's Spiral-faced bit addresses this limitation by placing inserts along a spiral pattern to eliminate the axisymmetric pattern by creating a trough-less, near-flat, rock surface.

Pressure Control Check Valve (PCCV, patent-pending)

Prior to drilling, downhole hammers are setup for specific, anticipated borehole conditions utilizing an adjustable air bypass commonly called a [choke](#). The bypass or [choke](#) allows the hammer to consume more air than the hammer cycle requires to effectively operate. In most cases, the bypass is setup to allow the air flow needed to clean the hole under the limit of a maximum desired standpipe pressure. The volume of air bypass is typically correlated with the expected volume of influx water. Therefore, if a hole will be wet, the bypass is opened. Conversely, if a hole will be dry, and there is no added annulus backpressure created from water influx, the tool will normally be setup to bypass no air.

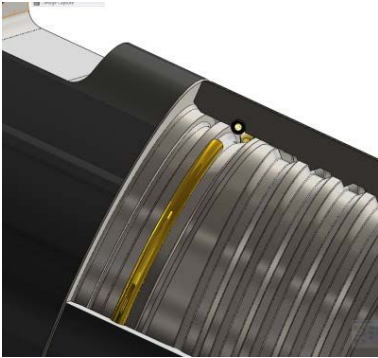
Drilling dry is commonly called [dusting](#) and drilling wet is commonly called [misting](#). A downhole hammer will operate the most efficiently without bypass, whereby all the air can be used to generate hammer power. The dilemma arises when an operator is uncertain if the hole will remain dry. If there is any risk that water will be encountered over the course of drilling, the hammer will be setup to handle wet conditions. In doing so, hammer performance for the dry section will now be highly compromised. For example, if 90% of the hole is dry and only 10% is wet then the requirement for a [wet](#) hammer setup compromises drilling speed over 90% of the hole. Conversely, if the



hammer was setup for dry dusting conditions (no bypass) and water was encountered, its likely standpipe pressure would rise to an unacceptable level, as more pressure is needed to compensate for a higher annulus pressure.

Center Rock identified this issue and introduced the PCCV valve. This valve addresses the above limitations by allowing the hammer setup to be optimized for dry drilling, while also allowing air bypass to be opened as downhole pressure builds. The PCCV opening pressure and opening flow can be adjusted for desired conditions. Therefore, with the PCCV, there is no loss in performance due to bypassing air in dry conditions and no risk of excessive standpipe pressure if water is encountered. The PCCV valve gives you the ability to truly maximize your productivity from spud to TD.

Thread Locking System

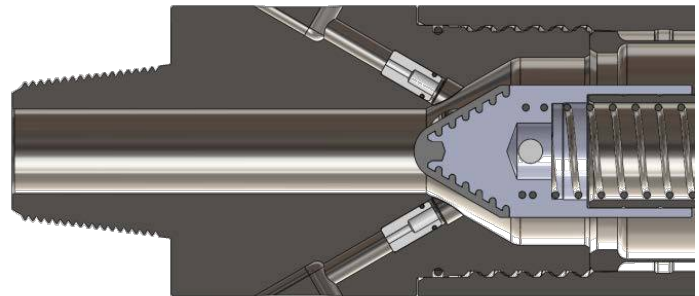


The threaded joints which hold the backhead (top sub) and chuck (driver sub) to the hammer casing are usually torqued sufficiently, so that under normal drilling conditions they will not loosen. However, normal drilling conditions are not always the norm. In many cases, if the hammer is not being rotated with sufficient torque, typically when there is low WOB, the joints may loosen allowing the hammer to come apart downhole.

Center Rock's thread locking system addresses this risk by integrating a non-ferrous shear ring into the backhead and chuck connections, thus ensuring that the threads do not loosen during normal drilling operations. Available on the Center Rock CR-88 hammer models, the locking ring is sheared off during hammer servicing with a breakout torque of roughly 30,000 ft-lb. This safety feature ensures that the threads loosen only when you want them to, not when the tool is downhole.

Jetted backhead

Most downhole drills bypass air utilizing an internal bypass (choke), where excess air is run in parallel with the piston porting through the central hammer exhaust gallery. With this setup, both the air consumed by the hammer and the bypass air share the same exhaust passage. While this is a simple arrangement, it creates backpressure on the piston exhaust ports and reduces hammer power. As more air is bypassed the backpressure increases which is analogous to restricting the exhaust pipe on an internal combustion engine.



Center Rock has solved this problem by developing the jetted backhead. The jetted backhead bypasses excess air out of the backhead, behind the downhole drill, and directly into the annulus of the borehole. This component ensures that you will have the appropriate air volume for hole cleaning without developing additional power-robbing backpressure on the hammer. Additionally, not only have we addressed the backpressure issue, but the customer will also benefit from reduced wear on external hammer components due to less exhaust air at the bit face and lower up hole velocity of rock cuttings.

These are just a few examples of the product enhancements that Center Rock has developed for the Oil & Gas industry. As you can see, Center Rock is on the leading edge of product enhancements tailored to the Oil & Gas market segment.

And, because Center Rock Inc. is focused only on drilling products, we are able to afford our customers unparalleled consultative expertise and the fastest available response time. Whether you require a sales representative or a field technician, we offer 24/7 domestic as well as international on-site support because we know how important that is to you...our customers.