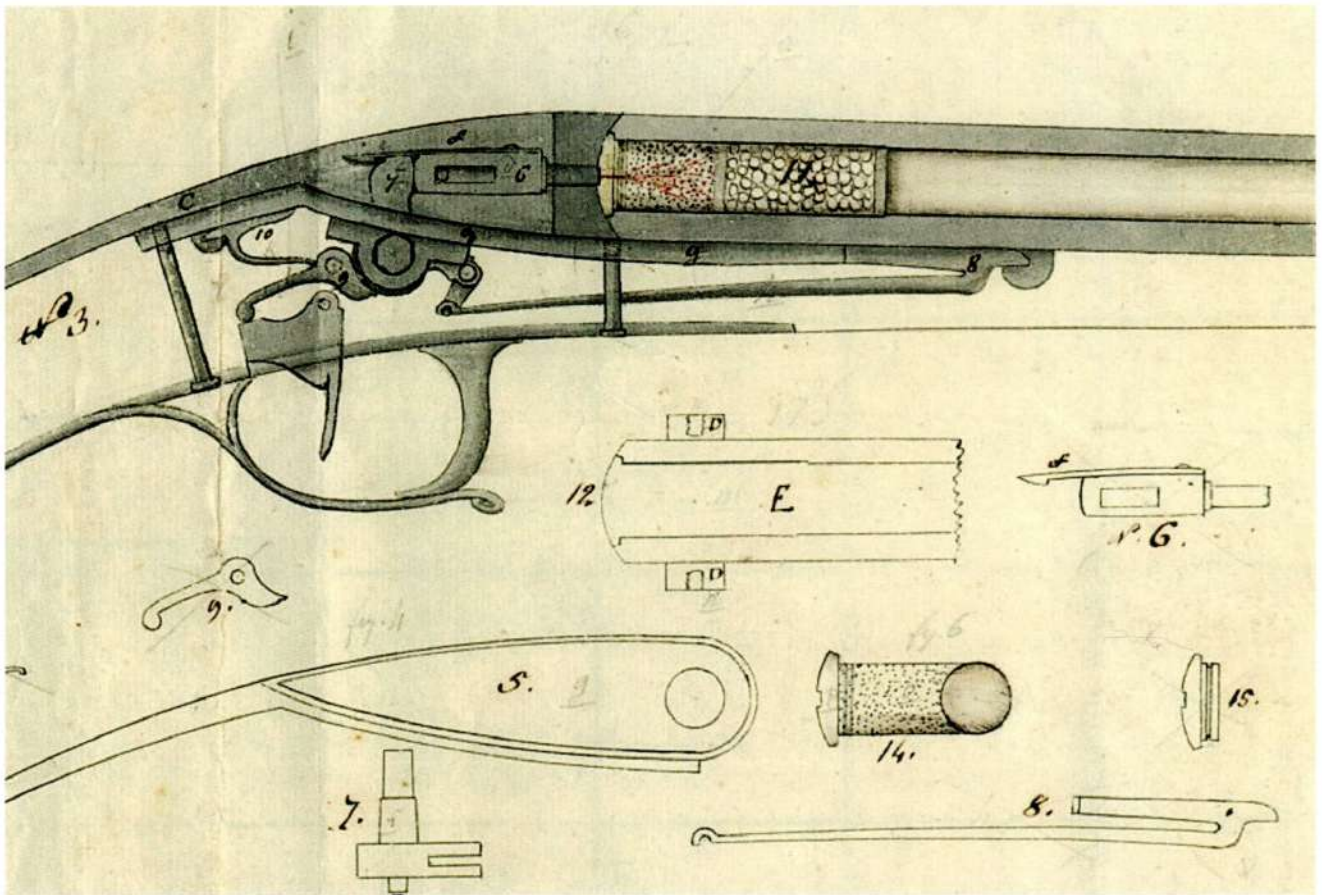


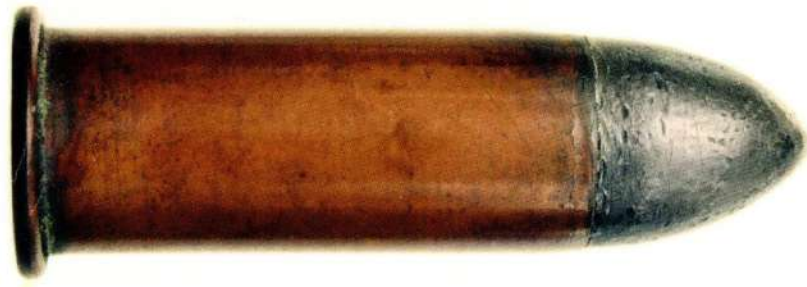
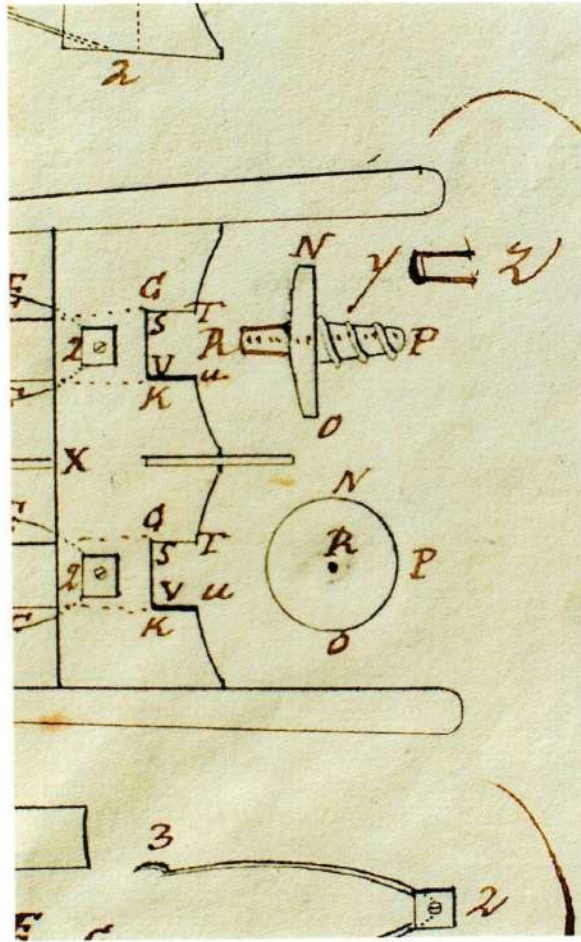
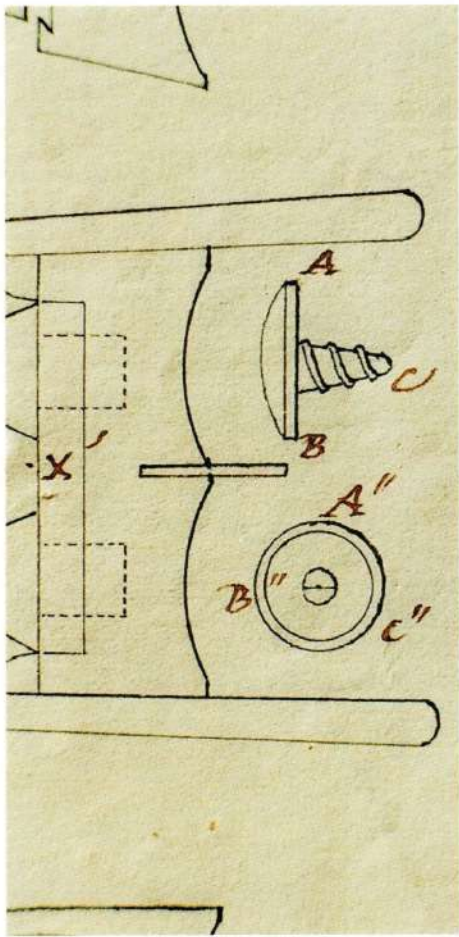
Jean Samuel Pauly, Henri Roux, and Successors

- their inventions from 1812 to 1882 -

New Light on the Forerunners of Modern Fire Arms Ammunition



Georg Priestel



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Title:

**Jean Samuel Pauly, Henri Roux, and Successors
– their inventions from 1812 to 1882 –
New Light on the Forerunners of Modern Fire Arms Ammunition**

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– their inventions from 1812 to 1882 –

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Georg Priestel

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- *Bolk Antiques*, who kindly made available photographs of the important very early Pauly hunting rifle.
- *Jonathan Furgeson*, curator of Royal Armories, National Firearms Centre, Leeds, who made available information on the cartridge for the Pauly volley gun, 1815.
- *Peter Grieder*, who made available photographs of his fine "Invention Pauly" Henri Roux shotgun.
- *Dr. Jürgen Kühnhold*, who was very helpful in the translation and understanding of the old French texts, and also in getting documents from INPI, Paris.

On the front cover

Design drawings of Roux's improved lock mechanism with percussion ignition and experimental rosettes, ca. 1815/16. Pauly-Roux cartridge, manufactured at the Arsenal Armory, Copenhagen, ca. 1820-22.

- *Amand Leveau*, French lifetime collector and researcher of French cartridges, whose new assignment of my cartridges gave the reason for this work in the first place. He made available his copies of original documents, collected over decades at INPI, Paris. This was the basis for the French historical part of the work.
- *Antonius Rauch*, who made available photographs of his extensive collection of early European cartridges.
- *Stephan Rudloff*, who is the one who has accompanied the entire work from its creation with all his expertise in weapon technology and mastery of the French language. In the end, he also made the "New Lights" stand out.
- *Guillaume Van Mastrigt*, who identified and confirmed the cartouche "HR" on the shotgun (pages 44/45) as Henri Roux.
- *Visier* gun magazine, *Matthias S. Recktenwald* (editor), who provided the color photos of the Henri Roux shotgun.

On the back cover

Design drawings of Roux's 1823 patent: rosette with nipple for percussion cap; Case with nipple of Roux 1823 patent; Pottet case of 1829 patent; .36 cal. Cofer cartridge for split-cylinder revolver (CSA); .54 cal. Morse, drawn copper case, Frankford Arsenal, ca. 1861; .58 U.S. Musket, Berdan 1866 patent.

preface

The creation of this book, which is in principle based on a happy coincidence, requires an explanation. In the course of my decades of dealing with the development of American ammunition in the 19th century, I also looked at the first European, i.e. French metal cartridges with central outside priming. The cartridges made by Pauly, Pottet and LePage between 1812 and 1832 were very attractive to me. After all, they are firmly anchored in literature as the forerunners of modern central fire cartridges. They essentially combined everything that only became standard 40-50 years later.

Regarding the early cartridges of Jean Samuel Pauly, I believed that everything was described in sufficient detail in the extensive literature on the subject. Berkeley R. Lewis (1972, 1973) and later also George Hoyem (1990) and Robert T. Buttweiler (1998) classified the known examples of the above inventors according to the time of their supposed manufacture. And publications from e.g. Lewis Winant (1959) and Matthew Schneiderman (2015) provided detailed explanations of the weapons of the Pauly system and a look at the associated ammunition. Everything seemed to me to be dealt with comprehensive correctness.

But my previous picture of Pauly's ammunition changed suddenly and dramatically when I was advised to contact the French collector and ammunition researcher Amand Leveau. One of his areas of specialty is "Pauly". The fact that I got in touch with him in spite of major problems with the French language proved to be a kind of blessing for the reappraisal of those important and formative years of French ammunition development.

In addition to a few simple questions, e.g. for markings on the Pauly rosettes, I also offered Mr. Leveau to present my small collection in the form of an image file. In order to keep my descriptions of the illustrated specimens as precise as possible, I named them "Type I", "Type II", "Type III", and "Type IV" depending on the chronological order in which I thought they were manufactured. Mr. Leveau's reply came promptly. What I would have called "Type I" is "Type II"! My "Type II" was "Type III" and my "Type III" was not Pauly at all, but a Roux according to his 1823 patent. My original specimen believed to follow Pauly's 1812 patent was a first improvement by Pauly from 1813 or, much more likely, invented by Henry Roux and shown in his 1816 patent. And even worse it concerned what I had classified under "Pauly cartridge for ignition with compressed heated air" (Type III). It is a brass case with a steel nipple for percussion caps patented by Henry Roux 1823. More detailed explanations can be found in the descriptions of the original French documents and the cartridges that actually exist.

With this short explanation my "Pauly world", which had been intact until now, was turned upside down, even completely out of joint. I had to change my mind radically. With Mr. Leveau's tireless willingness to provide me with copies of the original documents the first step had been done. The second important and decisive step in understanding the events at that time was the extensive discussions with my German collector friend Stephan Rudloff. Because of his good French language skills, his keen eye for key words in the texts and his excellent knowledge of weapon technology, he finally cleared the scene and made a significant contribution to understanding the processes as they really were from 1812. My sincere thanks go to both gentlemen!

This work should serve to explain the historical background and events of ammunition development with its brilliant inventors J. S. Pauly and Henri Roux, and to put those inventors in a better light than it had previously been. Under no circumstances should this be seen as a criticism of previous researchers and authors. Since all the documents (patents, reports and letters) now cited are "hidden" in the archive of the Institut National de la Propriété Industrielle (INPI), Paris, easy access to them was missing. Much of it can now be shown here and thus presented to a larger group of interested parties.

The structure of the content is based on the chronological order of the documents still available to us today in the form of commission reports, patent documents, letters and a contemporary publication (H. Roux, 1822). And last but not least, existing original ammunition examples in collections can underpin the developments with the illustrations shown here.

The presentation of ammunition development is an absolute priority. The technical peculiarities of the weapons are dealt with if this appears necessary in connection with the description of the cartridges. Detailed and good information on the weapons can be found in various publications (see bibliography).

To complete the picture, after the treatment of the French cartridges from 1812 to 1832, the way forward is also shown with examples that have been patented and manufactured in the USA.

Stephan Rudloff and the author, we are proud that we are able now to rewrite the early development of the Pauly and Roux cartridges. The composition of many individual pieces of a puzzle gives a fairly coherent picture of how the story went from the beginning to the modern central fire cartridge.

The author, who has summarized the whole in the form of this book and would like to make it available to you, the readers, now hopes to have shed some more light on the darkness of such important beginnings.

Moers, Germany, April 2020
Georg Priestel

chapter one

Pauly's milestone patent of 1812 – Breechloading gun for reusable metal centerfire cartridge base, and start with fire piston

The events are now to be described consistently using the original documents that are still available today. The reports, letters and patent specifications are shown as far as possible and necessary in full length and in sections, some of which are difficult to read. The old French from

Alexander John Forsyth – the revolutionary breakthrough

Jean Samuel Pauly could not have started his work if a kind of revolution* in ammunition and thus weapon technology had not taken place shortly before. With the invention of a substance that ignites explosively through percussion, the way to modern weapon and ammunition systems could only be paved. The credit goes to the Scottish referent Alexander John Forsyth (1768-1843), the father of the percussion ignition.

After extensive tests with different ignition agents, he succeeded in synthesizing the chemical substance potassium chlorate ($KClO_3$ - an extremely strong oxidizing agent) and recognizing its useful effect for igniting black powder either loosely or in the paper cartridges common at the time. The "acidic mercury oxide" (mercury(II)-fulminate [$Hg(CNO)_2$]), which had been isolated by alchemists since the end of the 17th century and known as an explosive, was unsuitable for use with small arms. First the potassium chlorate was mixed with small amounts of sulfur and charcoal, later antimony was used as an additive. Thus Forsyth was able to develop a reliable percussion lock, the so-called "scent bottle" system in 1805. In 1807, he received a patent for it.

This kind of revolution together with Jean Samuel Pauly's and Henry Roux's ingenious invention of a percussion-fired breechloader using a metal rosette or metal cartridge case did not lead to an immediate general paradigm shift. The time was simply not ripe for it, because a number of obstacles were waiting for the mature modern central fire cartridge until around the late 1860s and early 1870s. Important reasons: A still lacking or not very well developed technology for the drawing of metal to cartridge cases, which cause gas tightness, and above all the widespread reluctance of the conservative military (in Europe and in America). With very simple considerations, they thought the newly developed weapons for use on the battlefield were too complicated and too expensive to manufacture. They also feared that ammunition would be wasted and, last but not least, cowardice to the enemy.

*Origin of the word "revolution" in the title of the work "*De revolutionibus orbium coelestium*" ("*On the Revolutions of the Heavenly Spheres*") by Nikolaus Copernikus, 1543. With his heliocentric idea, Copernicus ushered in the age of modern science and technology, the so-called "Copernican revolution".

200 years ago is not always easy to understand. But it should help to understand how assessments, patent grants and patent specifications were written in France at that time.

Samuel Johannes Pauli's vita – a short version

Born in Vechtingen near Bern, Switzerland in 1766 under the name Samuel Johannes Pauli and died around 1821 in London, England under the name Jean Samuel Pauly. In Switzerland: carriage builder, blacksmith and service in the Swiss army (artillery).

1802: Move to Paris where he turned to the manufacture of weapons under the name of Samuel Jean Pauly as an employee of François Prélat.

