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## Examination of the effectiveness of antique ammunition

### Summary

The aim of the article is to present the results of the efficiency tests of old ammunition carried out as part of forensic expert opinions. Based on these results, the question can be addressed whether there are any age limits for integrated cartridges, beyond which they are definitely no longer functional and, consequently, cannot be fired from firearms. Such a question may be posed to forensic experts in the course of their activities. In addition, the article presents the risks associated with the firing of old ammunition.

**Key words:** cartridge, gunpowder, efficiency test, case bursting

The tests of ammunition, including that from the period of World War II and older, are commonly performed as part of firearms and ballistics expert opinions. Furthermore, such ammunition is still offered for sale by licensed arms and ammunition dealers (the author met in 2019 with commercially available 7,92 × 57 mm calibre Mauser rifle cartridges made in Germany in 1944). It is not surprising for a firearms and ballistics expert that cartridges manufactured 75 years ago retain their full functionality, i.e. they can be successfully fired. According to literature data on the storage standards for smokeless gunpowder, it retains functionality for the period of 12–15 years under the best storage conditions, after which it is considered unusable. Notably, the combat value of gunpowder is retained for even shorter (1.5–2x) period of time due to the loss of ballistic properties, caused by the spontaneous chemical decomposition properties of the nitrogenous compounds of which the gunpowder is composed. The smoky gunpowder (also called black gunpowder) is even more exposed to the loss of ballistic properties, due to its moisture sensitivity. When the humidity of the gunpowder reaches 15%, the smoky gunpowder is not suitable for use since it will fail to ignite. Drying does not restore these properties, unlike in the case of smokeless (colloidal) gunpowder, which is not sensitive to humidity (after moistening it is easy to dry and regains its ballistic properties). However, in most cases, the malfunction of the old cartridge is due to the loss of the initiating capability of the primer substance, and not to the properties of the propelling substance, which, after disassembling the misfired cartridge, burns in a manner typical of gunpowder. In order to illustrate

this issue, a few examples of the effective testing of old ammunition by using the correct calibre firearms with a positive result are given below. The bullets were fired correctly and the weapons were functional (e.g. the automatics of the repeating pistol was preserved).

(a) In 2018, four ammunition packagings containing sixteen 9 × 19 mm calibre Parabellum (Luger) pistol cartridges of German production each – a total of sixty-four cartridges – were delivered for testing (Figure 1). According to the accompanying investigative file, the cartridges were revealed in closed and labelled ammunition carton packs hidden in the chimney. On the labels there were inscriptions printed in German, in the so-called gothic language, with the following content: „16 Scharfe Pistolenpatronen 08” and the dates of production: 29 June 1917, 7 September 1918, 18 September 1918, (...) November 1918. (day marking illegible). All the packagings were full. Inside, there were brass-cased cartridges encasing full metal jacket bullets with rounded tops and clad, steel jackets. The primer cups of all the cartridges were sealed with black lacquer around the edges. On the bottoms of the cases there were markings of the manufacturer with the following contents: “S 5 17” (one cartridge from the packaging dated 29 June 1917), „S 6 17” (fifteen cartridges from the packaging dated 29 June 1917), “Ge 9 18 D” (sixteen cartridges from the packaging dated 18 September 1918), “S 7 18” (eight cartridges from the packaging dated 7 September 1918), „S 8 18” (eight cartridges from the packaging dated 7 September 1918), “RM S 3 18” (one cartridge from the packaging dated November 1918), “RM S 8 18” (two cartridges from the packaging

dated November 1918), “RM S 9 18” (two cartridges from the packaging dated November 1918), and “RM S 10 18” (eleven cartridges from the packaging dated November 1918). In the course of examination, one of the cartridges produced in September 1918 (marked as “Ge 9 18 D”) was disassembled. Inside the case, propellant material with a macroscopic appearance of smokeless gunpowder with cylindrical, seven-channel, greenish powder grains was found (the cartridge was reassembled). The markings on the bottoms of the cases under examination showed that they were produced by:

- Munitionsfabrik Spandau: May 1917 (one “S 5 17” cartridge), June 1917 (fifteen “S 6 17” cartridges), July 1918 (eight “S 7 18” cartridges), August 1918 (eight “S 8 18” cartridges),
- Rheinische Metallwaren und Maschinenfabrik Soemmerda: March 1918 (one “RM S 3 18” cartridge), August 1918 (two “RM S 8 18” cartridges), September 1918 (two “RM S 9 18” cartridges), October 1918 (eleven “RM S 10 18” cartridges),
- Gustav Genschow Durlach: September 1918 (sixteen “Ge 9 18 D” cartridges).

