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REGULAR

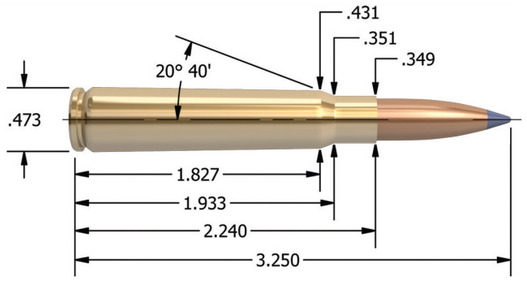
ARTICLES

- **Cover:** CZ 550 Magnum Lux, chambered in .416 Rigby, owned by Jan Venter. The rifle is displayed on a 17th century German strong box with an elaborate locking mechanism, that offered safe storage for valuables.
- **Cover photograph:** Nadia du Plessis
- **Cover design:** Nadia du Plessis
- **Contents photo:** Thea Venter

CHRIS BEKKER

The 8x57 mm Mauser: the mother of all rimless cartridges with a case head of .473

The Mauser M98 action - the de facto standard



8 x 57 mm Cartridge Case

Historical Background

Let me start with the historical background of the development of the Mauser, right at the beginning, in the 1870s. It was a period in time that saw the USA in turmoil. America just came out of a bloody civil war (1861 to 1865), so they had no desire or incentive for further firearms developments.

It was a different story in Europe, which was a simmering pot of feverish nationalism, arbitrary alliances and bickering monarchies glaring across borders at one another. Otto von Bismarck masterminded the unification of Germany in 1871 and served as its first chancellor until 1890, in which capacity he dominated European affairs for two decades. He cooperated with King Wilhelm I of Prussia to unify the various German states, a partnership that would last for the rest of Wilhelm's life.

Bismarck provoked three short, decisive wars against Denmark, Austria and France. Then, with Prussian dominance accomplished by 1871, Bismarck skilfully used "balance of power" diplomacy to maintain Germany's position in a peaceful Europe.

Advancements in arms technology were coming so fast as to nurture indecision. Each country wanted state-of-the-art rifles for their armies. The 1870s saw every European power eager to adopt some form of breech-loading rifle firing a self-contained metallic cartridge.

Enter the Mauser brothers of the German state, Wurttemberg

Paul Mauser was the gunsmith/inventor and Wilhelm Mauser the businessman. Paul Mauser focused on developing a cartridge rifle, loosely based on the bolt-action principle of the **Dreyse needle gun,** which at the time was the standard arm of the German states. His work culminated in the **Model 1871 Mauser**, a single-shot turn bolt rifle adopted first by Prussia and soon after by the other German states. The 11 mm cartridge Mauser designed for the '71 was the firstborn Mauser.

The 11 mm Mauser (or 11.15 x 60R, or .43 Mauser) was a Berdan-primed centrefire. Loaded with 77 grains of black powder, it propelled its 386-grain paper-patched lead bullet at approximately 1,435 feet per second (fps) from the 33½-inch barrel of the standard-issue rifle. The 11 mm Mauser cartridge was similar in size and performance to other weapons of the day: the **11 mm Dutch Beaumont**, **France's 11 mm Chassepot**, **Italy's 10.4 mm Vetterli**, **Russian and Bulgarian Berdan .42s**, etc.

Even before the **German army's rearming with their 71/84 rifles**, France stunned the world with its **Lebel in 1886**. Suddenly, every other army was holding obsolete ordnance. The three-phase rush from breech-loaders to cartridge rifles to repeaters that had occurred over the previous quarter-century had been all for nought.

The 8 mm Lebel was the first bottle-necked, small-bore smokeless powder cartridge adopted by a major power. It was smaller and lighter than its contemporaries, allowing the soldier to carry more ammo, taking up less space. Its charge of smokeless powder sent a more streamlined jacketed bullet of 232-grains roughly 600 fps faster than anything else used. The trajectory was decidedly flatter over range, increasing its maximum range. Gone were the plumes of smoke to betray positions and to obscure targets.