1812: French patent for a breech-loading rifle with fire piston (ignition by compressed heated air) for central ignition of metal cartridges or rosettes with attached charge in a paper cover. Patent protection for ten years. Pauly's great invention came when Napoleon Bonaparte was conquering Europe.

1813: Pauly tried to turn to the civilian market. Foundation of the company "Pauly & Company" for the manufacture of his own weapons.

1814: Emigration after the downfall of Napoleon from occupied Paris to London, where he remained until the end of his life (ca. 1821).

1814: Sale of Pauly's stake in the company to Henri Roux (as the sole owner).

1814 and 1816: British patents for weapons fired by compressed heated air.

Pauly worked and spent some time in England on the development of dirigible airships together with his compatriot Durs Egg. He did not follow up the development of his own firearm and cartridge ideas. Both men lost money with the airship. Egg sued Pauly who died impoverished.*

*More about Pauly's life can be found in the various publications listed under "Bibliography".

**The report of July 16, 1812 –
great approval for the new system**

The first reference to the activities of Jean S. Pauly in France can be found in a detailed report of a committee of July 16, 1812 (*"Rapport sur un fusil de Nouvelle invention présenté par le Sr. Pauly"*) (Fig. 1). From this report by Cotty and Bureau, both officers in high positions in the imperial army, it emerges that, on behalf of the Ministry of War, Pauly's weapons (a rifle and a pistol) were presented by the inventor and examined by the committee on July 12, 1812.

In addition to the detailed descriptions of the individual weapon parts, the associated new ammunition for a breech loader is also properly described (Fig. 1a). What is mentioned is something special and completely new: a brass rosette with a vertical central orifice for the ignition beam, which is located at the rear end of the powder charge with its bullet. There is also a small cylindrical recess on the bottom of the rosette to hold the ignition compound (a mixture of potassium chlorate with a little sulfur and charcoal). In addition to a round ball of 18 mm caliber, Pauly also introduced a cylindrical bullet for his rifled gun barrels. The powder charge was 5.5 grams.

For ammunition, the peculiarities of Pauly's invention are essentially already covered!

Ignition by compressed heated air in guns is mentioned here for the very first time (see Fig. 1b). This is an astonishingly important finding. Pauly had already presented his invention of an ignition by compressed heated air to the military in the middle of 1812 and not the mechanically much simpler percussion ignition with a broad firing pin that was later used. He was thus also ahead of his two British patents from 1814 and 1816, which secure the "compressed heated air ignition". Overall, the report praises the mechanics and performance of the breech-loading weapon and the ammunition developed for it. The weapon deserves to be part of the Museum of Artillery and the Minister of War is recommended to purchase such weapons for military use according to the Pauly principle (see Fig. 1c).

La Cartouche employée par le Sr. Pauly, se charge comme
celle ordinaire avec de la poudre de guerre; la Balle, qui est sphérique et de
18 Lignes, est maintenue à son extrémité supérieure à l'aide d'un papier collé
dont elle est recouverte.
Celle Cartouche porte avec elle, à l'autre extrémité, une rosette ou
Petit en cuivre au centre duquel on a pratiqué une petite ouverture cylindrique,
qui communique avec la charge et qui sert à loger l'Amorce composée de
Mercurie & Epigène de petite quantité.
Cette cartouche se fait ainsi que les 2/3 de la Charge ordinaire de Guerre.
L'ouverture fait aussi usage d'une autre Balle sphérique
de côté opposé à la poudre, ayant une rainure dont le but est de loger la balle à
la Cartouche, comme le sont les Sabots des cartouches à Boutete.
L'Amorce est enflammée par le choc d'un petit piston mis en jeu au
moyen d'un ressort que la pression du doigt sur la détente fait baisser.
Ce piston et le piston sont renfermés dans le Boie, de manière que la
Composition de l'Amorce qui n'est pas le point de contact de l'air ne peut
se détériorer promptement.

... tout également de son invention; au...
... d'après la même système que...
... diffèrent peu sensiblement.
... et les talents distingués
... de son invention est digne d'être
... l'honneur d'un projet
... Ministère de la Guerre.
A Paris le
J. Bureau

Fig. 1a: Close up of that part describing the ammunition ("La Cartouche"). Just another important point at the end of this excerpt on cartridges: Since the lock, the piston and the ignition substance are hidden in the frame it cannot degrade as quickly through contact with air.

Fig. 1c: Close up of the commission's positive recommendation at the end on page three.

L'Amorce est enflammée par le choc d'un petit piston mis en jeu au
moyen d'un ressort que la pression du doigt sur la détente fait baisser.

Fig. 1b: Close up of a most significant predicate under "La Cartouche": "[...] par le choc d'un petit piston mis en feu [...]". In translation: The ignition agent is ignited by striking a small piston, which creates an ignition jet in a cylinder due to the sudden gas pressure built up. This describes the complete ignition mechanism, the fire piston.

Rapport
Sur un fusil de
nouvelle invention
présenté par le
S^r Pauly.

Messieurs (Coty) Colonel au corps Impérial
de l'Artillerie et Bureau, Chef de Bataillon de la même arme.
J'ai l'honneur de vous adresser le Ministère de la Guerre, pour examiner une
nouvelle invention présentée par le S^r Pauly, officier d'Artillerie helvétique, sur laquelle
il a été procédé, le 12 Juillet 1812, en présence de
l'inspecteur, à la suite et à l'abri de cette arme.

Avant de faire connaître les avantages annoncés par le S^r Pauly
à son Excellence, nous allons indiquer sommairement
les moyens employés par le dit S^r Pauly pour y parvenir, ainsi que les
différences de fabrication que présente son fusil en le comparant à celui dont on
a jusqu'à présent employé l'usage pour les troupes françaises.

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Le Canon est dans sa partie et a une diamètre (placé) chez le pau-
Supérieur; il est rayé en spirale; il se charge pour le transport, ou l'usage à
pratique à cet effet une douille d'un diamètre un peu plus grand que celui de l'âme,
pour le logement de la Cartouche; ce Canon est très portable, grâces à sa construction
de la manière qui sera indiquée de suite.

La Culasse a été remplacée par une pièce en fer d'un autre genre
ou genre qui, au moyen d'un mécanisme fort simple, peut se lever ou s'abaisser de
façon que dans la première cas on peut facilement introduire la charge, et que dans
le second cette pièce en fer tient lieu de Culasse en fermant hermétiquement
l'orifice inférieur du canon.

Dans la Monture on a supprimé les différentes Douilles en
fixant la pièce à deux bois, comme il l'est dans les fusils ordinaires de chasse.

La suite de la manière dont on charge le canon la Baguette
devenues inutile, a été également supprimée; mais elle a été remplacée par une
pièce, fixée au Canon par deux fortes Baguettes, creusées dans toute la longueur
pour la rendre plus légère et d'un diamètre assez fort pour recevoir la Baguette
dont la Douille se place à son extrémité et y est retenue par une vis de pression.

C'est par le moyen de cette pièce plus ou moins enfoncée dans le canal
pratique dans le bois et retenue dans chaque position, à l'aide de vis de pression,
que l'inventeur parvient à porter la Baguette des Soldats qui sont aux 2^{es}
et 3^{es} rangs; à la hauteur et à côté des Baguettes du 1^{er} rang.

La Baguette est semblable à celle du fusil de Soldat ordinaire
1777; mais elle est plus légère et a moins de longueur.

La Platine, à la place de Battant, et son mécanisme n'a été
entièrement changé; ce n'est qu'en voyant cette partie de l'arme qu'il est possible
de se faire une idée bien exacte, elle fait corps avec la pièce en fer qui tient lieu
de Culasse; et son action s'exerce entièrement sur le Derrière du Canon.

La Cartouche employée par le S^r Pauly, se charge comme
elle ordinairement avec de la poudre de guerre; la Douille, qui est cylindrique et de
façon, est maintenue à son extrémité supérieure à l'aide d'un goupillon; celle
dont elle est recouverte.

Cette Cartouche porte avec elle, à l'autre extrémité, une solette ou

une pièce en masse...
devenue...
le fusil de guerre...
du S^r Pauly...
de l'artillerie...
l'acquisition à son Excellence

le 16 Juillet 1812
Bureau

Fig. 1: The complete report (three pages) of July 16, 1812.

C'est en cuivre au fûté duquel on a pratiqué une petite ouverture cylindrique qui communique avec la charge et qui sert à loger l'anneau composé de Mercure & d'opigina de potasse cristall.

Cette cartouche se soutient qu'à la charge ordinaire de Guerre l'insulteur fait aussi usage d'une autre Balle seulement d'opigina de côté opposé à la poudre, ayant une rainure dont le but est de faire la balle à la Carabine, comme la sont les Sabots des cartouches à boutéte.

L'anneau est enflammé par la choc d'un petit pistou mis en feu au moyen d'un ressort que la pression du doigt sur la détente fait s'élever.

Le piston et le pistou sont renfermés dans le Boîtier de même que la composition de l'anneau qui résiste par le poids au contact de l'air en vertu de l'atmosphère pressurée.

Le poids total du fusil est d'environ 11 livres unies 1/2.

Le Sr Lauby se sert pour soutenir ses cartouches, d'un gibet en fer blanc vernis, pareille à celle dont les Espagnols font usage, comme on le voit à la page 100. Cette arme se sert d'une Cartouche en cuir à l'une des côtés duquel il a adapté une plaque en fer portant une écharde de même métal qui traverse la Carabine pour l'effet, à feu de détente. Soit devant l'arme à la hauteur de la main de la main, et pour tirer dans cette position.

Le fusil du Sr Lauby s'ouvre comme on vient de le dire, par la même visée de visée pour la perfection du travail; toutes les pièces sont d'ailleurs très bien ajustées.

Quant à l'usage de cette arme, à la Distance de 700 pas, une assez grande quantité de coups tant à poudre qu'à balle; il a été reconnu qu'elle est d'une précision simple et facile, qu'elle se chargeait avec beaucoup de facilité, que le coup partait avec célérité, que le tir en était juste et la longueur de la portée. Cette précision; mais elle a donné quelques raisons que l'on attribue à la faiblesse du jeu du piston, et qui toute fois peuvent provenir de la nature de l'anneau d'opigina de potasse cristall.

Il nous reste à parler des avantages qui doivent constituer l'usage principal du fusil en question, en faisant part de nos observations à ce sujet.

Ces avantages sont par le Sr Lauby sont:

1° De porter la balle à une Distance plus que Double de celle des fusils ordinaires.

La cause du Sr Lauby étant rayé en spirale lui procure un avantage de Carabine sur les fusils ordinaires, non que comme il le pense; en augmentant la portée, mais en lui donnant plus de justesse, la qu'elle est en core augmentée par une plus grande résistance de la balle qui n'a pas été chassée à coups de maillet et peut être par que la communication du feu au centre de l'opigina de la charge.

2° De l'opigina ou d'opigina pour charger, en pierre, en bois pour faire partir la charge.

Ces trois avantages sont réels; il a fallu toute fois remarquer la Cause par une pierre ou balle destinée à mettre l'arme au point.

3° De pouvoir tirer 10 coups par minute sans passer l'arme à gauche.

Ces avantages sont également réels, puisqu'on peut charger et tirer.

Cette qualité est un avantage pour un
L'opigina est très facile à faire dans un
situation de l'arme le fusil du Sr Lauby

il suffit de lever la culasse mobile, d'ôter le culot qui reste après chaque coup, pour la Cartouche, abaisser la culasse, armer et faire feu.

4.° De porter les Bayonnettes des hommes des 1.° et 3.° d'usage à la portée de coup de 1.°

Si l'on veut considérer cette manœuvre comme un très grand avantage, il se trouve sensiblement diminué par l'inconvénient grave qui en résulte, en ce que la portée de la pièce qui remplace la Bayonnette et celle de la Bayonnette portée en avant de la bouche du canon, augmentent considérablement le poids de l'arme à son extrémité, ce qui doit la faire balancer et par conséquent nuire à la justesse du tir; en outre la Bayonnette allongée et raccourcie ne vaut pas celle en usage et n'est pas à beaucoup près aussi solidement fixée.

5.° Inconvénient de proposer de faire quelques corrections à cette disposition de la Bayonnette.

6.° D'ôter le poids de la charge, insensible aux effets de la pluie sur la poudre, sans jeter de fumée et de ne pouvoir être paralysée par la pluie de la Bayonnette.

Ces faits sont assez exacts, mais le fusil peut donner des coups, si l'extrémité du piston vient à s'imprégner de poudre ou de quelque autre matière qui empêche un choc suffisant d'en résulter. L'inflammation de l'armure ou en feu de la Métrite d'origine de pot à feu est trop évitée.

Il résulte de toutes ces observations que ce fusil est fort ingénieux qu'il a paru supérieur à tous ceux du même genre qui ont été présentés jusqu'à ce jour et qu'il réunissait presque tous les avantages d'un autre genre d'invention; Mais en considérant que 1.° l'emploi pour un service d'origine de ce fusil, quoique mérité, se réduirait à un service d'urgence entre les mains du soldat, 2.° que la fabrication et les réparations de cette arme impliquée deviendraient très difficiles et coûteuses; 3.° qu'elle est plus pesante que le fusil Modèle de 1777 corrigé; 4.° que l'arme dans son ensemble, et notamment la Bayonnette, n'offre pas assez de solidité, on pense qu'elle ne peut être adoptée comme arme de guerre.

Le S. L. P. ayant présenté au fusil de chape aussi qu'un pistolet qui sont également de son invention; on a reconnu que ces deux armes avaient été fabriquées d'après le même système que le fusil de guerre et que leur construction ne différait que sensiblement.

Le génie et les talents distingués du S. L. P. méritent des honneurs et le fusil de son invention est digne d'être placé au musée de l'artillerie ou à quelque autre lieu d'honneur d'un grand établissement à son Spéciale Le Ministre de la Guerre.

Paris le 16 Juillet 1812

Bureau



Ignition with fire piston

The principle of igniting combustible substances by means of suddenly compressed heated air in a hollow cylinder with an airtight piston has been known for around 1000 years. It is said to have developed in Southeast Asia. For a long time it was quite unknown in Europe until the French chemist and physicist Joseph Louis Gay-Lussac (1778-1850), as a professor at the Sorbonne, Paris, dealt with it scientifically.

In its simplest form, Gay-Lussac's gas law of 1802 states that pressure, volume and temperature are closely linked. The temperature is proportional to the volume ($T \sim V$) at the same pressure. This means that as the pressure on the gas increases, its volume decreases and the temperature rises. The gas volume must be reduced suddenly, however, so that no heat exchange with the surroundings can take place. If the compressed heated gas is passed through a very narrow nozzle, it can ignite flammable substances such as the black powder in the cartridges.

The handy fire pistons, which were mass-produced, were already very popular around 1812, when Pauly developed his system. So it was only natural that he also wanted to use this method of ignition. The end of the fire pistons came with the invention of the matchstick in 1826.