Evidence cartridges were tested by firing nine randomly selected cartridges, i.e. one from each of the groups bearing the same manufacturer’s markings, using a Parabellum P-08 calibre 9 mm pistol from 1914 made in Germany. One cartridge from 1918 (marked as “RM S 8 18”) failed to fire because of a defective primer. The remaining ones fired correctly, the pistol worked properly, i.e. its automatics was fully preserved. Longitudinal cracks in two cases from the cartridges fired were observed.

The efficiency tests carried out proved that the cartridges produced 100 and 101 years ago remained functional and could be successfully fired.

b) In 2016, a 7.62 mm x 54R calibre Mosin Model 1891 rifle cartridge was submitted for testing. The evidence cartridge was a blunt-nosed, full metal jacket bullet, punch embedded in a brass case. The case’s

bottom bore the manufacturer’s markings “P 05”. These markings show that the evidence cartridge was produced in Germany by the Polte Armaturen- und Maschinenfabrik in Magdeburg in 1905 on Russian orders in the face of the needs of the Russian-Japanese war of 1904–1905. It did not bear any traces of disassembly or firing attempts. Therefore, the evidence cartridge was subjected to efficiency testing by shooting it from a 7.62 mm calibre Mosin Model 1891 rifle. The result was positive, the cartridge was properly fired after 111 years from the date of its production. The specificity of the shot showed that it was effected by smokeless powder.

c) In 2016, the German .320 (7.65 mm x 17R) calibre and in 2017 the Czech .380 (9 mm x 17R) calibre revolver cartridges were submitted for testing. Evidence cartridges contained solid lead bullets (made of lead alloy) without jackets, with the so-called external lubrication, embedded in brass cases on the bottoms of which there were manufacturers’ markings with the content “R.W.P. 320” and “SB 380”, respectively. Both cartridges were subjected to efficiency tests by firing them from proper calibre firearms, i.e. a Howard Arms Co. calibre .32 S&W revolver and a H&R Model The American Double Action calibre .38 S&W revolver, respectively. The result was positive, both cartridges were fired correctly. The effects that accompanied the firing and the gunshot residues remaining inside the cases proved the presence of smoky (black), possibly semi smokeless gunpowder inside the cartridges subjected to the study. Although the cases of the cartridges were not marked with the date of their production, the type of propelling material used indicates that they could have been produced as early as in the 19th century.

d) In 2018, the Mauser Model 1871 11 mm calibre rifle, without numbers, manufactured in Germany was submitted for testing. This rifle was shortened using a home-made method to the so-called “sawn-off”



**Fig. 1.** Parabellum 9 x 19 mm calibre pistol cartridges from 1917 and 1918 submitted for testing and cartridge cases from evidence cartridges fired with ammunition packaging. The bullet jackets of the cartridges from the packaging dated 18 September 1918 were melchior-clad, while the remaining cartridges had bullets with tombac-clad jackets.



**Fig. 2.** Single-shot Mauser Model 1871 11 mm calibre rifle, without numbers, produced by Germany, in the condition as submitted for testing, the so-called “sawn off”.

form (Fig. 2). The alterations consisted in cutting off a significant part of the barrel, bending the lock handle downwards at an angle close to right, placing the rifle in a home- adapted wooden bed with a butt and a metal trigger guard from a pneumatic rifle. There were no alterations of the four times, right-handedly threaded rifle barrel with a cartridge chamber compatible with 11 mm × 60R calibre Mauser rifle cartridges. The rifle's mechanisms worked properly, indicating the possibility of firing the above mentioned cartridges.