The British had the Lee–Metford rifle, a bolt action rear-locking bolt system and a detachable magazine with an innovative seven groove rifled barrel designed by William Ellis Metford. It replaced the Martini-Henry rifle in 1888, following nine years of development and trials, but remained in service for only a short time until replaced by the similar Lee–Enfield in 1895. The cartridge was loaded with a .311"-calibre, 215 gr, full-metal jacket bullet over a charge of black powder that produced a velocity of 1,850 fps. In 1892 the new nitro-glycerine-based cordite smokeless powder was adopted as the standard propellant; the round was now known as the Mark I and produced a velocity of 2,060 fps. The British Lee-Metford and Lee-Enfield were used against the two independent Boer Republics in the two Anglo-Boer wars in 1880 and 1899, respectively, after the discovery of gold and diamonds. They had to have it by any means possible; thus, a war of greed by conquest.

Meanwhile, Norway was also working on a new design, and Denmark helped test their new rifle. The 30-40 Krag–Jørgensen rifle is a repeating bolt action rifle designed by two Norwegians, Ole Herman Johannes Krag and Erik Jørgensen, in the late 19th century. It was adopted as a standard arm by Norway, Denmark, and the United States. After strenuous tests, Denmark adopted the Krag–Jørgensen rifle on 3 July 1889. The Danish rifle differed in several key areas from the weapons later adopted by the United States and Norway, particularly in its use of a forward (as opposed to downward) hinged magazine door, rimmed ammunition, and the use of an outer steel liner for the barrel.

Like many other armed forces, the United States military searched for a new rifle in the early 1890s. A competition was held in 1892, comparing 53 rifle designs, including Lee, Krag, Mannlicher, Mauser, and Schmidt–Rubin. The trials were held at Governors Island, New York, and the contract was awarded to the Krag–Jørgensen design in August 1892. Around 500,000 "Krags" in .30 army (.30-40) calibre were produced at the Springfield Armory in Massachusetts from 1894 to 1904. The Krag–Jørgensen rifle in .30 army found use in the Boxer Rebellion, the Spanish–American War and the Philippine–American War. The .30-40 Krag–Jørgensen fired a round-nose 220-grain cupro-nickel jacketed bullet in .30 calibre, loaded with 40-grains of smokeless powder to a muzzle velocity of approximately 2000 fps. These were the main rifle developments that would rival the German's attempt to perfect their Mauser up until 1898.

The original (.318 inch) 227-grain Round Nose full metal jacketed bullet for the M88 cartridge doing 2,034 fps.

The invention of smokeless powder in the late 19th century immediately rendered all of the large-bore black powder rifles then in use obsolete. To keep pace with the French (who had adopted smokeless powder "small bore" ammunition for their Lebel Model 1886 rifle), the Germans adopted the *Gewehr* 88, using its own new 7,92x57 mm cartridge, which the German Rifle Commission also designed. The rifle was one of many weapons in the arms race between the Germanic states and France and Europe.

The 1888 Commission Rifle

The 7.92 x57 mm, as used in the **'88 Commission rifle**, typified the rimless centrefire cartridges that have endured to the present day. Having no protruding rim, it would provide smoother, more reliable feeding in the box magazine rifles that soon appeared after 1888. Mauser was not the originator of the rimless case; the idea was borrowed from the same Swiss Army officer who had perfected the metal-jacketed bullet that was now necessary with the higher velocities imparted by smokeless powder, **Colonel Rubin.**

The 7.92 x 57 mm/8 mm Mauser cartridge, as introduced in 1888, was loaded with a .318" diameter round nose, full metal jacket bullet weighing 227 grains. Ludwig Olson in Mauser Bolt Rifles, 3rd ed., pg. 42 (the bible for Mauser enthusiasts) refers to this round as the "Commission Model 88 Cartridge." Olson lists the muzzle velocity at 2,034 fps from a 29.13" barrel.

Truth be told: The M88 cartridge case (8x57) was not a Mauser design, and Mauser had nothing to do with its design. It was, in fact, designed by a Commission. The Rifle (M88) was not a Mauser but a hybrid Mannlicher. "Paul Mauser's Model 1888 rifle was really a **modified Mannlicher**, not as stout as the Mauser that replaced it a decade later. But Mauser's name has long been attached to the 7.9x57 cartridge that appeared in 1888 for the "*Gewehr* 88," or "Commission" rifle. (The 1888 rifle owes its design to the German Infantry Board or Commission at Spandau Arsenal)." ➤➤

Gewehr Model 1888 in 7.92mm.