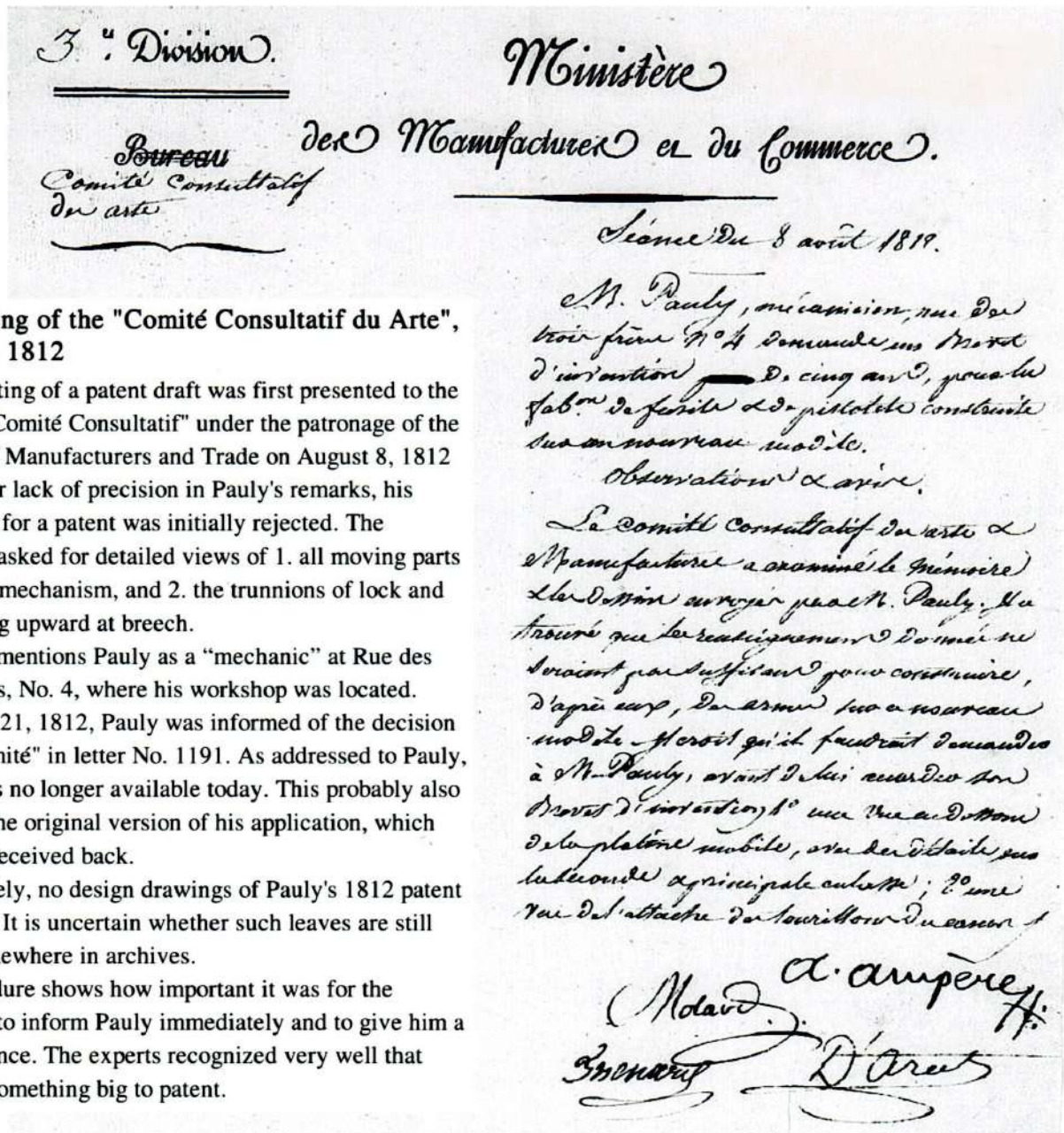


Fig. 2: The document of the meeting of the "Comité Consultatif du Arte", August 8, 1812. A very remarkable fact in the document should be pointed out, the signature of the committee's member A. Ampère. In honor of the great physicist André-Marie Ampère (1775-1836), one of the seven physical non-derived base units, the electrical current, the ampere [A], was named after him.

Pauly's letter to the Minister of Trade and Manufacturers, September 15, 1812

In his response to letter No. 1191, Pauly made a new submission to the responsible ministry with improvements on one and a half pages. As requested, he now provided a new description of his invention as well as the complete graphic representation of all weapon parts.

Note: Unfortunately we are not aware of these extremely important documents (drawings of the function of the mechanical parts) today. They would have contributed a lot to understanding Pauly's ignition mechanism. Either these documents have been lost or they are not correctly assigned in another file or maybe even in another museum.

In this letter, Pauly also requests that patent protection be extended from five to ten years. The reason for this

is that he still needs time to set up a large-scale production plant and to procure the necessary financial resources. Since he has now completed all the legally required formalities, he asks to process and submit his patent application quickly.

This time with success, the patent was granted on September 29, 1812, for ten years.

The meeting of the "Comité Consultatif du Arte", September 22, 1812

At this crucial meeting, it was decided that Pauly could be granted a ten-year patent for his invention of a rifle and pistol. The patent number "No 771" and the date of issue "Delivré le 29 7Bre 1812" (September 29, 1812) are recorded on the document (Fig. 3).

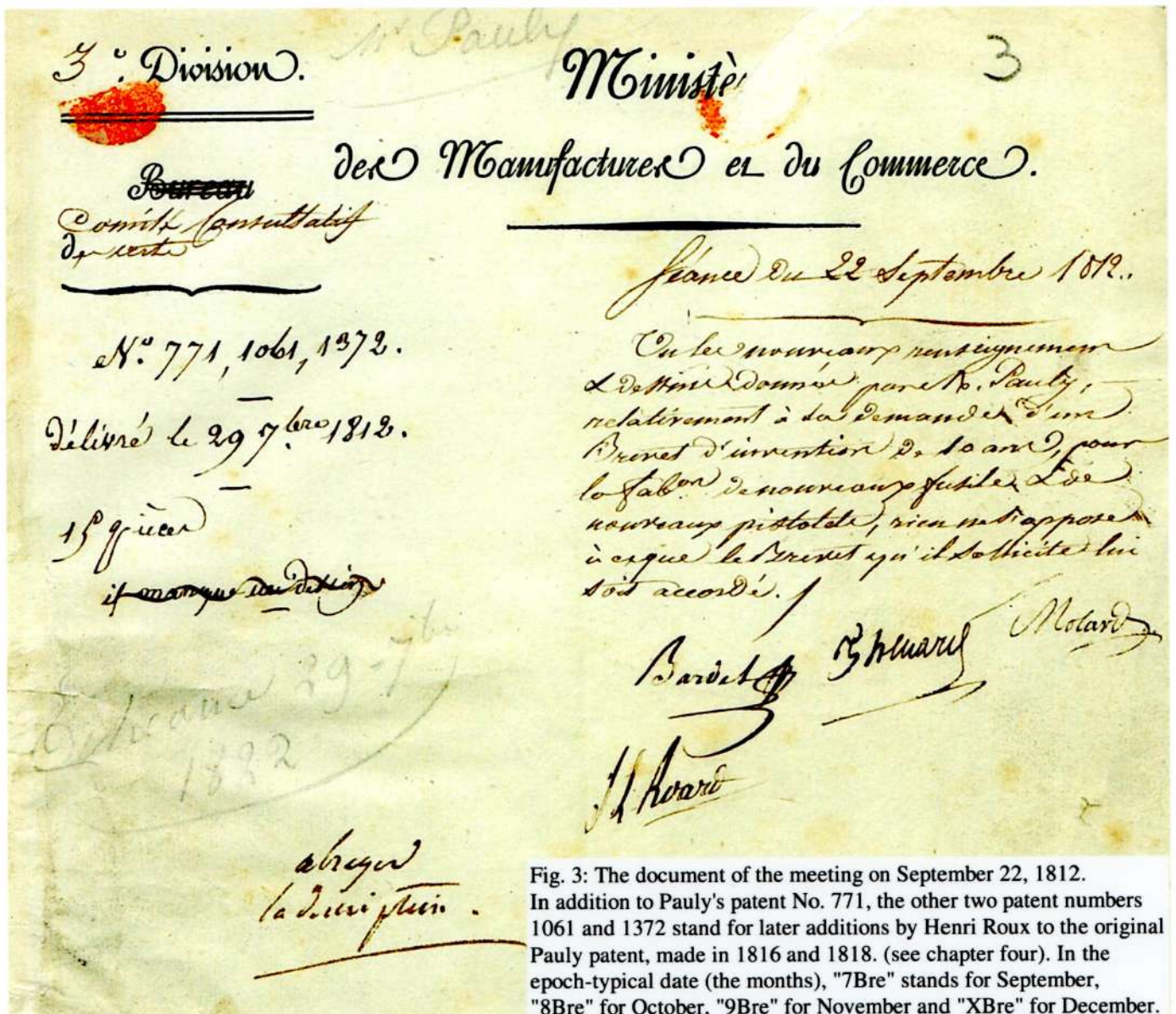


Fig. 3: The document of the meeting on September 22, 1812. In addition to Pauly's patent No. 771, the other two patent numbers 1061 and 1372 stand for later additions by Henri Roux to the original Pauly patent, made in 1816 and 1818. (see chapter four). In the epoch-typical date (the months), "7Bre" stands for September, "8Bre" for October, "9Bre" for November and "XBre" for December.

Pauly's patent application (undated)

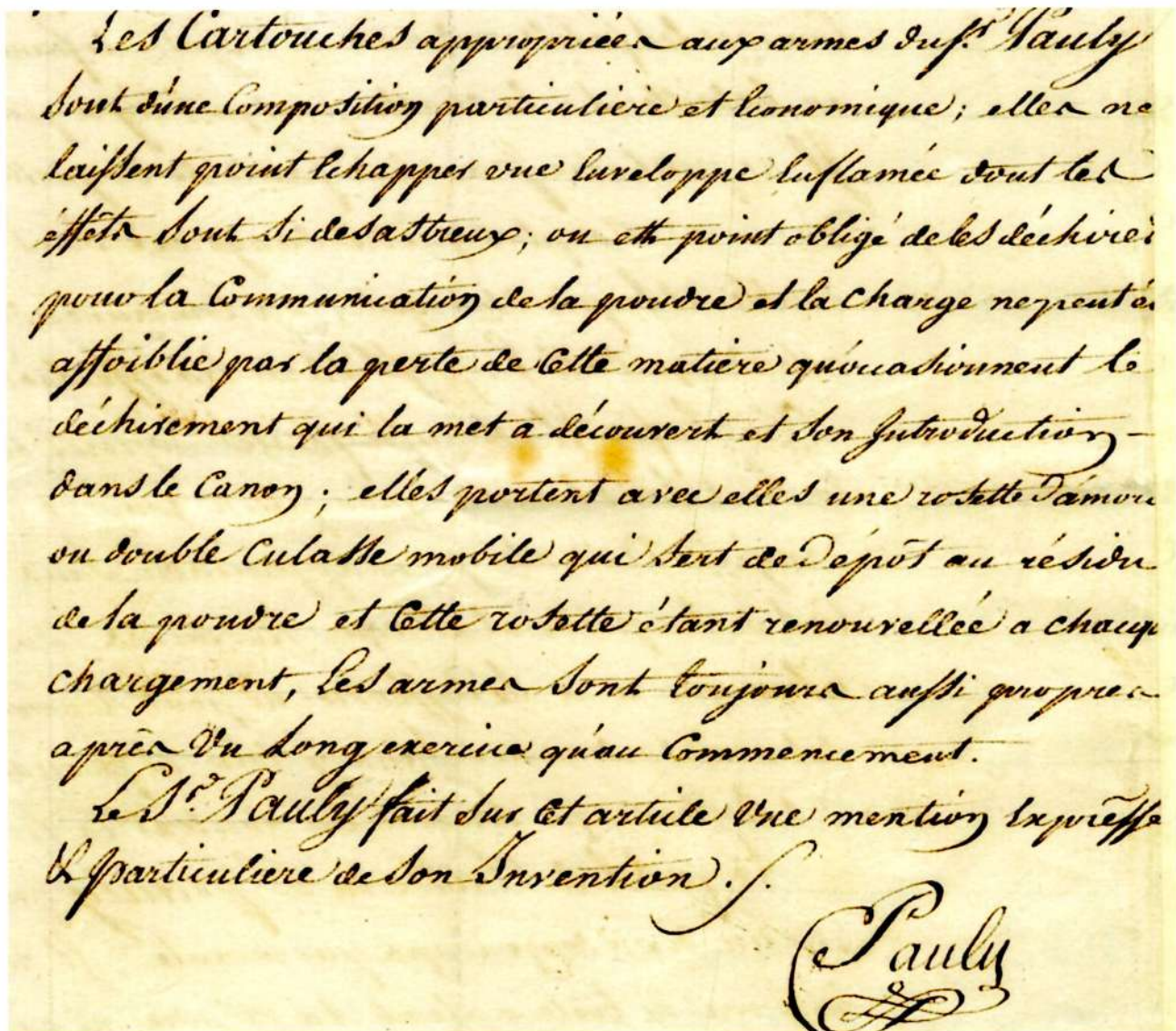
In this undated document (Fig. 4), Pauly presents his arguments on four pages in order to obtain a patent for his war and hunting rifle, his pistol and the new cartridges.

"Patent for 10 years" is noted in the top left of the manuscript's page one.

Pauly explains in great detail the peculiarities and advantages of his invention over other weapons of war. Unfortunately, however, he does not go into mechanical details very much, or better, not at all. The ignition by compressed heated air is nowhere mentioned. Also the last passage on page 4 under "Les Cartouches" (Fig. 4a) gives no indication of the exact shape of the rosettes used in 1812.

Unfortunately, it is not meant to sound disrespectful, but the document what we have previously considered Pauly's patent specification turns out to be more of an advertisement because of the general explanations.

Fig. 4a: A close up of page four relating to the ammunition "Les Cartouches [...]". The advantages of Pauly's cartridges: They do not have to be torn apart when loading like the conventional paper cartridges. So there is no loss of powder. Only 2/3 of the usual amount of powder is required. A double movable lock together with the rosette keeps the weapon clean even after frequent shooting, since the deposit of powder residues on the rosette does not play a role with every shot due to its renewal. Multiple loading is not possible by reloading using a rosette.



Les Cartouches appropriées aux armes Inf.^{te} Pauly
sont d'une composition particulière et économique; elles ne
laissent point échapper une enveloppe inflammée dont les
effets sont si désastreux; on est point obligé de les déchirer
pour la communication de la poudre et la charge ne peut en
affoiblir par la perte de cette matière qu'occasionnent le
déchirement qui la met à découvert et son introduction
dans le Canon; elles portent avec elles une rosette d'amorce
ou double Culasse mobile qui sert de Dépôt au résidu
de la poudre et cette rosette s'étant renouvelée à chaque
chargement, les armes sont toujours aussi propres
après un long exercice qu'au commencement.
Le S^r Pauly fait sur cet article une mention expresse
de particulière de son Invention.

Pauly

6

Brevet
d'Invention
De 10 ans

Exposé du S^r Pauly mécanicien rüe
des 3 freres N^o 4, l'iderant officier d'artillerie
helvétique pour l'obtention d'un brevet d'invention
de fusils de guerre et de chasse, d'un Nouveau
pistolet et de Cartouches d'une Composition
particulieres appropriées a ces armes.

Le S^r Pauly n'entreprendra pas de retracer les modifi-
cations que l'on a fait subir aux armes a feu depuis leur
invention jusqu'à nos jours; Il se contentera de faire remar-
quer quelles n'ont éprouvé de changements qu'en faveur de
la légèreté et l'élégance mais non dans les parties les plus
essentielles, le chargement et la portée, En sorte qu'un fusil
ordinaire de guerre, quelques bien ajusté que soient toutes
les pièces qui le composent, n'est toujours que le tube plus
ou moins imparfait du premier Inventeur qui, pour mettre
un fantassin quelques instans dans un état de semi Défense,
l'expose pendant un plus long tems, l'arme étant à gauche, le
bras droit élevé, la cartouche ou la baguette à la main,
aux atteintes meurtrières de la Cavalerie qui sait si habilement
profiter de ces momens dans ses harrières à la charge.

De même le fusil de chasse force le chasseur à s'arrêter
dans sa course pour le chargement de son arme qu'il ne peut
effectuer sans un repos et des mouvemens qui donnent
leveil au gibier et le tems de se soustraire aux coups
qu'il lui prépare.

A ces Considérations le S^r Pauly croit devoir
appeler l'attention sur les armes de son Invention dont le
mécanisme et l'usage offrent de très grands avantages
Comparativement aux autres genres de destruction de l'espèce
dont s'agit, lui attendant que l'on veuille bien l'entendre sur

Fig. 4: Pauly's four-page patent application.

les inconvénients qu'on est en droit de reprocher aux canons de terre et de mer.

Le Sr. Pauly propose

1°. Deux Nouveaux fusils, l'un de guerre l'autre de chasse.

2°. Un Nouveau pistolet.

3°. Une Nouvelle Composition de cartouches appropriées à ces armes.

Son Fusil de guerre a pour qualités principales

1°. De porter la balle à une distance double.

2°. De pouvoir être tiré dix à douze coups par minute sans passer l'arme à gauche, sans sortir de la ligne horizontale parallèle à la ligne d'en joue et sans solution de continuité, l'exercice que l'inventeur a rendu facile et beaucoup moins fatiguant que celui usité 1° en substituant au baudrier de la giberne une ceinture de cuir garnie d'une plaque métallique au milieu de laquelle est une cheville servant à fixer la crosse du fusil et à rendre le choc en quelque sorte insensible, en même temps quelle sert de point de résistance dans l'usage que l'homme de guerre fait de la bayonnette. 2° en composant cette ceinture de plusieurs courroies dans lesquelles glissent à volonté des boîtes extrêmement légères contenant des cartouches qui à ce moyen le combattant place sous sa main.

3°. De résister ni à la baguette ni pierre ni vie boue ni à la piquette.

4°. De rendre l'infanterie quasi invulnérable par la cavalerie au moyen de bayonnettes qui à l'ongée ou raccourcies d'une manière toujours solide et à volonté par les soldats des second et troisième rangs, présentent le premier éculement à côté de ces ingénieuses auxiliaires.

5°. D'offrir les mêmes avantages dans les retraites les plus précipitées, par la facilité que le soldat effectue le chargement. Soit en marchant soit en courant, l'arme étant horizontalement placée sur le joule le bras gauche

appuyé sur la crosse de manière qu'il ne lui reste plus à faire qu'un tour de demi-tour en portant le pied gauche en arrière pour faire feu avec autant de promptitude et de justesse que si il tiroit de front, à plus forte raison le tirailleur peut-il effectuer sa charge dans telle position qu'il se trouve, debout, couché ou strictement embusqué.