The evidence rifle was not delivered with the appropriate ammunition. Therefore, in order to carry out efficiency tests, the German 11 mm × 60R Mauser calibre rifle cartridges obtained from the Ammunition Standard Collections of the Department of Firearms and Ballistics Examinations, Forensic Laboratory, Voivodeship Police Headquarters in Wrocław were used. Ten original cartridges were used that did not bear traces of disassembly, alteration or firing attempts. The cartridges had solid lead bullets (made of lead alloy), rounded at the top (five cartridges) or flat ended (five cartridges). All the bullets were wrapped in paper in the lower part. One of the cartridges (marked as “B&S IV 1878”) was disassembled and it was found that in the interior of its case, underneath the bullet, there was a cardboard attachment, a sealant,

most probably made of beeswax, another cardboard attachment (the attachments were glued together with wax, which strongly adhered to the inner wall of the case), a propellant with a macroscopic appearance of black (smoky) powder with thick, irregular grains (Fig. 3). The bullet and extracted powder were weighed using electronic laboratory scales Radwag PS 1000.X2. The results were as follows: bullet 24.96 g, gunpowder 5.05 g.

Each cartridge had different manufacturer's markings on the bottom of the case, including:

- “D 1 78 \*\*” with an ‘O’ – a cartridge manufactured by Königliche Munitionsfabrik Danzig in January 1878, case single factory refilled,
- “E 3 83 \*\*” – a cartridge manufactured by Georg Egestorff Linden in March 1883,
- “E 4 83 \*\*” – a cartridge manufactured by Georg Egestorff Linden in April 1883,
- “E 5 83 \*\*” – a cartridge manufactured by Georg Egestorff Linden in May 1883,
- “HE&C I 1876” with one “O” – a cartridge manufactured by Henri Ehrmann u. Company Karlsruhe in January 1876, case single factory refilled,
- “HE&C I 1877” with one “O” – a cartridge manufactured by Henri Ehrmann u. Company Karlsruhe in January 1877, case single factory refilled,



**Fig. 3.** Disassembled 11 mm × 60R calibre Mauser Model 1878 rifle cartridge: a bullet with a paper wrap, a cardboard attachment, a wax and a cardboard (bottom) attachment, black (smoky) gunpowder, a case.



- “S A 11 75” with one ‘O’ – a cartridge manufactured by Königliche Munitionsfabrik Spandau in November 1875, case single factory refilled,
- “S A 2 76” – a cartridge manufactured by Königliche Munitionsfabrik Spandau in February 1876,
- “S 02 78” with one ‘O’ – a cartridge produced by Königliche Munitionsfabrik Spandau in February 1878, case single factory refilled,
- “B&S IV 1878” with tripple “O” – a cartridge produced by Basse & Selve Altena in April 1878, case triple factory refilled (this cartridge was disassembled and was not used for efficiency testing).

The ballistic tests of the evidence 11mm calibre Mauser Model 1871 rifle, without numbers, produced in Germany, home-converted into the so called sawn off, were carried out with the use of nine of the above mentioned cartridges. Four cartridges marked as: “HE&C I 1876 O”, “E 5 83 \*\*”, “SA 11 75 O” and “SA 2 76” were fired correctly and the effects accompanying the shots (visual, acoustic and fragrant) indicated that they were effected by black (smoky) gunpowder. One of the bullets fired pierced three coniferous wood planks 15 mm thick each (45 mm in total) and then stuck into the wooden bullet trap (wooden blocks positioned vertically). The other cartridges did not fire due to the malfunction of the primers. On the basis of the tests carried out, the weapon was found to be technically functional and capable of expelling projectiles. Moreover, it was proved that the cartridges used

maintained their functionality and could be fired after 135 years, 142 years, and approximately (judged by the markings for case refilling) 142 and 143 years from the date of manufacture, respectively.