Herr Mauser had no part in the M88. He was not even consulted and entirely left out of the whole deal. The Commission only used some of his designs in the M88. Also, **Ludwig Loewe** company was the major shareholder in Mauser and built M88's. **Von Mannlicher** was, as far as gun designs go, probably the most prolific designer of all time. He had 104 patents in operation and received credit for 150 working and more than 100 experimental designs.

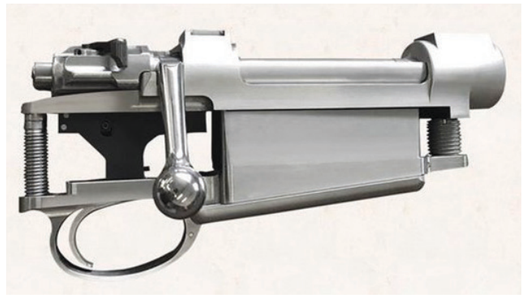
The 8 mm Mauser comes with a twist rate of one turn in 9.45", which is needed to stabilize up to 220 gr soft-nosed bullets. Ideal for bullets that followed many years later, such as those offered by Woodleigh, Swift and other custom bullet makers. Here is an example of the original 227 gr bullets in a stripper clip for the M1888. The Mauser features a 5-round magazine, and the stripper clip was designed for fast loading. Hence the action had a cut on the left side of the receiver – referred to as the thumb-cut.

The Mauser Model 98 Rifle

On 5 April 1898, the Mauser Model 98, the improved action, was adopted as standard issue for the German armed forces. The Mauser is, of course, a controlled-feeding design. Notably, Mauser went from a push-feed to a controlled feed for maximum reliability in his earlier designs. As a result, the Mauser extractor will not slip off a case rim, and the harder you pull on the bolt handle, the harder the claw tips inward and grips the case. This is why a round should always be fed from the magazine and not pushed into the chamber as with a push-feed system.

Some people may not understand why the M98 action rattles with the bolt open, but it was not due to sloppy machining. Tolerances were deliberately kept loose by design for maximum reliability in dirty/muddy conditions. The Mauser bolt does not rattle in the closed and locked position. Also, the wide Mauser claw extractor is unsurpassed in reliability. These design features were focused on the rifle's future military application.

The controlled round feed design allows the magazine to be emptied simply by cycling the bolt back and forth without lowering the bolt handle. The extractor engages the cartridge as soon as it leaves the magazine and before it is fully chambered. This is perfectly safe even with the safety disengaged because the bolt cam prevents the firing pin from moving forward while the bolt is cycling, and the firing pin also has a safety shoulder that blocks the firing pin from moving forward when the bolt is unlocked. This method of unloading may be quicker and easier than releasing the detachable magazine floorplate found in some Mauser actions. One of the reasons Mauser rifles handle gas deflections better than most other rifles, aside from the flange on the bolt shroud, is the thumb-cut which allows the gas to vent harmlessly off to the side



Mauser action M98 with a side safety.

Unique features of the Mauser design

One of the features of a Mauser made rifle often not discussed or written about was that its magazine box was designed to be case-specific, and that is where some others, even modern factory rifles, fall flat. Mauser understood the science of making magazine boxes and followers, and it was the key to the success of their rifles, both military and commercial. It was Paul Mauser who first pioneered and correctly calculated proper dimensions for a staggered magazine to be used in bolt action rifles. He went strictly by a mathematical formula for all the cartridges he made. Rounds should stack in the magazine, forming equilateral triangles of contact, limited by the box, the follower, and the rails.

Some of today's gunsmiths are still unaware of his magazine design concept. Great rifles need to be reliable to ensure superior feeding every time. Great rifles are built from the inside out!

Mauser's formula for the optimum magazine width was as follows: -

(Cosine of 30 degrees) x base diameter of cartridge case) + base diameter = width of magazine

Here are some examples: -

For a .30-06 Spr = (.866 x .473) + .473 = .882 inches
For a .300 Win Mag = (.866 X .532) + .532 = .993 inches.
For a 404 Jeffrey = (.866 X .545) + .545 = 1.017 inches.