6° Le fusil de guerre comme celui de chasse et le pistolet sont va être fait description, exempt de tout long feu, insensible aux effets de la pluie sur la poudre, n'a plus comme les fusils ordinaires les jets de fumée si incommodes en bataille et à la chasse puisqu'il n'y a pas de lumière. Il ne peut être paralysé faute de baguette ou instrument d'amorce, non plus qu'être dangereux sous le rapport des double et triple charges trop communes dans les fusils attendus qu'il est impossible de les effectuer.

7° Enfin il est aussi facile d'opérer le chargement la nuit sans lumière qu'en plein jour et sans aucun danger. Avantage inappréciable sans doute pour les cas de surprise et attaque nocturne dans lesquels celui qui a à se défendre ne peut renouveler la charge des armes ordinaires sans y voir et par conséquent sans des lenteurs qui souvent lui coûtent la vie.

Le fusil de chasse du S^r Gaudy peut également être tiré dix à douze coups par minute; Il n'exige ni baguette ni pierre ni boîte à plomb et à poudre ni outil d'amorce ni tire-bourre et le chargeur ne peut être arrêté par la crainte d'une double ou triple charge. Le canon sur son bois est le seul instrument de chasse si l'on en excepte les cartouches qui font pas un nouveau procédé uniforme, économique & hors des atteintes de la pluie lui éviteront le désagrément des longs feux & du rat.

Le pistolet de guerre et de combat du S^r Gaudy

Est Carabiné Comme son fusil de guerre; Il en partage toutes les propriétés sous le rapport de la vitesse du tir. Il peut être chargé six fois plus promptement que le pistolet ordinaire sans baguette ni maillet et il est plus que impossible que la secousse du cheval fasse descendre la balle sans les futes et paralise ainsi l'arme Comme Il arrive Souvent de celles en usage. Sans cette sa Course en fondant sur l'ennemi, sans quitter la bride, la Cavalerie peut imiter le feu roulant de l'infanterie.

Les Cartouches appropriées aux armes du Sr Pauly sont d'une composition particulière et économique; elles ne laissent point échapper une enveloppe inflammée dont les effets sont si désastreux; on est point obligé de les déchirer pour la communication de la poudre et la charge ne peut être affoiblie par la perte de cette matière qu'occasionnent le déchirement qui la met à découvert et son introduction dans le Canon; elles portent avec elles une rosette d'amorce ou double Culasse mobile qui sert de Dépôt au résidu de la poudre et cette rosette s'étant renouvelée à chaque chargement, les armes sont toujours aussi propres après un long exercice qu'au commencement.

Le Sr Pauly fait sur cet article une mention expresse & particulière de son Invention.

Pauly

A riddle – the sheet with the drawings

The author has included this sheet with the drawings here (Fig. 5a, 5b, 5c), although there is no direct reference to the patent application from 1812. Reasons are a missing date, no patent number and no Pauly signature. The small note "*Desine & Invante par Pauly*" at the bottom right is very unspecific and also not Pauly's handwriting (Fig. 5a). It is rather H. Roux's way of pointing out Pauly's basic invention. The mechanics clearly show the percussion ignition used later with a broad firing pin (H. Roux's 1816 patent) and no ignition with compressed heated air as described in the two commission reports of July 16, 1812 and then again of December 9, 1812 (see explanations there). This sheet poses some puzzles. When Mr. Leveau sent me the photocopies of the document and the sheet that he probably made decades ago in the archive together with the drawings in a file, one might have assumed that the assignment was wrong.

However, when I asked "Patent No. 771, September 22, 1812" directly from the Institut National de la Propriété Industrielle in good reproducible quality, both documents came together again. So they are actually stored in one file as belonging together. However, the sheet with drawings definitely does not correspond to what Pauly constructed in 1812.

For this reason, I will go into more detail about the drawings, especially those of the cartridges, from 1814, when Henry Roux became the leading person of the company. The cartridges shown here correspond to a preliminary stage until 1816, when Roux patented his first improvement to the Pauly system and also shows a rosette with a groove to support its extraction. Roux also radically switched from the barrel tilting up at breach to part of the lock tilting upward and forward (see Fig. 5a: "*No. 1.*" – this lock mechanism follows Pauly's British patent of 1814).

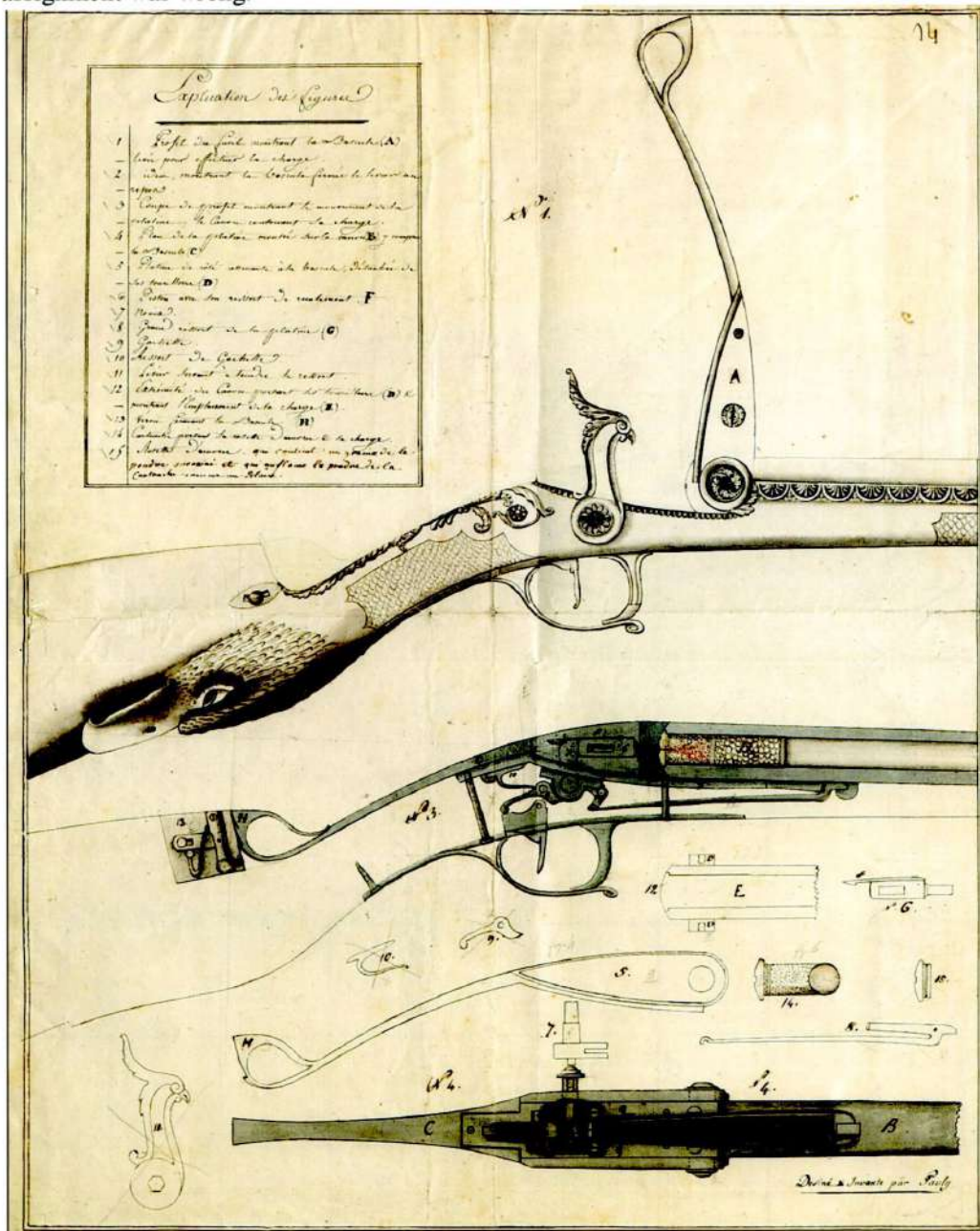


Fig. 5a: The whole page of the drawings with some colored parts. Note "*Desiné & Invante par Pauly*" on lower right corner.

Desiné & Invante par Pauly

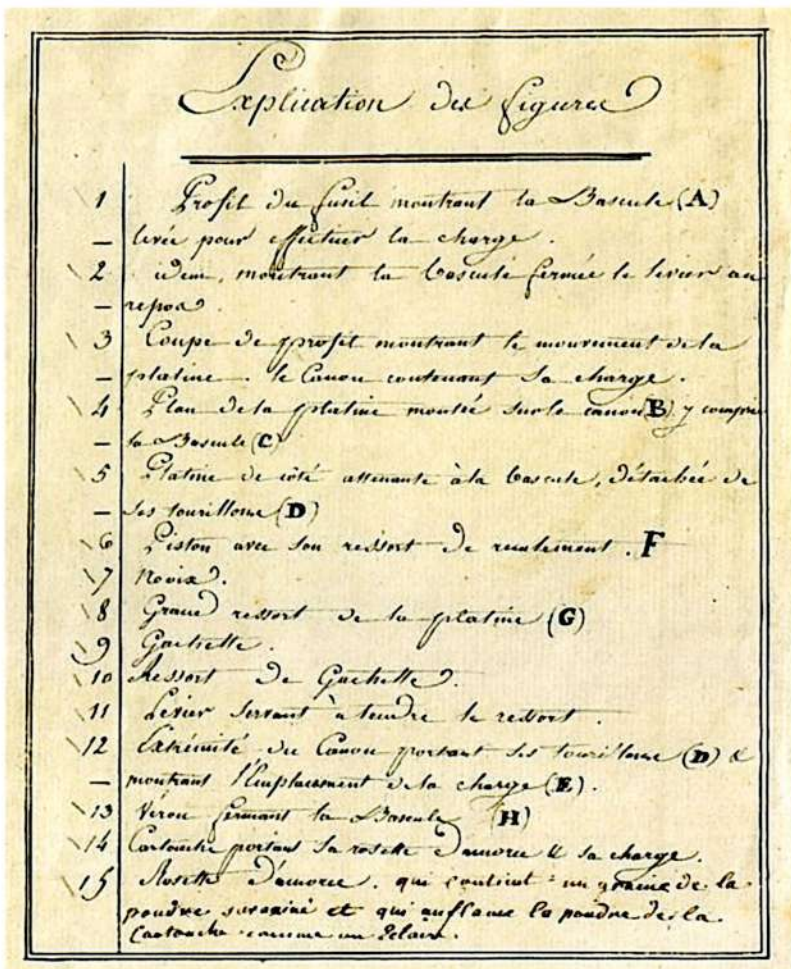


Fig. 5b: Close up of the explanations of the illustrations. Numbers 6, 14, and 15 are interesting. In translation: 6. Firing pin with its reversing spring; 14. Rosette to hold the primer and charge; 15. (with inked addition) "Rosette which contains a grain of the superoxine powder and which ignites the powder of the cartridge like a [??]".

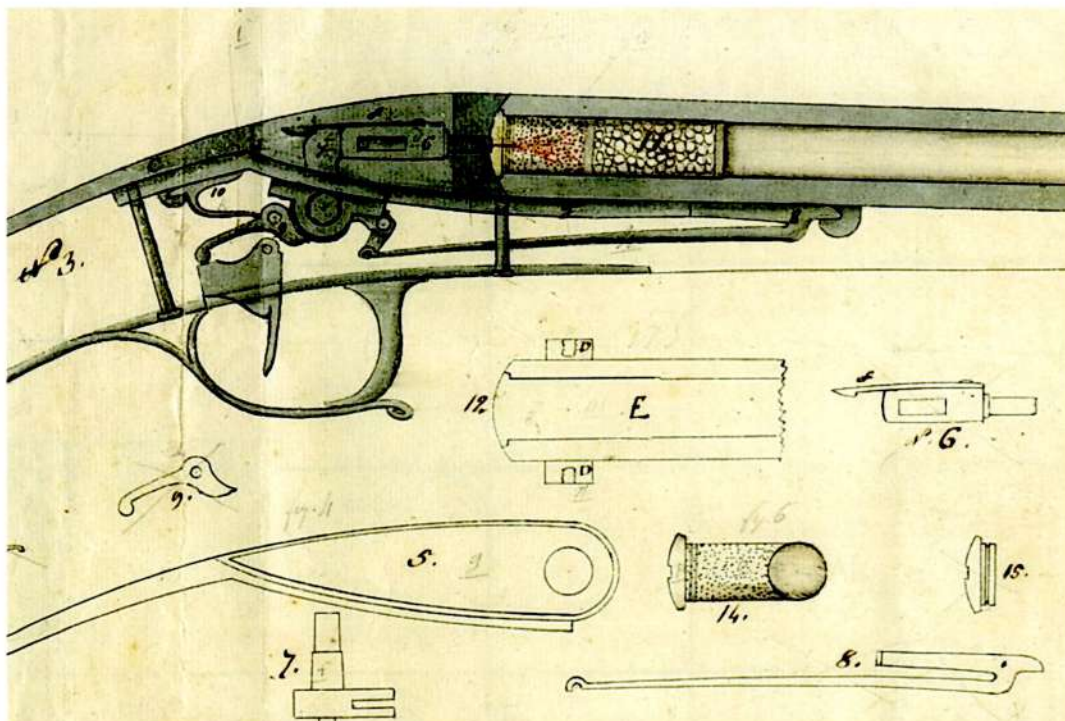


Fig. 5c: The rosettes and cartridges shown here correspond to those designed by Pauly in 1812. They do not have an extractor groove yet. In addition, the largest diameter of the paper tube is attached to the rosette and not as later with a pointed screw. Such rosettes are not known as originals to us today. The lock mechanism with firing pin (N^o. G.) for percussion ignition has been developed and patented by Henri Roux in 1816.

Report of the commission, dated Dec. 2, 1812 – rejection for military use

With the fairly positive assessment of his new weapon and associated ammunition by the commission in July and the granting of the patent in September, Pauly certainly had hoped a lot, i.e. a lucrative order from the Ministry of War. But with the six-page report (Fig. 6), the military jury with Cotty, Bureau *et al.* judged contrary to what Pauly expected. At the end there is the sentence with a rejection of Pauly's rifle and pistol for military use (Fig. 6d).

On the first three pages of the report, the properties of the weapon and ammunition as well as the test result of the shooting are described in great detail in comparison with the French infantry rifle Model 1777 of 17.5 mm caliber (.69) in its improved version as standard ("Description sommaire du fusil"). Under "Observations" there follow six points that highlight the system Pauly, rifle and rosette, with advantages over the standard. These include a better hit pattern, firing of six to eight rounds per minute without lowering the rifle, less powder required, no risk by avoiding multiple loads and renewing the rosette before each round.

But despite these positive characteristics, the committee then highlights eleven points for the Pauly system, which are essentially very critical of the handling of weapon and ammunition and their possibilities for military use.

Author's note: Unfortunately, all of these cited manuscripts are written in an extremely cumbersome and complicated way from today's perspective and are sometimes very difficult to read and understand.

The main points of rejection of the Pauly system (rifle and ammunition) for military use are

- The rifled barrel, which is also more difficult to forge, has a greater weight than the standard weapon. It is difficult to operate the gun lock.
- The lock parts are very susceptible to wear and breakage. Thus, they can easily trigger the shot unintentionally and thus become a danger to the soldier. (Note: The lock parts were not yet case hardened at that time.)
- A new part, which replaces the front retaining ring of barrel and stock, is too small, so that it takes longer to disassemble the rifle and this is only possible with a lot of practice.
- The mechanism of the lock with its springs can even be disturbed by minor impacts.
- The bayonet usual for infantry cannot be attached to the rifle.
- The position of the cock does not clearly indicate whether it is cocked or not, which can lead to fatal accidents.
- The rifle's lock is difficult to dismantle, which can only be done with great practice.
- The lower weight of the rifle compared to the standard is due to its weak parts.

- The rifle as a whole offers less mechanical stability than the standard rifle used by the troops. The most important parts for its function require a maximum of perfection that does not meet the desired criteria. In addition, the price of the rifle and its repairs would be much higher than for improved Model 1777.

- The rosette of the cartridge has several disadvantages: It requires great precision to fill the small recess in the bottom of the rosette with primer. In addition, there is the danger during handling and transport, and the possibility of deterioration of the priming substance. Because of these negative properties, better chemical production would first have to be found.

- The use of fine powder can quickly lead to contamination, which would prevent the rosette from being placed safely.

- The handling of the wooden ejector rod requires a lot of skill from the soldier and this part can easily get lost in the field. (A channel in the side of the wooden frontstock serves as a guide for the ejector rod.)

Only five points are criticized on the pistol. This concerns the dangerous handling of the ignition compound, the handling of the rosette, the price of the pistol too high, the trigger being too difficult and the recoil too strong.

