

## The open bolt

A semi- or fully-automatic firearm is said to fire from an open bolt if - when ready to fire - the bolt and working parts are held to the rear. When the trigger is pulled the bolt goes forward, feeding a round from the magazine into the chamber and firing it. Like any other self-loading design without an external power supply, the action is cycled by the energy of the shot; this sends the bolt back to the rear, ejecting the empty cartridge case and preparing for the next shot.

### Bolt mechanisms—Semiautomatic and fully automatic

- **Open bolt:** This type of mechanism is found in a fully automatic firearm when operation requires the bolt to be pulled back and locked before firing, thus leaving the chamber open. The cartridge is subsequently stripped from the magazine by the action of the bolt when the trigger is pulled. Weapons with this type of operation include the Sten gun and MP 40.

- **Closed bolt:** This type of mechanism is found in a fully automatic firearm when operation requires the bolt to be pulled back and then pushed forward before firing, chambering the cartridge and cocking the striker mechanism, thus leaving the chamber closed. Weapons with this type of operation include the Browning M1919 and M2 as well as the Bren and MP 34.

“Open-bolt” designs tend to be cheaper to manufacture than the more complex “closed-bolt” types and are not so prone to the dangerous phenomenon known as “cooking off.” This occurs when the firing chamber becomes so hot that the chambered cartridge fires spontaneously without the trigger being squeezed, which makes the “open-bolt” design more suitable for weapons designed for constant, fully automatic operation.

The open bolt system has fewer moving parts and is far less sophisticated than a revolver’s hammer in a striker-fired design and the firing pin is usually part of the bolt. The other advantages are open bolt designs operate much cooler, and are far less prone to cook-off. However, the disadvantages are: weapon is more prone to fire when dropped. It is prone to accumulating dirt in the working parts. Open-bolt machine guns cannot be synchronized to fire through the arc of a propeller. Accuracy can suffer in an open-bolt design, but this is less of a concern in automatic weapons. The large mass moving forward kicks the gun forward a bit on single shots. All these reasons are why single-shot sniper rifles (which obviously don’t suffer from cook-off) fire with a closed-bolt.

The Browning M1919's original design was as a water-cooled machine gun (see the [M1917 Browning machine gun](#)). When it was decided to try to lighten the gun and make it air-cooled, its design firing from the closed bolt created a potentially dangerous situation. If the gun was very hot from prolonged firing, the cartridge next in line to be fired could be resting in a red hot barrel. This could cause the propellant in the cartridge to heat up to its flash point where it would ignite on its own without warning. With each further shot heating the barrel even more as this happened, the gun would continue to fire and become uncontrollable until the ammunition ran out, since the trigger was not what was causing the gun to fire in this situation. This is known as a ‘cook-off’. It was the reason gunners were taught to cock the gun with the palm facing up so that, in the event of a cook-off, their thumb wouldn't be dislocated by the reciprocating cocking handle. Gunners were trained to manage the barrel heat by firing in controlled bursts of three to five rounds, with a delay between bursts to allow the barrel to cool and delay heating up. Most other machine gun designs are fired in the same way, even though most feature quick-change barrels and fire from an open bolt, two features that make air-cooled machine guns capable of sustained fire, features that the original M1919 design lacked.

The [50-cal](#) is essentially a scaled-up 30-cal, but because of the limits of early 20<sup>th</sup> Century manufacturing, it lacks a common feature on later guns, rapidly interchangeable barrels. These are a factor for sustained fire in ground combat, but changing the barrel on an [M2HB](#) is an involved process, involving setting headspace (the gap/tolerance between the barrel face and bolt face) and timing (precisely when the weapon fires as the bolt closes. All Browning MGs fire from an open bolt for cooling and safety). Headspace and timing can be set by using Browning-designed gauges - this is indeed the textbook way to do it - or, by an experienced gunner, by touch (for headspace) and sound (for timing).