By multiplying the Cosine of 30 degrees ((0.866) by the case head diameter, then adding the diameter to the product of the equation, the correct magazine box width could be determined.

For example, a 9.3x62mm case measures 11.95mm across the rim:

So, 0.866 x 11.95 = 10.35 +11.95 = 22.3 mm.

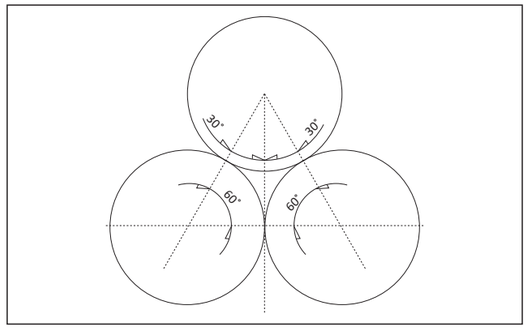
Theoretically, that is the correct inside rear magazine box width for any cartridge deriving from the 9.3x62 mm case. However, all cartridges taper, and so must the magazine.

The same formula yields the proper box width at the point of shoulder contact:

The shoulder diameter is 11.45mm
So 0.866 x 11.45 = 9.92 + 11.45 = 21.4mm

Therefore, a magazine box for a 9.3x62 mm cartridge must theoretically taper from 22.3 mm to 21.4 mm. Adding an extra 0.07 mm (0.003") or so for dirty or oversized cases makes practical sense. So, a practical magazine box for the 9.3x62 mm cartridge would taper from 22.4 mm to 21.5 mm.

For smooth, reliable feeding from double-stack magazines, it is important that the feed rails or lips are designed to properly align the cartridge with the chamber, both horizontally and vertically, and release the cartridge at the right time. Today the majority of centrefire sporting rifles feed from double-stack magazines. Compared to



Mauser magazine layout.

single-stack magazines, staggering the cartridges in two rows allows the same number of cartridges to be carried in a shorter column height. I don't like protruding single-stack magazines as they are in my hand's way where the rifle should balance and where I am used to holding the rifle when I run with it.

With double-stack magazines, functioning is not affected much by necking the case to a different calibre, as long as other case dimensions are unchanged - the critical case dimensions are diameter and case length. For example, a Mauser rifle built around the 8 mm cartridge easily adapts to cartridges of similar dimensions, such as 7 mm Mauser or .257 Roberts. It generally will work with cartridges such as .30-06 or .270 Win having the same body diameter but a longer case. Change these significantly, and we run into trouble.

Paul Mauser was very proud of his patented magazine design. Not only are the feed lips of the Mauser machined into the receiver (rather than, say, a part of the magazine), but he designed the magazine and follower for each cartridge.

Mauser changed the calibre from .318 to .323

In 1905, Mauser increased the working pressure of this cartridge and switched from the original 0.318-inch round nose 1888 bullet of 225-grain (MV = 2,095 fps) to a 153-grain, 0.323-inch, Spitzer bullet (MV = 2,880 fps), a phenomenal velocity for that early era. The reason behind the increase in bullet diameter was that the grooves of all existing military 8x57 J barrels were deepened to extend useful barrel life. All new barrels were specified with the deeper grooves, but the bore diameter of 0.311-inch remained unaltered. Thus, the groove depth became [(.323 - .311)/2] .006" or 6-thou deep. It should be noted that a 153-grain bullet at 2,880 fps was made possible from a long 29.3-inch barrel that Mauser rifles had at the time. The new cartridge was now known as the 8x57JS (the S stands for *Spitzgeschoss*, from which came the Americanized term "Spitzer").

The **8x57 JS** (the correct denomination would be IS, where I stand for *Infanterie* or **Infantry**, and S stands for ***Spitzgeschoss* or Pointed-tip bullet**). Also known as the 8 mm Mauser round, the 8x57 JS cartridge as we know it today is a vastly improved variant of the **8x57 I calibre developed in 1888** by the German GPK (*Gewehr-Prüfungs-Kommission*, or Rifle proofing commission) for its *Gewehr* model 1888 rifle, also known as the *Kommissionsgewehr*.