The numerous critical points that ultimately led to the rejection of the Pauly system were deliberately listed in full. There is a strong suspicion that the commission has acted more for political reasons than considering the completely new technology. The military did not like this radical change from the flintlock of the improved Model 1777 to the breech-loading weapon with a metal rosette. Conservative thinking had won.

This report had very significant consequences for the rest of the events, which ultimately led to the fact that the Pauly system, despite its continuous improvements, without a military order, was unfortunately only on a secondary track for the further development of weapons and ammunition.

Rapport

Sur un fusil de nouvelle Invention.

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M. M. Cotté, Colonel au Corps Impérial de l'artillerie, Bureau
Chef de Bataillon et Poncharra (Capitaine) de la même arme, Régrier
Conservateur du Musée de l'artillerie et Deschaseaux, 1^{er} Contrôleur de
la Manufacture d'armes de Versailles, nommés par Son Excellence le
Ministre de la Guerre, pour examiner de nouveau le fusil inventé
par le S^r Pauly Mécanicien et ci-devant officier d'artillerie belge, et
qui procéda les 7 et 8 Décembre 1812, en présence de l'Inventeur, à la visite
et à l'essai de cette arme à laquelle le S^r Pauly a fait subir différents
changemens.

Description
Sommaire
du Fusil.

Le Canon du nouveau fusil présente à 38 pouces de longueur
et $7 \frac{1}{4}$ ^{lignes} ^{lignes} de calibre; il est rayé en spirale dans son intérieur; les rais,
au nombre de 24, sont placés à égale distance l'une de l'autre et la profondeur
de chacune d'elles est d'environ 3. Lignes, comme celle des rais de nos
fusils de guerre.

Il est sans culasse et se charge par le tonnerre, ainsi que les canons
à la Spangnette, de Mortalembert, l'Amusette du Maréchal de
Saxe &c. &c., déposés au Musée de l'artillerie; à cet effet l'Inventeur a
pratique au tonnerre une boîte d'un diamètre un peu plus grand que
celui de l'âme; pour le logement de la cartouche et de la balle qui est
cylindrique et d'environ $7 \frac{1}{2}$ ^{lignes} de diamètre.

La Culasse a été remplacée par une bascule en fer qui sert à cet
effet; cette bascule se lève ou s'abaisse par un mouvement de rotation
sur deux tourillons faisant corps avec le canon, de façon que dans
le premier cas on peut facilement introduire la charge dans le canon
et que dans le second, cette pièce en fer ferme hermétiquement l'orifice
inférieur.

Sur le pan supérieur, l'Inventeur a pratiqué une lumière
nécessaire pour donner passage au fluide résultant de l'inflammation
de l'amorce qui, sans cette précaution, séjournerait longtemps dans
l'intérieur de la platine et en détruirait bientôt les pièces.

à ce canon est adapté une Bayonnette en forme de sabre
dont le but est de faire l'office de chacune de ces deux armes blanches.

La Platine n'a pas de Bassin et son mécanisme a été
amélioré depuis la visite du 1^{er} fusil; son action s'exerce toujours sur

Fig. 6: First and second page of the report, dated December 9, 1812
(exemplary of the document).

le derrière du canon; ce n'est qu'en voyant cette partie de l'arme qu'il est possible de s'en faire une idée bien exacte.

Le devant du fusil est monté d'une manière analogue à celle du modèle de France maintenant en usage; le canon fixe au bois dans toute sa longueur y est retenu au moyen de trois boucles, à peu près semblables à celles du fusil, modèle 1777 corrigé.

Sur le côté et dans l'intérieur du bois on a pratiqué un canal qui sert de logement à une tringle à bouton destinée à faciliter la sortie du fulon que l'on est obligé de retirer après le départ de chaque coup.

La Cartouche employée par le S. Pauly, se charge avec 1 gros 32 grains de poudre fine, dite à giboyer; la balle est maintenue à son extrémité supérieure à l'aide du papier de la cartouche dont elle est recouverte.

Cette cartouche porte avec elle à l'autre extrémité une rosette ou culon en cuivre; au centre duquel est pratiquée une petite ouverture cylindrique qui communique avec la charge et qui sert à loger l'amorce composée de muriate ^{de} potasse mitigée.

L'inventeur fait aussi usage d'une autre balle, seulement sphérique du côté opposé à la poudre, ayant une rainure dont le but est de lier la balle à la cartouche comme le sont les sabots des cartouches à boulets.

Cette balle a le même diamètre que la première, mais elle est un peu plus pesante.

L'amorce est enflammée par le choc d'un petit piston, en la compression de l'air; de mouvement de la vis, fait avancer ou reculer le piston, qui traverse une pièce de cuir bouilli au moyen de laquelle le gaz ne peut s'échapper.

La platine ou le piston sont enfermés dans le bois, de manière que la composition de l'amorce qui n'est pas exposée à l'humidité de l'atmosphère ne peut se détériorer promptement.

Le poids du fusil sans bayonnette est de 7^{lb} 6^{oz} 9^{gr} } 8^{lb} 6^{oz} 5^{gr}
idem de la bayonnette 1 . . . 3

Le S. Pauly se sert pour contenir ses cartouches d'une Giberne en fer blanc vernis, pareille à celle dont les Espagnols font usage; comme il la porte à l'aide d'un ceinturon en cuir à l'un des côtés duquel il a adapté une plaque en fer portant une charnière de même métal qui traverse la crosse, percée à cet effet, afin de contenir solidement l'arme à la hauteur sans le secours de la main droite et pour tirer dans cette position.

La Cartouche employée par le S^r Pauly, se charge avec
1 gros 32 grains de poudre fine, dite à giboyer; la balle est maintenue
à son extrémité supérieure à l'aide du papier de la cartouche dont
elle est recouverte.

Cette cartouche porte avec elle à l'autre extrémité une rosette
ou culon en cuivre; au centre duquel est pratiquée une petite
ouverture cylindrique qui communique avec la charge et qui sert
à loger l'amorce composée de nitrates ^{de} potasse mitigés.

L'inventeur fait aussi usage d'une autre balle, seulement
sphérique du côté opposé à la poudre, ayant une rainure dont le
but est de lier la balle à la cartouche comme le font les sabots
des cartouches à balle.

Cette balle a le même diamètre que la première, mais elle
est un peu plus pesante.

L'amorce est enflammée par le choc d'un petit piston; en la
compression de l'air; le mouvement de la noix fait avancer ou
reculer le piston; qui traverse une pièce de cuir bûilé au moyen de la
quelle le gaz ne peut s'échapper.

La platine ou le piston sont renfermés dans le bois; de même que
la composition de l'amorce qui n'étant pas exposée à l'humidité de
l'atmosphère ne peut se détériorer par son exposition.

Fig. 6a: Close up of the description of the cartridge „La Cartouche“.

L'amorce est enflammée par le choc d'un petit piston; en la
compression de l'air; le mouvement de la noix fait avancer ou
reculer le piston; qui traverse une pièce de cuir bûilé au moyen de la
quelle le gaz ne peut s'échapper.

Fig. 6b: Close up of the detail mentioning the ignition by compressed heated air
"l'amorce es enflammée par le choc d'un petit piston en la compression de l'air [...]"
The rest of the sentence is also interesting (see under Fig. 6a). The forth and back
moving bolt of the fire piston is led through a leather seal so that no gas can escape
"[...] de mouvement de la noix fais avancer ou reculer le piston qui traverse une pièce
de cuir bûilé au moyen de laquelle le gaz ne peut s'échapper".

1. l'Inventeur a reconnu plusieurs des inconvénients détaillés,
et se propose de chercher les moyens d'y remédier.

Le sieur Pauly ayant aussi présenté un pistolet de
canon de son invention, on a reconnu que cette arme avait
été fabriquée d'après le même système que le fusil de guerre,
que son mécanisme en différait peu sensiblement, qu'elle en
partageait les propriétés sans en avoir tous les défauts qui
se réduisent

1. au danger de l'emploi du Métriate,

2. à l'usage des culots,

3. à la pesanteur de l'arme,

4. au départ qui est très dur, et

5. au recul qui est violent.

La commission pense en conséquence que le fusil de
l'invention du J. Pauly, de même que le pistolet, qui sont
d'ailleurs très ingénieux en lui méritant des éloges, ne doivent
pas être adoptés pour armes de guerre.

fait à Paris le 9. Décembre 1812.

Bureau

Deschaseaux

Ponchass.

E. Requier

Fig. 6c: Part of the last page of the document of December 12, 1812 with the summary of the negative properties in five essential points regarding the war pistols, and below the important summary of the report, which ends in the rejection of Pauly's weapons for military use. The document is signed by Cotty, Bureau, Rénier, Deschaseaux and Ponchassa, the officers of the imperial army.

Summary of the year 1812

- Pauly's French patented breech-loading gun used the initial design of the very first self-contained reloadable centerfire cartridge (a brass rosette) with obturation by a bevelled head.
- Pauly invented the basic principle, which was later gradually developed into the modern centerfire cartridge.
- The cartridge was a, if not even the salient feature in Pauly's invention.
- Pauly's invention must be considered as the next milestone after Alexander J. Forsyth's creation of a reliable igniting substance. He was a true pioneer in metallic centrefire cartridges!
- Pauly started using in his invention the ignition system by means of compressed heated air (fire piston) and not by a firing pin.
- The rosette, still without an extractor groove, was removed from the chamber with an ejector rod guided in the rifle's wooden fore-end.
- We have no design drawings of the weapon and ammunition from the year the patent was granted.
- We also do not know of any original rosettes without an extractor groove.
- The sheet of construction drawings that is currently stored with the patent application does not date from 1812 but probably from the time between 1814 and 1816, when Henry Roux had taken over the company. The Pauly system (weapon and rosette) was assessed by the military commission in December of the year as unsuitable for use in war and was therefore rejected.

chapter two

The transition period of 1813-1815

Intermediate constructions partly Pauly partly Roux

1813 – Pauly turns to the civilian market

What happened to Pauly's efforts to maybe get an order from the military to make his new weapon? Until his final departure to England in the first half of 1814, there was only one document, a letter he wrote to the Minister of War, dated February 8, 1813.

In the letter, Pauly initially regretted the rejection of his invention and that only a single rifle was bought for the artillery museum. He had dared to hope to contribute to the honor of France. Instead, the reasons for the commission that led to his weapons not being taken into account in December 1812 were already published. Pauly writes, disappointed, that under these circumstances he has only wasted time and money and has not been recognized. In ten points, Pauly then tries again to highlight the advantages of his system, which he would have perfected in a year. These are the essential positive characteristics that were already highlighted by the commissions in the previous year (e.g. ignition compound protected from rain, avoiding double loading, saving 3/5 of the powder, high rate of fire, shortening the training time for soldiers, etc.).

Interesting in the letter is the fact that Pauly has received approval from the Minister of War to manufacture 200 rifles for the civilian market. He sees this at least as a general encouragement to continue in his efforts. Pauly also emphasizes his ability to produce weapons much cheaper than any other weapon manufacturer, even cheaper than conventional (flintlock) rifles.

In the last paragraph of his letter, Pauly unequivocally states that he will present his invention (rifle and pistol) to the public from March of the year and will also offer it for sale if the Minister of War does not withdraw his rejection.

This letter provides no information as to whether Pauly has fundamentally changed anything in the ignition mechanism. It is most likely that it has continued to fire from compressed heated air.

We learn a lot about the events that happened between 1813 and 1815 from the monthly bulletins of the "Société d'encouragement pour l'industrie nationale" [abbr. "SEIN" and so on used], Paris. SEIN was founded at the suggestion of Napoleon Bonaparte in 1801 to make France's industry great. This society can perhaps be compared to the "Institution of Civil Engineers" based in London. It exists from 1771 and was founded as "the world's first professional engineering body" with their main object "The general advancement of mechanical science [...]", i.e. knowledge sharing and promotion of profession.

1814 – Henri Roux takes over the regime

The second document available to us from the period between 1813 and the end of 1815 is a letter of July 21, 1814, written by the newly founded company "Pauly & Co." to the Minister of War. Pauly had already left Paris by that date and left for England forever. From a report by the SEIN we can see that A. Moreau (also a gun maker) and Henri Roux acted as new company owners. Original documents from this company foundation are not known and it is therefore no longer possible to determine who else was still involved in the company. This is where the name Henri Roux first appeared. A little later, Roux was the sole owner of the company. He made an improvement on the Pauly system with a new focus on the ignition mechanism.

It is astonishing that today we know practically nothing about Henri Roux's life, although he gave a decisive impetus to the development of the cartridges (for more information, see his patent No. 2166 of June 26, 1823 in chapter seven). The search in dictionaries or on the Internet does not lead to any results ("A man without a story"). And in the otherwise so extensive literature on ammunition development, as far as I could judge, Roux is not mentioned at all. Perhaps nobody has bothered to evaluate the original French documents. Henri Roux is unfortunately still completely undervalued with his influence on the way of the cartridge to modern central fire ignition.

In a letter dated July 21, 1814, the new company (with Roux as the owner) again pointed out the advantages of Pauly weapons for the military and for hunting compared to the standards. The improved weapons would have worked well in tests. This would be confirmed by the bulletins of SEIN. What has been improved, however, leaves the letter open. The society would like to hear the opinion of the war minister again and asks for an appointment to be allowed to demonstrate the weapons again. An officer could also come to the company for this purpose.

What has changed technically with Henri Roux's takeover of development? A newspaper article in the *Journal de Lyon* dated January 12, 1815, which of course refers to the publications of the SEIN, gives a very decisive hint. The quotation first in French: "[...] *Voici ce qui se passe: la platine pousse rapidement un piston qui se meut dans un cylindre; l'extrémité du piston frappe avec force le point de la rosette, sur lequel est placé le grain de poudre; [...] qu'elle ne peut être enflammée que par la percussion forte de deux métaux, s'enflamme; la flamme est portée par une ouverture au center de la cartouche, et le coup part rapidement. [...]*".

Here the percussion ignition is clearly mentioned and not the ignition by Pauly using compressed heated air. The ignition compound is now ignited between two metal parts, the iron firing pin and the small iron disk with ignition hole screwed into the rosette.

In this period around 1815, the already under Fig. 5a shown construction drawing should be classified. It is therefore shown again at this point. The ignition mechanism and the rosette used are still a middle ground between Pauly's original invention (rosette still without extractor groove and without a pointed screw) and Roux's real percussion ignition. Roux describes and shows the novel design of weapon and rosette in his first addition to Pauly's original patent dated May 16, 1816 with the assigned patent number 1061.

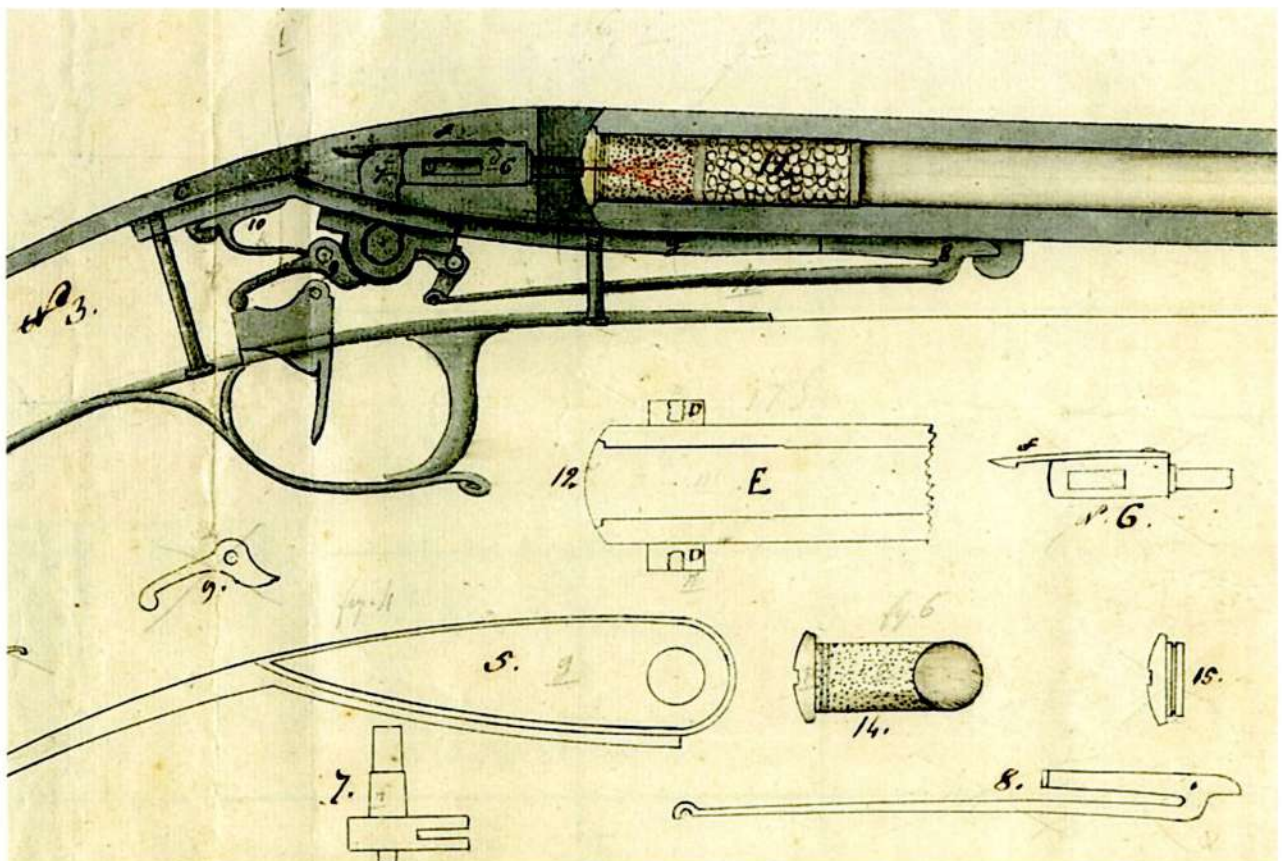


Fig. 5a: Part of the undated construction sheet once again. The ignition mechanism does not cover Pauly's 1812 patent specification. Instead, we see something intermediate: percussion ignition by broad firing pin invented by Roux, and first type rosettes without extractor grooves invented by Pauly.

