Research Paper for the Use of Caseless Ammunition

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Introduction

Caseless ammunition, as the name suggests, is an ammunition form that does not use a brass casing and instead uses some form of solid propellant to house the projectile. This allows the ammunition to be lighter, in expense of the "heat sink"-like ability of the brass casing. (Telescoped) Caseless cartridges eliminate the need for extraction of spent casings, are lighter than conventional cartridges, and are much more compact compared to conventional and conventional caseless rounds. These rounds, due to different possible shapes and configurations allow for newer chamber designs for firearms (Farmer & Ruth 1967). Conventional ammunition cartridges, on the other hand, are made to fit within the chamber of a firearm, where the charge is ignited via a percussion cap (a cap that detonates when hit) and a firing pin. While this ammunition satisfies current military demands, firearms designers realized that by removing the metallic cartridge, firearms could be made lighter and fire faster by eliminating the extractor (removing the cartridge from the chamber) and ejector (removing the cartridge from the gun), making the bolt lighter. In firearms in aircraft and armored fighting vehicles, this also removes the need for storage space for these spent cartridges/vulnerabilities in vehicles for disposing cartridges. Furthermore, since this technology does not require a metallic casing, more metals, such as brass, are saved, and can be used in other fields. However, the problem with this sort of technology is that gas can escape the chamber in automatic firearms, leading to a lower muzzle velocity and a possibility of a failure to cycle and feed (Harvey & Reed 1963).

Literature Review

Caseless ammunition is a technology dating from the 1960s, developed by nations such as the United States and Germany. While caseless ammunition was proven feasible before this time, the lack of a good solid propellant, which burned either incomplete or faulty, and, in turn, the lack of sufficient gas-generation to propel the projectile was evident in earlier forms of caseless ammunition. Previous ignition types, such as a hot electrical resistance wire, were too time consuming or relatively ineffective in detonating the powder charge. The ammunition described in the patent states that the powder charge is a solid cylinder of usual substances used in ammunition. This charge is hollow, as to allow the bullet to rest within the charge as it would in a conventional brass casing (Ritchley, H.W. 1971). One example of the use of caseless ammunition is the Heckler & Koch G11. The H&K G11 uses caseless ammunition. The magazine is on top of the barrel, with the caseless ammunition facing downward (Heckler & Koch GmbH). The G11 and its prototypes had a rotating breech block and a horizontal magazine, allowing for the rifle to be more compact than a traditional rifle (Moller & Ketterer 1975). In the case of the rotating breech block, the breech swivels about a central axis between the barrel and the (horizontal) magazine. This allows the rifle to be more compact than conventional rifles, as the magazine is horizontal instead of vertical, allowing for a lower profile when prone. The breech also works as both the “bolt” and the “chamber”, as it moves the ammunition into position, in which it can be fired (Kastner, Ketterer, Moller, & Wossner 1974). The bolt-and-

breech assembly, as well as the barrel and the magazine, recoils rearward, toward the rear of the stock. This delays/eliminates recoil during sustained fire/a burst as some of the energy is expended as the assembly recoils into empty space (Moller & Ketterer 1975). Another example, as illustrated in U.S. Patent No. 4,015,527, caseless ammunition with a spin stabilized flechette (a metal dart, telescoped) is ideally suited for an anti-aircraft and anti-tank/armored fighting vehicle role. Within the ammunition, there is a frontal aperture, so the projectile can exit, four different charges (two hollow, two solid), a primer, a disintegrating sabot (a device used to keep the projectile in the center of the barrel until it exits the barrel), and the flechette round itself. Due to there being no casing to eject, there is no need for there to be an ejection cycle, allowing for higher rates of fire in fully automatic firearms. The removal of the casing means that the ammunition is lighter than conventional rounds, allowing for an aircraft to carry more ammunition (Evans 1977).

Even today, this technology is still being developed. For example, The LSAT (Lightweight Small Arms Technologies) Trials conducted studies on the difference between conventional (5.56x45mm NATO, meaning North Atlantic Treaty Organization), cased telescoped, and caseless ammunition types. The weight of 600 cartridges and links of each are 20.8 lbs, 12.7 lbs, and 10.1 lbs, respectively, making the caseless ammunition the lightest and the conventional ammunition the heaviest. The firearms themselves should also be mentioned, where the weights of the firearm and 600 rounds of ammunition are 38.3 lbs for the M249 SAW (in use today), 21.9 lbs for the LSAT Cased Telescoped

Firearm, and 20 lbs for the LSAT Caseless Ammunition Firearm (Phillips 2010). The Cased, Telescoped Small Arms Systems (CTSAS) program, previously called the Lightweight Small Arms Technologies (LSAT) program, developed by Textron, is a program for the development of a cased, telescoped cartridge, developed from the caseless, telescoped ammunition of the Heckler & Koch G11. The cased, telescoped ammunition (CTA) has been widely adopted in autocannons, but has not been adopted for small arms until recently. The major advantage of CTA is the weight, as it is ~41% lighter and ~12% smaller in volume, allowing for more rounds to be carried in the field and more rounds to be shipped in (Gao 2017).

Analysis

Caseless ammunition is lighter, smaller, and more efficient to manufacture compared to conventional ammunition, such as 5.56mm NATO. Thus, more ammunition can be placed into a magazine and in a transport crate, which allows for the shipping and transport of ammunition more efficient. However, in the case of ground forces, this technology will come into conflict with current systems, such as the M249 Squad Automatic Weapon (SAW) and M16/M4/M27 Infantry Automatic Rifle (IAR) platforms, due to the departure from the current cartridges. Thus, if a new cartridge were to be developed, the entirety of NATO would be forced to either develop their own firearm capable of firing this new ammunition or only a select few units will be outfitted with weapon systems that use this new ammunition type, which would place a strain on logistics, as it would add to the large list of small arm and light weapon ammunition, such as 5.56mm NATO, 7.62 NATO, and 12.7mm BMG

(Browning Machine Gun). However, the LSAT/CTSAS studies claim that the 6.5mm ammunition is more effective than 5.56mm NATO at all ranges and the same as 7.62 NATO at longer ranges. If this is the case, then this new ammunition can replace both types of ammunition simplifying logistics and saving resources.

References

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