The Mauser rifle pushed into WW1 & WW2

Germany fought two world wars with the 8 x 57 mm Mauser. Quite remarkable how the Mauser would go on to service the war effort. Hitler denounced the Treaty of Versailles in 1934 and started with rapid re-armament in June 1935. It is interesting to know that just before World War II, during 1934, the Germans replaced the 153gr Spitzer bullet running at 2,880 fps with a 198 gr Spitzer boattail bullet at 2,493 fps. The new cartridge was now known as the 8x57JS (the S stands for *Spitzgeschoss*, from which came the Americanised term "Spitzer").

This time, Germany went to war with the short version of the Mauser, the **Karbiner 98 Kurz** - it had a 23.6-inch barrel instead of a 29.3-inch barrel, as it was too long for trench warfare. Between 1934 and 1945, over 14 million were manufactured. While reloading was slower than with a .303 Br, the German Kar-98k's accuracy more than enough made up for it. The Mauser's rate of fire was 15 rounds per minute, whereas, for the British .303, it was 20 rounds per minute, but with a detachable magazine holding ten rounds. In contrast, the Mauser was loaded with a stripper-clip holding five rounds.

A German infantryman of the Great War armed with *Gewehr* **98.**

The main reason was that the bigger powder charge of the 153 gr load produced excessive muzzle flash in the shorter barrel of 23.6 inches in the Kar.98. We learn from Olson's Mauser Bolt Rifles that the Germans gained experience in World War I. It showed that the 153-grain "S" bullet was too light for machine gun applications where maximum effective ranges needed to approach a thousand yards rather than 400 yards. Another reason was that the bigger powder charge of the 153 gr load produced excessive muzzle flash in the shorter Karabiner barrel. At the same time, the heavier bullet gained better sectional density. Even though they sacrificed some velocity, the round was much more powerful in its higher momentum value and better penetration ability. The Mauser Karabiner 98K was adopted on 21 June 1935 as the standard service rifle by the German *Wehrmacht*.

The 198-grain Spitzer boattail bullet with a **9-degree boattail** was developed to go through the transonic region in a stable mode – its better aerodynamics was a considerable improvement. Opting for a heavier bullet (higher sectional density) gained them a higher ballistic coefficient for a flatter trajectory even though they sacrificed velocity, but overall, it yielded a much more lethal and devastating load; more momentum and better penetration, whilst the lower velocity was also less destructive on the bullet, avoiding blow-up.

During WWII, the **198 gr FMJBT projectile** was the most aerodynamically efficient rifle bullet of the entire war, with a G1 BC of .593 at supersonic speeds (that's considerably higher than the modern .308 M118 sniper bullet). A typical muzzle velocity of 2,493 fps through a 23.6" barrel translates into a 1,000-meter effective range for the cartridge. The bullet is still travelling at Mach 1.07 at 1,000 meters under International Standard Atmospheric conditions. During WWII, the 8 x 57 mm load was a 198-grain bullet at 2,575 fps yielding a pressure of around 49,500 psi.

Some handloads for illustration purposes

I modelled a mild and safe load with QuickLoad as follows using a 200 gr Nosler Partition bullet (COAL = 81mm):

- Load: 45.8 gr S335
- Case fill: 89.3%
- Velocity: 2,453 fps
- Pressure: 50,497 psi
- Which is well within the CIP P-Max @ 56,565 psi

3 typical loads:

- Load: **44.6gr** S335 - 86.9% case fill - Velocity: 2,402 fps - Pressure 47,045 psi (low)
- Load: **45.8gr** S335 - 89.3% case fill - Velocity: 2,453 fps - Pressure 50,497 psi (medium)
- Load: **47.0gr** S335 - 91.6% case fill - Velocity: 2,503 fps - Pressure 54,186 psi (high)

Here are some stats to look at ex Quickload:

Detail	200 gr NP	Trajectory
Bullet's BC	0.350	Not applicable

The German 198 gr FMJBT bullet that Germany fought WWII with.