**Pauly hunting and sporting rifle with fire piston
Patent of 1812**

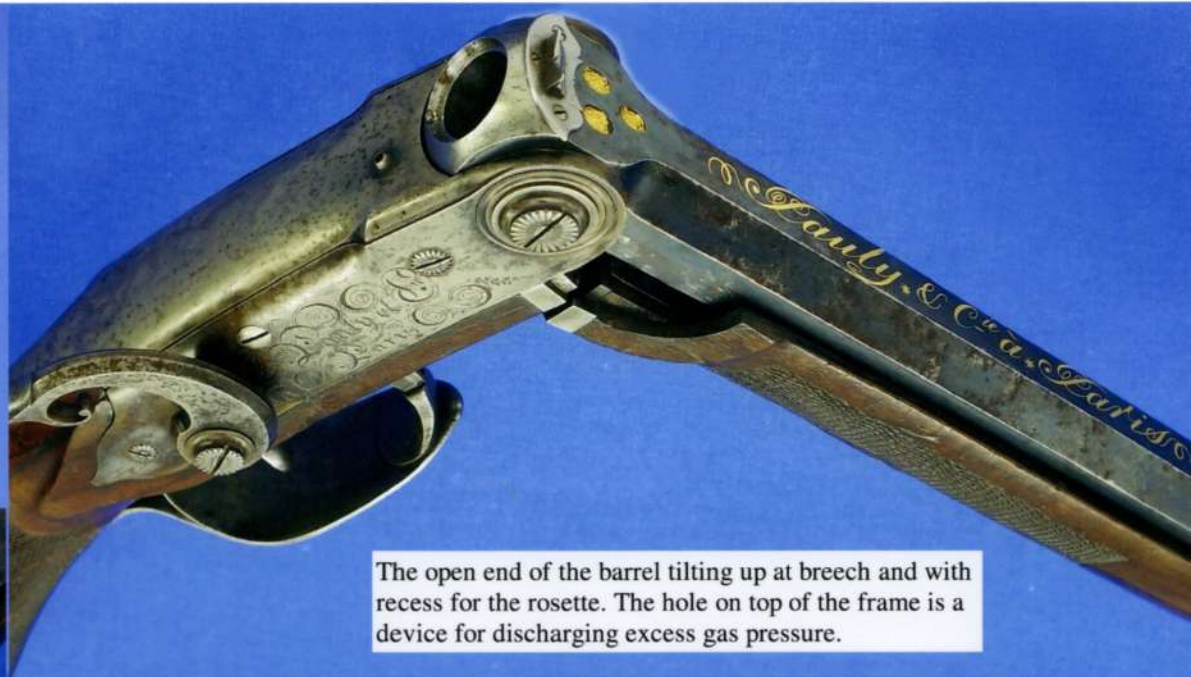


This 12.5 mm rifle, which was manufactured for civilian purposes, can be classified very precisely in the period between first half of 1814 and maximum until 1815 on the basis of its design features and inscriptions. The principle of ignition by means of fire piston (compressed heated air) follows Pauly's patent from 1812. In the year of his patent grant, Pauly had only made a few weapons available to the military for test purposes. Unlike this civilian version, the military rifles carried a small wooden rod on the right side of the frontstock to eject the rosettes. As previously described, Pauly had turned to the civilian market from March 1813 after the military rejected his system in December 1812.

When exactly the company "Pauly et Cie" was founded cannot be exactly documented. But after Pauly left Paris for London in the first half of 1814, the previous co-partner Henri Roux took over the company. Roux immediately turned to a fundamental mechanical change in the Pauly system.



The 100 cm long blued barrel bears the fancy gold-inlaid inscription "*Pauly et Cie à Paris*" and three gold marks of barrel maker Jean LeClerk of Versailles. "Brèvetés" on the left side of the frame means patented.



The open end of the barrel tilting up at breech and with recess for the rosette. The hole on top of the frame is a device for discharging excess gas pressure.



Roux turned away from the ignition through compressed heated air and followed the path with percussion ignition using a broad firing pin. Henri Roux received his patent as "1st improvement and addition to the Pauly patent of 1812" in May 1816. It can be assumed that after the takeover of the company under his leadership, Roux did not produce many rifles with ignition by compressed heated air. The rifle pictured must be considered a very rare piece from early Parisian manufacture according to the Pauly patent from 1812.

A firearm of identical lock construction from London manufacture (ca. 1815) is shown on pages 28/29. Photos by courtesy of Bolk Antiques.

chapter three



A.D. 1814 N° 3833.

Apparatus for Discharging Fire-arms by Means of Compressed Air.

PAULY'S SPECIFICATION.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, JEAN SAMUEL PAULY, of Little Charlotte Street, in the Parish of Saint George, Hanover Square, and County of Middlesex, Engineer, send greeting.

5 WHEREAS His most Excellent Majesty King George the Third did, by His Letters Patent under the Great Seal of the United Kingdom of Great Britain and Ireland, bearing date at Westminster, the Fourth day of August, in the fifty-fourth year of His reign, give and grant unto me, the said Jean Samuel Pauly, my eñors, adñors, and assigns, His 10 special licence, full power, sole privilege and authority, that I, the said Jean Samuel Pauly, my eñors, adñors, and assigns, should and lawfully might, during the term of years herein mentioned, make, use, exercise, and vend, within England, Wales, and the Town of Berwick-upon-Tweed, my Invention of "IMPROVEMENTS IN THE CONSTRUCTION 15 AND USE OF FIRE-ARMS;" in which said Letters Patent there is contained a proviso that if I, the said Jean Samuel Pauly, shall not particularly describe and ascertain the nature of my said Invention, and

Fig. 7a: The title page of patent No. 3833 from 1814 (August 4). Incidentally, all British patents begin with what is today a lengthy introduction. All patents available in England until 1854 and later were printed like this (by G.E. Eyre & W. Spottiswoode, London) and published in "booklet form" with blue cover pages. Libraries received specimens that later came to private collections. The author owns several of these original prints.

Pauly's British patents of 1814 and 1816

When Pauly went to London in mid-1814, his employment as a designer and inventor did not end. He worked here in the workshop of the gunsmith Durs Egg, his Swiss compatriot who also had emigrated years ago from Switzerland and was well known for arms of high quality.

The two British patents Pauly received in 1814 and 1816 (Fig. 7 and Fig. 8) also describe compressed heated air ignition. Pauly is therefore strictly following what he already introduced in 1812 and patented. It also seemed unlikely that Pauly would have worked out a completely new method in the short time in between. The two British patents therefore once again speak a clear language, with which Pauly originally started.

Some weapons were built on this principle in England and two of them can be shown on pages 28/29. But as from the period before that from 1812, we are absolutely not aware of any single rosettes or cases that resemble the patent drawings, with the exception of the seven-shot volley cartridge.

In 1816 Pauly's efforts in England to bring about his fundamental invention came to an end. The complexity of the mechanics of his weapons, based on compressed heated air, also prevented large orders from the civilian market, not to mention complete ignorance among the military.

For a few more years, Pauly "tinkered" with Durs Egg on moving, i.e. controllable airships. Even without any noteworthy success. It is a little sad that this man, who – unfortunately – was decades ahead of his time, disappeared "without a sound". Not even the exact date of death is known.

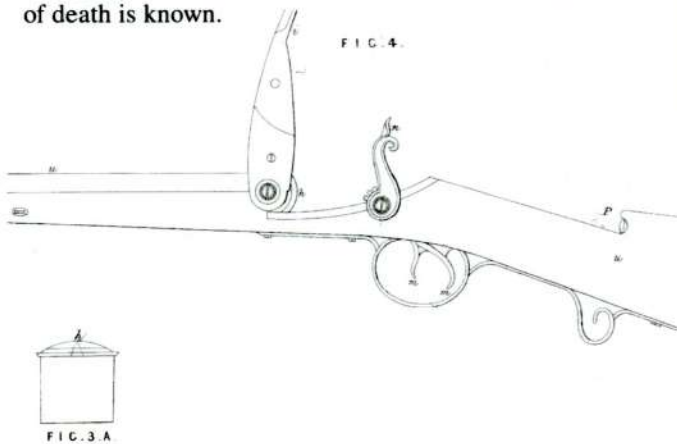
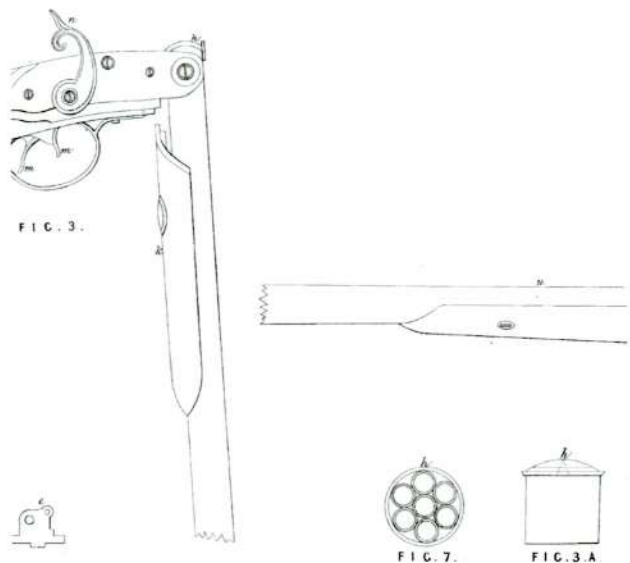


Fig 7c: In addition to the two different lock mechanisms for fire piston ignition, Pauly also shows two types of cartridges in the illustrations, the normal case "FIG.3.A." and under "FIG.7." the concept of the seven shot volley gun with its specially designed seven shot cartridge.

It is also noticeable here that Pauly continues to do without the extractor groove that was later common under Roux.



Pauly's Improvements in the Construction of Fire-arms.

Drawings hereunto annexed, and the explanations thereof. Fig. 1 A, is the vertical section of a gun, of which *g, g*, represents the breech pin with part of the chamber having its touch-hole behind, and opposite to *b, b*, an air syringe, having its minute perforation opposite the touch-hole, and its piston *b, b*, driven by the tumbler *d*, which receives its force from the main spring when discharged by the trigger *m*, fitted up as usual, and the machinery is supported by and in connection with the lock plate *a*, and bridle *e*. Fig. 2, shews the same parts distinguished by the same letters, and will be sufficiently understood from the Drawings, excepting the piston *b, b*, where the fore part is seen perforated in the upper sketch, and closed by a valve opening outwards, but kept shut by a weak interior spring in the lower sketch, and the effect of the said valve is to admit the external air during the time of cocking the piece; and Fig. 1 A, is a view of the upper part of the same gun which has been drawn as double barrell'd; *n*, represents the cock. Fig. 3, represents the method of charging at the breech by means of a joint at the inner end of the barrel, which is perforated all through, and is provided with cartridges attached to or contained in a cup or cap of wood, metal, or other fit material having the touch-hole therein, as shewn at *h*, Fig. 3 A, and at *f*, Fig. 2, one of which, when charged, is to be put into the breech of the piece; and the same kind of cap may be attached to the piece to open and shut, and used with a common cartridge, and the said cartridge or piece is provided with a small touch-hole, and is discharged by the means or method herein-before described at such time as the barrel of Fig. 3, has been restored to the proper right line direction thereof. *K*, shews a sliding piece for preserving the said direction, which may be done by a variety of other methods in common use for other purposes. Fig. 4, shews a method of charging for the use and application of my means of giving fire also by the breech. *i*, represents a lever piece which lifts up and down, containing the air syringe and its apparatus, and the other parts of the lock are fixed along with the barrel and stock *n*. When *i* is lifted up, the charge of Figure 3, may be put in at *h*; and upon restoring it to its ordinary position, wherein *i* and *p* are locked together, the whole apparatus becomes united, and the discharge may be made as herein-before described; and in both constructions wherein Fig. 3, is used the

I do prefer making the form shewn in *b*, Fig. 2, and that the stroke or pressure be given by the action of a strong helical spring, and the holding up or discharging of the same be done by a detent or catch, as is well known. Fig. 7, shews the method of placing the barrells and cartridges to be used in a considerable number for quick firing, according to my Invention.

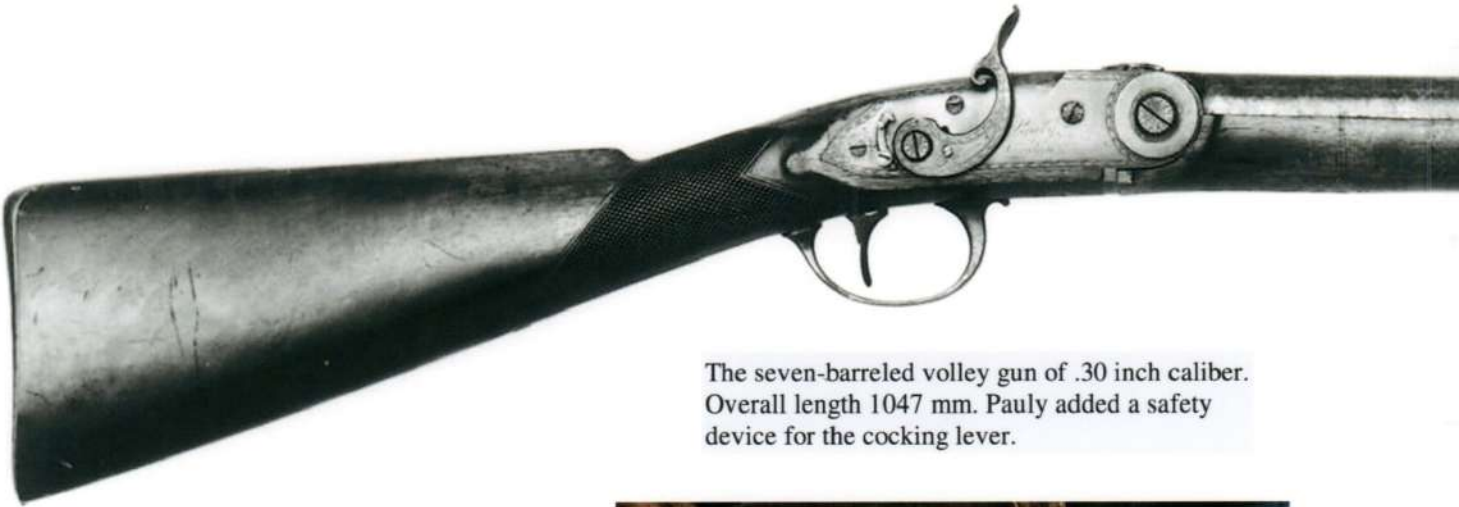
In witness whereof, I, the said Jean Samuel Pauly, have hereunto set my hand and seal, this Third day of February, in the year of our Lord One thousand eight hundred and fifteen.

JEAN SAMUEL (L.S.) PAULY. 35

Fig. 7b: The page three of the patent describes under *Fig. 3* and *Fig. 3.A*. the cartridge. Pauly attaches great importance to the mention of the "small touch hole", an orifice with an extremely fine diameter so that the ignition can work.

Fig. 7d: Pauly mentions here the method for faster shooting under point *Fig. 7*. The barrels of the seven shot volley gun are combined as a bundle, and the cartridge case also has seven chambers.

Pauly seven-barreled volley gun with fire piston
London made, 1815



The seven-barreled volley gun of .30 inch caliber. Overall length 1047 mm. Pauly added a safety device for the cocking lever.

Like the rifle made in Paris (pages 24/25), this weapon also follows the Pauly patent of 1812 in its lock construction and has a barrel tilting up at breech.

