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## Technical Note 54, Gas Versus Piston Drive

Purpose: To compare the merits of gas and piston driven rifle actions.

Facts: The AR-15/M16 and the AR-10 family of rifles employ a unique gas powered operating system patented by Eugene Stoner in the 1950s. This gas operating system works by passing high pressure propellant gasses tapped from the barrel down a tube and into the carrier group within the upper receiver. The gas expands within a donut shaped gas cylinder within the carrier. Because the bolt is prevented from moving forward by the barrel, the carrier is driven to the rear by the expanding gasses and thus converts the energy of the gas to movement of the rifle's parts.

Most previous semiautomatic rifles used a piston mounted in a gas cylinder attached to the barrel. Propellant gasses expanded within the cylinder and forced the piston to the rear. The piston either contacted and drove a carrier to the rear (FAL), or were part of, connected to, or struck a rod segment that passed around the action to cam and move the bolt (M1, M14, AK-47). In some cases the piston was fixed and the movable cylinder drove the rod (AR-180).

Advantages and disadvantages.

The Stoner system allows a very symmetric design that allows straight line movement of the operating components. This allows recoil forces to drive straight to the rear. Instead of connecting or other mechanical parts driving the system, high pressure gas performs this function, reducing the weight of moving parts.

In Piston systems, the path of the operating force is mechanically shifted around the action, resulting in a considerable mass of moving parts moving outside the centerline of the firearm.

There is a common belief that the piston operated systems are less accurate than the Stoner system because the operating parts start moving while the bullet is still in the bore. This is not true: Army Ordnance tests conducted in the 1960s revealed that the bullet is 25 feet out of the bore of the M1 and 15 feet out of the bore of the M14 before any operating part begins to move. It is more likely that the imbalances of the piston, operating rod, cylinder, and other parts hanging on the barrel produce disruptive vibrations as the bullet exits the bore.

Although movement of the operating parts while the bullet is in the bore isn't apparently a culprit in reducing the accuracy of Piston systems, the inherent accuracy of the Stoner system has been consistently confirmed in competitive shooting. In all competitive events that allow use of any mechanism the shooter wishes, the Stoner system is prevailing. Few competitive shooters use

the Garand or Kalashnikov systems, and none observed now use the FAL system. In American Service Rifle and NRA competition, the piston operated rifles are considered a disadvantage.

There is a debate about which system remains cleanest. The Stoner system tends to leave propellant residue in the receivers, while the Piston systems keep the residue outside the action in the cylinder. Piston driven systems, however, tend to allow more external dirt into the action because of the openings required for various connecting members (operating rod, bolt lugs, etc). Comparison tests of the Stoner and the M-14 before Desert Storm confirmed the superiority of the Stoner system in sand and dust tests.

MARK A. WESTROM  
President