Velocity	2,500 fps	-1.5"
100 yds	2,258 fps	+2.7"
200 yds	2,031 fps	Zero
237 yds	1,950 fps	-2.9" (Point blank range)
250 yds	1,921 fps	-4.3"

If you can live with it, the 8x57 cartridge will provide lower recoil and a much lower operating pressure and still offer enough punch out to 250 yards, catering for most of the kills you need to make.

The ballistic sweet spot of the 8 mm Mauser comes by virtue of its design; the interplay of its case volume (its energy source), and its relationship to its bore size and the bullet weight that has to be pushed (resistance to movement), yielding a lower peak pressure than all other rival cartridges. In addition, and as part of its design, it is a long-throated design (allowing longer and heavier bullets to be utilized) that essentially increases the combustion volume and thereby assists in reducing pressure. The combination of all these contributing factors creates a sweet spot in this cartridge with regard to a 200-grain projectile.

In the US, 8x57 factory loads have always been under-loaded. This pretty well emasculated the cartridge's performance and ensured that it would never become very popular in America. This was done because the original 1888 German Commission rifle could not withstand the higher pressures of 8x57JS loads intended for use in the strong Mauser 98 action. Evidently, the US loading companies didn't want to bother informing American shooters about the differences between the two cartridges and the rifles that shoot them.

For a straight-out comparison with 200 grain bullets, the picture becomes clearer why the 8x57 cartridge operated at a far lower pressure level:

8x57: 200 gr @ 2,575 fps (CIP P-Max =56,564 psi)
.338-06: 200 gr @ 2,720 fps (SAAMI standardized in 1998, Pressure = 65,000)
.338 Win Mag: 200 gr @ 2,950 fps (CIP P-Max = 65,000 psi)

Ballistic Sweet Spot

I regard the 7,92x57 mm Mauser loaded with a 200-grain bullet as occupying a ballistic sweet spot with its low operating pressure level. Ballistically, the cartridge is very well balanced, as it befits a design that came about because the ballisticians began with a blank sheet of paper and set out to produce the ideal cartridge. As a custom hunting rifle for handloaders, very little cannot be hunted with it. Bullets that suit the cartridge and its twist rate run from 170 to 220 grains. One RWS factory load fires a 180-grain bullet at 2,690 fps, and another offering is a 196 gr RWS @ 2,592 fps. Then there is a 196 gr Norma @ 2,526 fps and a 196 gr Sellier & Bellot @ 2,592 fps.

Paul Mauser never saw WW1

Paul Mauser died on 29 May 1914 before World War I started in August of that year. World War I saw a huge spike in demand for the company's rifles and several variants. Needless to say, the legacy of the 8x57 in two world wars raised the Mauser brothers to cult status. The 8 mm Mauser in Model 98 guise was one of several cartridges designed by the renowned firearms genius Peter Paul Mauser. Most of the other Mauser-designed cartridges were devised to satisfy specific requirements of the many countries which contracted the famous manufacturing firm to supply them with shoulder arms in the late 19th century.

Credit to this great man for his ingenuity in designing a master piece that still has no equal to this day - Peter Paul Mauser.

Epilogue

We should remember that the 8 x 57 mm Mauser designed in 1888 was the mother of all rimless cartridges. The 8x57 mm spawned many other cartridges in all .473" head-based cartridges, including the 7X57 mm, 30-06, .308 Win, .243 Win, .270 Win, etc., owe their heritage to the 8X57mm cartridge. Looking back over more than a century (1888 to 2021) of enormous progress in every facet of gun-making, it is easy to forget the challenges faced and overcame by military planners and manufacturers. There were many different areas of research involved, such as changes in metallurgy for rifle barrels, improvements in the quality of barrels, bullet jackets, chemical advances for smokeless powder and primers. We have also experienced a bullet revolution with bonded bullets and mono-metal bullets since the early 1990s.

We have come a long way over the past 133 years. Today, we stand aghast at the advances in the likes of military rifles, canon armoury, armour piercing projectiles made from tungsten carbide and depleted uranium, laser technology, tanks, panzer vehicles, missiles, nuclear bombs, planes, drones, ships and GPS technology—phenomenal progress on the one hand, but also with a chilling destructive intent lurking in the background.