It is believed that this volley gun was made in Durs Egg's workshop in 1815 after Pauly's patent was granted in 1814. With a volley gun, Pauly might want to arouse the military's interest in ship boarding.



As described in the patent of 1814 under *FIG. 7*, this volley gun uses a central fire cartridge to simultaneously ignite its seven chambers.

The 76 mm long, rimless brass tube, which tapers somewhat conically in the direction of its mouth, carries a screwed-in steel insert with a recess to take the ignition compound.



In order to exactly align the chambers of the cartridge with the bundle of the seven barrels, a small steel pin, which is located near the bottom of the cartridge (arrow in the top color picture), can snap into a groove on the underside of the barrel's chamber (arrow) and lock the whole thing securely.

Color photos by courtesy of Jonathan Furgeson.



The muzzle of the gun with the bundle of its seven smooth bore barrels of .30 inch caliber.

Pauly pistol with fire piston
London made, 1814



The lock of the pistol with fire piston. The air tight piston is driven by a cog-wheel.



All half-tone photos by courtesy of Royal Armories (Crown Copyright Content).



A.D. 1816 N° 4026.

Apparatus and Arrangements for Discharging Fire-arms by means of Condensed Air; also Cartridges applicable thereto.

PAULY'S SPECIFICATION.

TO ALL PERSONS TO WHOM THESE PRESENTS SHALL COME, I, JEAN SAMUEL PAULY, late of Knightsbridge, in the County of Middlesex, Engineer, but now of Kennington, in the County of Surry, send greeting.

5 WHEREAS, by His Majesty's Royal Letters Patent under the Great Seal of the United Kingdom of Great Britain and Ireland, bearing date the Fourteenth day of May now last past, after reciting that I had by my petition humbly represented unto His Majesty that I had lately invented "CERTAIN IMPROVEMENTS IN THE CONSTRUCTION AND
10 USE OF FIRE-ARMS," and obtained His Majesty's Royal Letters Patent, bearing date the Fourth day of August, One thousand eight hundred and fourteen, for exclusively enjoying the benefit of the said Invention; that after considerable application and expence I had invented certain
15 improvements in the said Invention which I believed would be of general benefit and advantage; that I was the true and first Inventor of the said last-mentioned improvements, and that the same had not been made or used by any other person or persons whomsoever, to my knowledge or belief; and that I therefore most humbly prayed that His Majesty would be graciously pleased to grant unto me, my exors,

A

Fig. 8a: In Patent No. 4026 of 1816 (May 14) the cartridges are now also included in the specification's title. This very long 18-page patent raises questions about the construction of the cartridges, which the author could not clarify, especially since no originals are known. The title page usual in England with a long introduction.

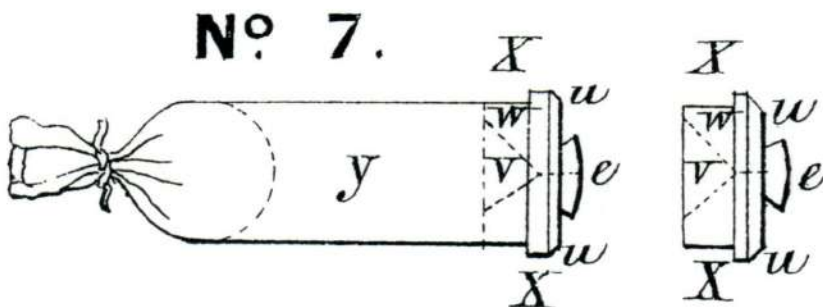


Fig. 8c: The illustration of the cartridge No. 7, as described in the text. Behind the very fine hole in the rosette (*e*) there is a conical recess (*v*) in the direction of the powder charge, into which, if necessary, ignition compound can be put to support the ignition process.

Pauly's Appar. for Discharging Fire-arms by means of Condensed Air, &c.

from the strength of the spring, to prevent this piece from breaking. G, and H, N° 14, are top views or plans of top plates, which may be applied to the upper part of the gun stock, to strengthen the same. H, is immoveable, and fastened by receiving the ends of the screws, which pass through the bottom plate N° 10, and 6; G, is moveable, 5 either in a vertical or horizontal direction, upon a pivot or hinge at the end nearest the letter G, so as to form a door or opening to get at the syringe and piston, for the purpose of cleaning or greasing them. This door G, is fixed down by a latch, catch, or turnbuckle. A side view of the same is seen at G, and H, in N° 1. 10

Having so far described my lock, and the means of producing ignition to the charge of gunpowder, I shall in the next place describe my cartridge or cartouche, as I construct it, for loading all small or portable fire-arms at the butt end of the barrel. It is shewn at N° 7, where *u*, represents that part which I nominate the rosette or cap of the 15 cartridge, which may be formed of box or other hard wood, or of paper mache, or lead, or some plastic or yielding substance, turned or cast in a mould, as pressed or stamped, to such size and form, and made so much smaller than the inside of the barrel of the gun as to permit a paper or other case, as *y*, to be glued, tied, or fixed upon the shoulder 20 *W*, to contain the charge of gunpowder, with the ball, shot, or other missile weapon in it, as indicated in the Drawing, and which must altogether fit the barrel as nearly as possible, but so as to permit it to enter the same without difficulty. *x, x*, is a small projection or shoulder on this rosette, which is turned to a conical or other form, fitting a 25 rebate of a similar shape, which is made in the butt end of the barrel, for the purpose of not only stopping or preventing the cartridge or charge from slipping down the barrel, but of forming a close and airtight joint, when pressed into its situation, by the return of the barrel into its right lined direction, or other contrivance; to be hereafter 30 described. *v*, N° 7, shews a small space or chamber in the rosette of the cartridge, which diminishes into the small hole *e*, which is rammed with a small portion of gunpowder or other explosive material, in the making of the cartridge, before it is charged with its contents of explosive powder, ball or shot, so that when the gun is loaded with such a cartridge 35

Fig. 8b: From page six of the document, Pauly begins with the detailed description of the cartridge from line 11. The different materials that could be used as cartridge cases are interesting. But the description from line 24 is even more interesting and at the same time more mysterious. A shoulder or projection with a conical (or other) shape on the rosette is designated as *x, x*, which should fit into the counter bearing when the lock is closed and should result in gas tightness. That is understandable. But what part is inclined inward between *u, u*? How can this projection fit into the counter bearing?

Pauly's Appar. for Discharging Fire-arms by means of Condensed Air, &c.

as aforesaid, the small hole *e*, in the same, will present itself to and in immediate contact with the small hole *e*, in the end of the syringe before described. And I find that if a small piece of thin paper is glued, pasted, or affixed upon the rosette end of the cartridge over the small hole *e*, it

5 will effectually prevent the bruised gunpowder or explosive material from escaping or being injured by damp, and will not be detrimental to the ignition and discharge. N^o 15, represents another cartridge, in which the rosette is made conical or tapering, instead of with a bead or shoulder, to fit the conical or other shaped rebate before described, to be formed

10 in the butt end of the barrel. This form of cartridge, however, requires that the inside of the butt end of the barrel should be made of the same shape to receive it, and it is forced into an air-tight bearing likewise by the return of the barrel, which forces or presses it against the end of the syringe piece or breech. A small stud or nutt is turned, as at *u, u*,

15 in both rosettes, for the greater facility of taking them out of the barrel after a discharge. N^o 17, is the same gun as N^o 1, but with the side

Fig. 8d: Page seven describes a slightly different shape of the rosette under No. 15.

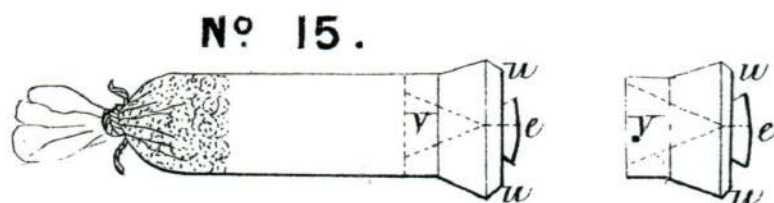


Fig. 8e: The illustration of cartridge No. 15 with a slightly different shape of the rosette than No. 7.

Fig. 8f: On page 15 Pauly mentions from line 13 that his rosette or "stopper" are an essential part of his invention. So far, gas tightness with breech loaders has been the big problem. With his invention, he solved this by using material that can be deformed by gas pressure, such as lead or copper, to seal the movable chamber.

Pauly's Appar. for Discharging Fire-arms by means of Condensed Air, &c.

should be made for it to fit into, as at *g, h, e*, Figure 62. In all other parts the door may be made less than its recipient cavity, to prevent friction, but the curved lines of its sides must be parallel with each other, as at *g, e*, and concentric with the centre of the hinge *c*, upon which the
 5 same turns. *i, i*, in Figure 61, is a front view of the toothed edge of the door X; and a side view of the same is seen at *i, i*, in Figure 62. The manner in which my syringe locks may be applied to the guns Nos 58, 59, and 62, will be seen at Y, in those Figures; and in these the priming or rosette may be applied to the end of the syringe in these
 10 several doors, instead of applying it in the culot.

Having described the various forms and constructions which I give to cannon or other large arms, for the purpose of loading or charging them at the breech or butt end, I shall in the next place describe my culot, plug, or cartridge stopper, which is an essential part of Invention,
 15 which must be used with any or all the constructions of cannon which have herein-before been described or mentioned by me, when the same are to be fired or discharged. The great obstacle to the use of large arms loading at the breech has hitherto been the difficulty of producing an air-tight or perfect closure between the moveable breech and the
 20 body or remainder of the gun; and if the effort of the explosion can at all make way into this joint or closure, the construction becomes dangerous, inasmuch as the opening will become larger, and eventually the moving breeching may be blown away or torn from its situation. This effect will entirely be prevented by the adoption of
 25 my culot, plug, or cartridge stopper, which is so placed in the gun as to come between the charge of gunpowder and the moveable breeching in all cases, and is formed of lead, copper, or such other ductile materials as will give way to the explosive force of the charge, and so formed and situated that by yielding or giving way it will completely
 30 and effectually cover and close up the joint or joining between the moveable breeching and the gun itself. Some of the manners in which this is to be performed and placed will be seen in the Drawing A, in which N° 63, is a general section of one of these culots or cartridge stoppers, drawn half of their size in dimensions for a six-pounder; and
 35 N° 64, a front view of the same. The external edge *a, a, b, b*, of this

chapter four

1816 – Henri Roux's 1st addition to Pauly's patent from 1812

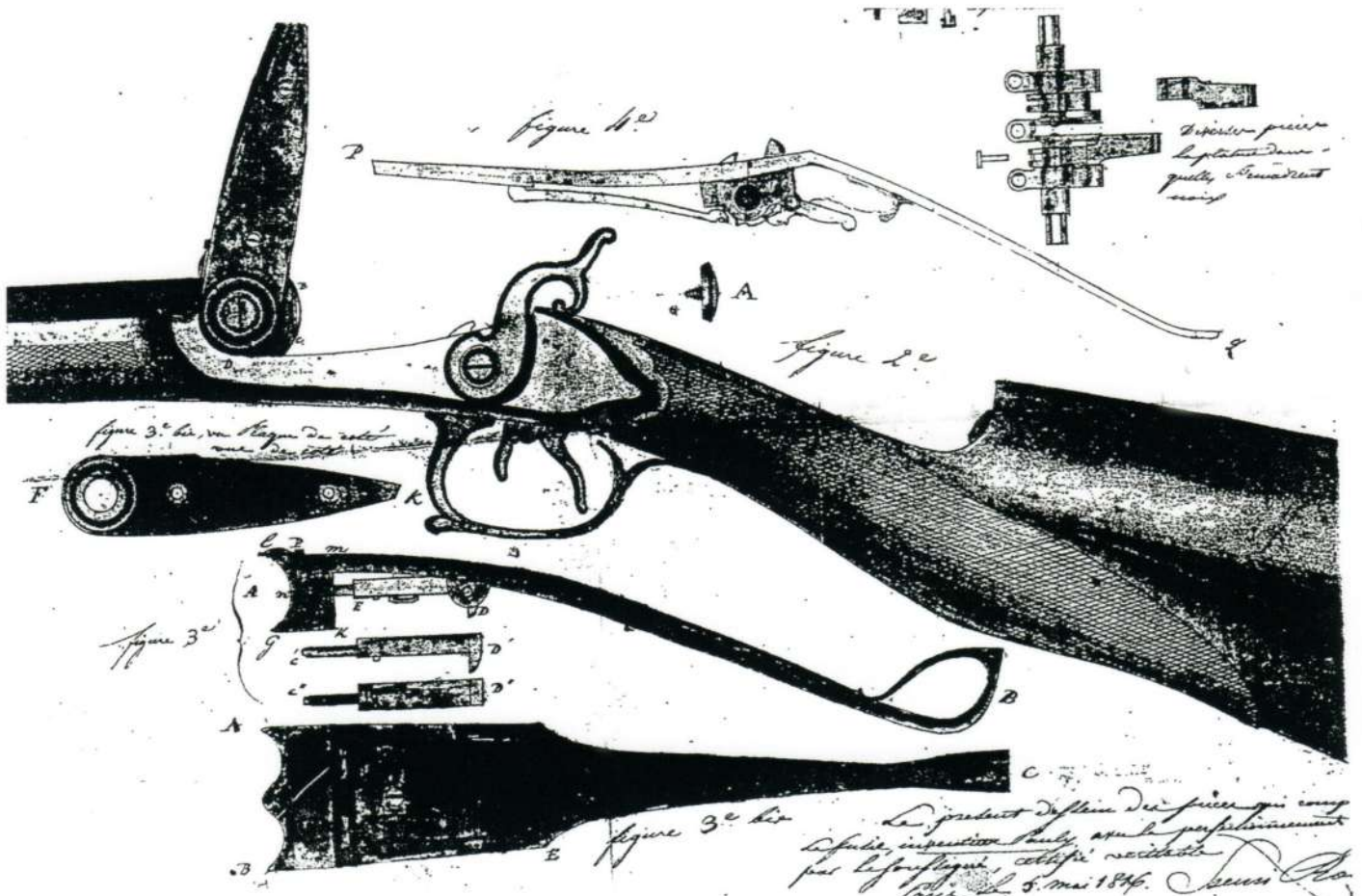
On May 5, 1816, Henri Roux, as the "owner of the factory of arms, invention Pauly", signed his application for a patent with improvements to Pauly's invention. In the head of the 3 1/2 page document is a kind of summary (translated) "*Perfection by omitting the movable lock with fire piston in the weapons of the invention Pauly*" (Fig. 9a).

Henri Roux has continuously worked on improving the Pauly system since he took over the company and probably before that when he was still in Pauly's service. The decisive factor is the simplification of the mechanics, which also enables the weapons to be produced more cheaply. He "refined" the system. The new weapon using Pauly's 1814 British patented upward and forward tilting lock now has a firing pin that strikes the ignition compound in the base of the rosette (Fig. 9b). The new design of the rosette with extractor groove is also presented here for the first time (Fig. 9c, 9d).

All of the rosettes and cases of the Roux invention (in improvement of the Pauly rosette) known to us today have this shape.

In addition, it should be mentioned that Roux made a second addition to the Pauly patent on June 11, 1818. It refers to a weapon with a flintlock as a breech loader. The patent is numbered 1372 and is also noted on the document of September 22, 1812 (see Fig. 3). Roux probably wanted to fit into the "flintlock era" with this construction, since he must have noticed how far he was ahead of the general standard with his construction. The second addition naturally had no influence on the further development of the ammunition.

Fig. 9b: The firing pin is shown in three views under "figure 3e D", the new rosette "A" under "figure 2e A", and in the chamber of the barrel with lock open.



Demande d'un certificat
de perfectionnement
pour les armes à feu
à piston.

(4)

M. Roux

Brevet de perfectionnement des armes à feu de l'invention Pauley.

3^e supplément & dernier

Le 16 Mai 1816.

C. C.
N° 3037

Memoire du Sr Henri Roux

afin d'obtenir un certificat de perfectionnement

pour la suppression de la culasse mobile dans
les armes à feu de l'invention Pauley.

Un des obstacles qui s'est le plus opposé à
l'adoption des fusils Pauley pour la guerre,
a été jusqu'à présent, l'usage d'une culasse
mobile en cuivre qui s'adapte à chaque
cartouche; cette culasse a un poids qui
joint à sa valeur, faisoit craindre deux
inconveniens entre les mains des soldats
quelquefois peu expérimentés peu vigoureux.

A cette considération s'en joignoit
peut-être encore d'autres, sur l'intelligence
qu'on supposoit falloir à ceux qui devoient
s'en servir, et sur les habitudes et les préjugés
qu'il falloit vaincre ou détruire. A présent
toutes ces raisons doivent disparaître; j'ai
fait construire un fusil dont je vais
faire la description, qui atteint le même
but, sans avoir besoin de faire usage de
culasse mobile; il se charge et part aussi
rapidement que ceux de la 1^{re} invention,
la poudre s'inflamme au milieu de la
circonférence de la base et la portée est la
même.