#### Risks associated with the firing of old ammunition

The well-known saying that an old cartridge will either misfire or explode is not true, as can be seen from the above study, but at the same time it cannot be entirely disregarded. During the long-term storage of ammunition, its propelling material undergoes a number of qualitative changes caused by the natural ageing processes, as a result of which ammunition changes its physicochemical, ballistic and mechanical properties. In general, time adversely affects cartridges in such a way that they can cause accidents during shooting. Specifically, the cartridge case ruptures and gunshot gases escape backwards, while the bullet leaves the barrel in a correct manner. Another issue is the cause of this phenomenon, i.e. the question whether it lies in the chemical decomposition of gunpowder and its detonative burning, the weakening of the structure of cartridge case walls, or in both of the above or yet other processes. There are known cases when 5.6 mm calibre (.22 Long Rifle) rimfire cartridges produced in the Nitron Chemical Plant in Krupski Mlyn in the 1970s, fired nowadays, often lead to the rupturing of the bottom of the case at the edge of the rim, including its ripping off and expelling it backwards. These cartridges have standard solid bullets made of lead alloy with four leading rings and variable width, embedded in brass cases with no markings on the bottoms. In the 1950's, they were packed in black-red-grey cardboard ammunition packages, labelled with a printed inscription: “REGULAR .22 RIM FIRE CARTRIDGES SPORT NITRON EXPORTED BY UNIVERSAL”. The firing of these cartridges should be warned against due to the undesirable effects described above, which may result in damage to the weapon, as well as injury to the shooter. In particular, it is dangerous to fire such a cartridge from a weapon without a bolt, e.g. a repeating sport pistol. The author has personally experienced a case rupture by ripping off its bottom in the course of firing such a cartridge from a Margo MCMK calibre 5.6 mm Russian-made pistol. As a result of the shot, the cartridge magazine fell out of the nest in the grip of the pistol, right-side grip lining was cracked (with its upper part torn off) and the extractor removing the case from the firing chamber was ejected (and lost), while the body of the case was stuck in the cartridge chamber. These cartridges can be safely fired basically only from a revolver, although this still causes cracks in the cases at the edge of the rim and unpleasant contact of gunshot gases with the hand of the person holding the weapon. Figure 6 shows such cartridges, ruptured cases and ammunition packaging.

Another dangerous case rupturing took place during the firing of a 7.92 × 57 mm calibre Mauser rifle



**Fig. 4.** 11 mm × 60R calibre Mauser rifle cartridges and cases thereof after being fired from the Mauser Model 1871 11 mm calibre rifle, without numbers, manufactured in Germany.



**Fig. 5.** Case bottoms from 11 mm × 60R calibre Mauser rifle cartridges fired in the course of weapons proficiency tests. Visible traces of the firing pin and manufacturer's markings.



**Fig. 6.** “Regular SPORT rim fire cartridges” from the 1970s, which are nowadays the cause of dangerous case ruptures during firing. Next to the cartridges, there is a ruptured case in the form of a body and a detached bottom. Ammunition packaging is shown in the background.



**Fig. 7.** Damaged case of the fired 7.92 × 57 mm calibre Mauser rifle cartridge from 1929, manufactured in Poland.

cartridge from 1929, which was produced in Poland. This cartridge did not show any signs of modifications or damage under microscopic examination. It had a regular “S-type” bullet, embedded in a brass case, on the bottom of which the manufacturer’s markings were displayed in four fields divided by lines: “Pk/67/DZ/29”. The cartridge was fired in 2019, i.e. 90 years after its production, using a fully operational Mauser 98k 7.92 mm calibre German rifle. The shot resulted in a triple rupture of the cartridge case, including its bottom, and in ripping off the primer cup from the nest in the bottom of the case (Fig. 7). Through the cracks and openings formed in this way, gunshot gases rapidly moved backwards, above the bolted chamber of the rifle, hitting the shooter’s forehead and causing local bleeding (without breaking the continuity of skin tissues) with single gunpowder grains stuck into the epidermis. The bullet was correctly expelled from the barrel of the rifle.

### Conclusions

Every firearm cartridge, including the ones manufactured over 140 years ago, i.e. shortly after the invention of the integrated cartridge in the second half of the 19th century, can be fired correctly. A bullet from such a cartridge fired from a firearm of the right

calibre can strike a target at a distance, just like a bullet from a modern production cartridge. When firing old ammunition, one should be careful about the possibility of rupturing the case and expelling gunshot gases through the hole created in this way in the direction of the shooter. This may also cause damage to the weapon. A completely separate issue is the historical value of old cartridges. It seems that, unlike firearms, cartridges are still not treated as vintage items and remain beyond the interest of museums collecting military items. Consequently, just as other material evidence, they are often utilised after the conclusion of criminal proceedings.

**Source of figures:** *author*

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