Le perfectionnement que j'ai donné
à la construction des fusils Pauley

Fig. 9a: Page one of Roux's patent application dated May 5, 1816. The issue date of the patent with "16. Mai 1816" in upper left corner. The patent number for this 1st supplement by Roux is only on the document of the "Comité Consultatif du Arte" dated September 22, 1812 (see Fig. 3). It is "1061". How this patent number was assigned and why it is only noted on the document dated September 22, 1812 is beyond the knowledge of the author.

Figure 1^{re} un fusil monté et équipé.
 Figure 2^e un fusil monté et équipé dont
 la bascule D E est ouverte. A la petite Culasse
 en Cuivre qui s'adaptait à chaque Cartouche,
 B. C la petite Culasse placée dans le tomme
 avec la Cartouche.

Fig. 9c: Excerpt from the text with mention of the rosette "A. la petite culasse en cuivre" and its placement in the chamber "B. C."

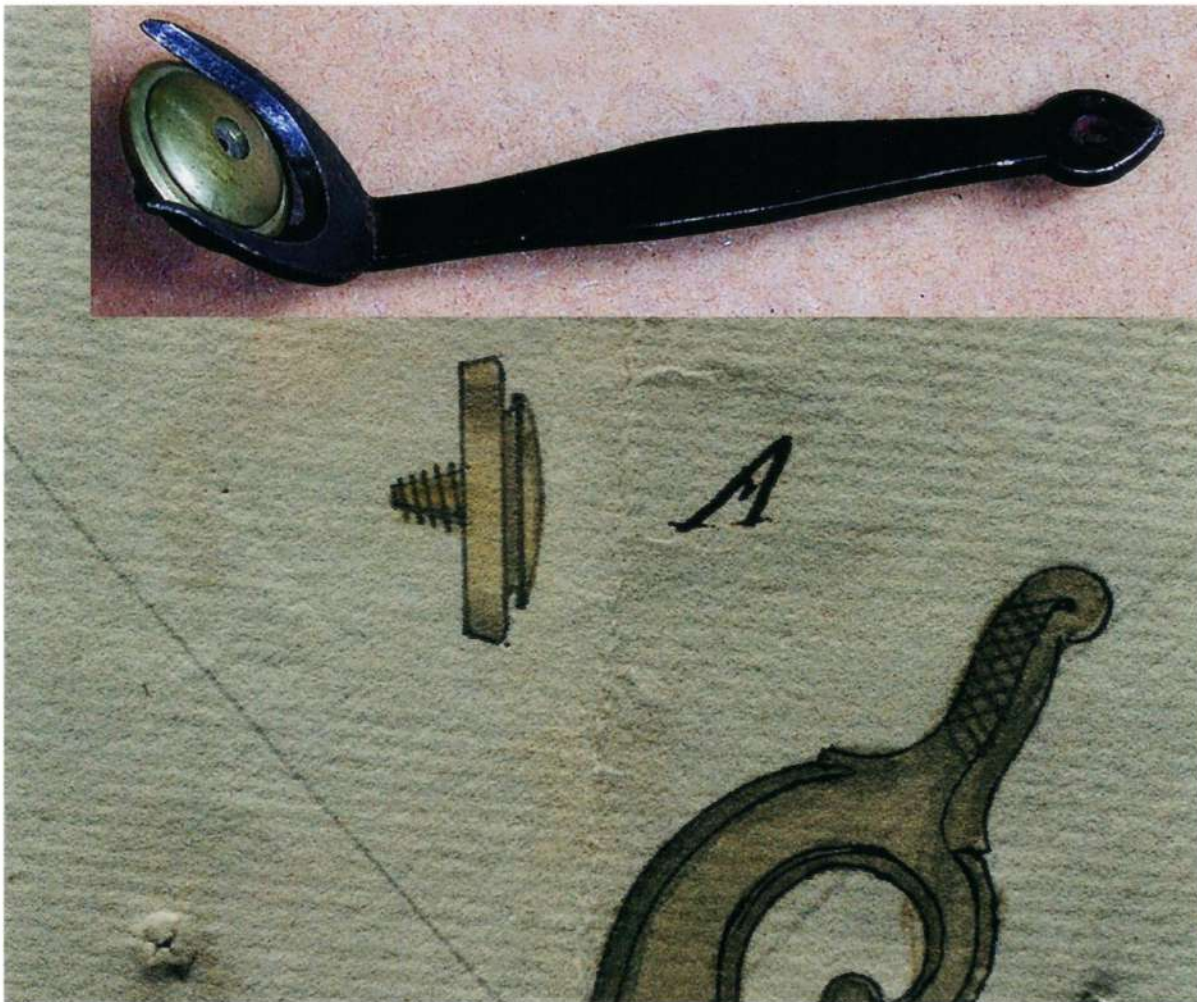


Fig. 9d: This section of the colored construction drawing accompanying the patent application shows the rosette with all its new details: base with extractor groove and pointed screw for fastening the load in a paper sleeve. Furthermore, the photo shows an original specimen of the new tool for pulling out the rosette using an iron fork, also an invention of Roux. Composition image by courtesy of Amand Leveau.

Ministère de l'Intérieur. (2)

arts & Manufactures
7 Juin 1816
No. 1964
Reg. 4

Comité Consultatif
des Arts & Manufactures.

Session du 6 Juin 1816.

M. Roux demande, comme
il est aux droits de M. Dauly,
un Certificat d'addition au brevet que
M. Dauly a pris pour ses armes
à feu à piston. à sa demande
sont jointes une description et des
dessins assez bien faits.

Le Comité est d'avis que le
Certificat peut être délivré.

Bureau Molard.

a. ampère. Gay-Lussac.
F. Guillard. Anonville.
F. J. P.

Fig. 9e: At the meeting of the "Comité Consultatif du Arts & Manufactures" on June 6, 1816, the patent application was approved. The committee again consists of outstanding personalities in physics: André-Marie Ampère and Joseph Louis Gay-Lussac.

chapter five

1822 – Henri Roux summarizes his inventions

In his book "*Des Fusils de Chasse, [...]*", published in 1822 (Fig. 10a), Henri Roux gives us 82 pages in eight chapters with a deep insight into the invention and meaning of the Pauly system and its improvements. Right in the preface, he emphasized that the designation "Pauly" for rifles of this design will continue to be used in order to distinguish them from designs with an external lock.

The book by Roux pays homage to Pauly. He emphasizes in a philosophical way that there is a big difference between people who are inspired by basic ideas and those who follow in their footsteps. By naming names such as Archimedes, Newton and Francklin [*sic*], Roux doesn't want to put Pauly on the same level as these great geniuses. But there is no doubt that he is at the forefront of the talents that shaped Pauly. The modesty with which Roux classifies his important innovation is remarkable.

Roux did not use the metaphor "*Standing on the shoulders of giants*"* ("*Using the understanding gained by major thinkers who have gone before in order to make intellectual progress*"), although it would certainly apply here. As Roux *expressis verbis* Newton enumerates, Isaac Newton's famous quote from a letter from 1676 to his rival Robert Hooke should not go unmentioned "*If I have seen further it is by standing on ye shoulders of giants.*"

"Franklin" means Benjamin Franklin (1706-1790), one of the founding fathers of the United States of America. Roux mentions him for his scientific inquiries. He explored the phenomena of electricity and the nature of electric charge (principle of charge conservation). Franklin was the inventor of the lightning rod.

Henri Roux recognized exactly on what basis he could only continue his further developments. It shows the human size of a man whose life we unfortunately know almost nothing about.

What Roux describes in great detail in the various chapters on the guns "System Pauly" and their ammunition is remarkably summarized on the sheet with the drawings (Fig. 10b) at the end of the book. Roux presents all his further developments here. In addition to the innovations already described, such as ignition with a firing pin, the newly designed rosette with screw and extractor groove and the extractor fork. Roux also constructed a mechanically sophisticated tool for loading the cartridges. Its handling is well explained in the text.

*The metaphor has its origins in Greek mythology and has been used repeatedly since the 13th century.

DES FUSILS DE CHASSE,

ET PRINCIPALEMENT

DES FUSILS A PISTONS

DE L'INVENTION PAULY,

AVEC QUELQUES OBSERVATIONS SUR LA FABRICATION DES
ARMES A FEU, SUR LA CHASSE, SUR LA POWDRE ET SES
EFFETS ;

PAR HENRI ROUX, FABRICANT.

Aux habitans de l'air faut-il livrer la guerre,
Le chasseur prend son tube, image du tonnerre,
Il l'éleve au niveau de l'œil qui le conduit,
Le coup part, l'éclair brille et la foudre le suit.

DEUILLE, H. D. C.



CHEZ DELAUNAY, LIBRAIRE, Palais-Royal.

MONGIE, Boulevard Poissonnière.

1822

Fig. 10a: The title page of Henri Roux's "*Des Fusils de Chasse*", 1822. The only known original is now in the National Library of France, Paris.

Fig. 2.

Fig. 1.

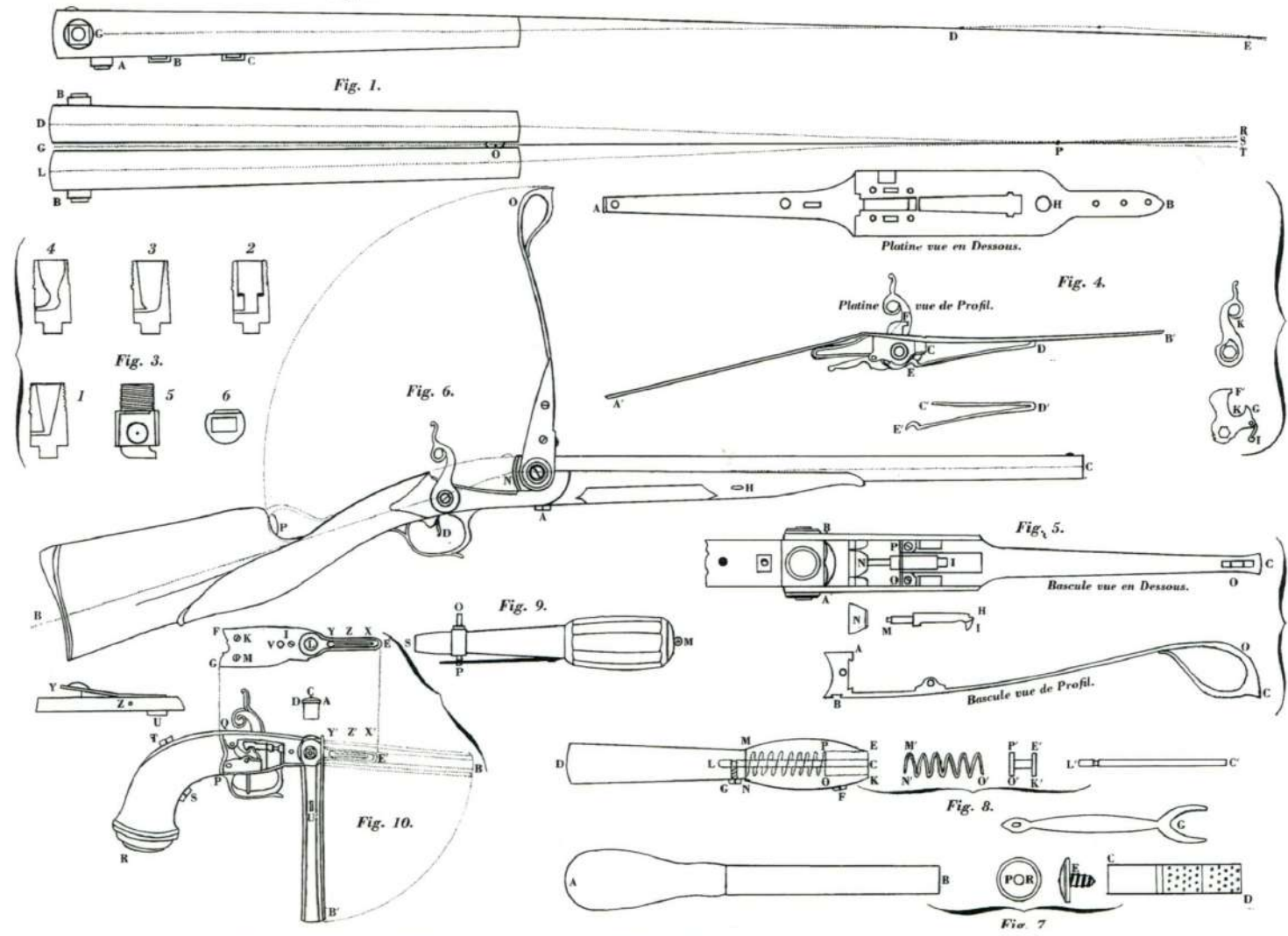
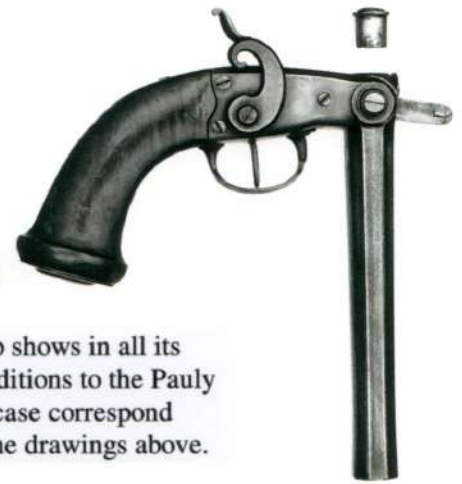


Fig. 10b: The sheet with the drawings by H. Roux from "Des Fusils de Chasse", 1822. The firing pin under "Fig. 5 M, H, I", the rosette, the shot cartridge and the extractor fork under "Fig. 7" and the exploded drawing of the tool for loading the cartridges "Fig. 8". All illustrations are described in detail in the text of the book.

**Roux pistol with firing pin
(1820-22)**



This specimen of a pistol from Henri Roux's workshop shows in all its views the design features of his improvements and additions to the Pauly system made until 1822. The pistol and the cartridge case correspond exactly to the illustration in Fig. 10. on the sheet of the drawings above.

Left: In the lock the firing pin is pulled back with the hammer cocked; right: hammer released and firing pin pushed towards cartridge.



Photos by courtesy of Royal Armories (Crown Copyright Content).

chapter six

Original ammunition specimens from development until 1822

The cartridges, individual rosettes and cases known to us from the period between 1812 and 1822 correspond uniformly to the design developed by Henri Roux from around 1815/16. These are the cartridges that have already been rearranged from "Type I" to "Type II" (see preface). It should be emphasized again here that the rosettes shown in the undated design drawing under Fig. 5c are not known in this form today ("Type I").

A clear assignment of rosettes and cases to certain manufacturers is hardly possible due to the many producers at that time. The "*à la Pauly*" weapons are produced in France as well as in Belgium.

The most important characteristics are

- Extractor groove on rosette and case
- Rosette with a pointed screw for fastening the load in a paper sleeve
- Flat circular recess in the base to hold the ignition compound
- Iron disc screwed into the base with the diameter of the recess and ignition orifice.

The known variations can be exemplified here.



Fig. 11a: Both sides of a complete 18 mm cartridge of the rosette-type [or 16.26 mm = .64]. The inked marking "ad B. 1893" is an inventory number of "Tøjhusmuseet" (Arsenal Museum), Copenhagen. The buff colored paper case containing powder and one round ball has a perforated cardboard washer which is screwed on the turned brass "button head" (called "bassinet" or rosette by Pauly). The paper case is closed at the nose with a simple tan colored string ligature. Overall length of cartridge: 43 mm; diameter paper over round ball: 17.8 mm.

Since the origin of this type of cartridge is the only one that has been clearly established, it also has a history. Those cartridges were manufactured together with the rifles according to the Pauly principle in the arsenal in Copenhagen under the direction of the Danish gunsmith and amorer Christian Wilcken Kyhl. He made them for King Frederik VI of Denmark around 1820-1822.* The various gun manufacturers were already well networked in Europe at the time and their inventions state of the art. In 1822, the ten-year Pauly patent from 1812 was expiring and thus freely available. Or perhaps the Copenhagen armory paid royalties to Henri Roux. This specimen was once part of Tøjhusmuseet (Arsenal Museum), and later of the Berkeley R. Lewis collection. Under what circumstances a few of these complete cartridges (maybe three?) left the museum in the 1950s or 1960s remains unclear.

*Askgaard, Finn: Rustmester Christian Wilcken Kyhl – Bøssesmager og Opfinder. *Tøjhusmuseets Skrifter* 9, København, 1975



Fig. 11b: The view of the base of the turned rosette with a recess for the ignition compound and screwed-in iron disc with ignition orifice. Iron used as a more resistant metal to impact than brass. Diameter of the rosette: 22.55 mm.



Fig. 11c: Two views show the inside of the rosette with the number "2". This "2" can be found on all known rosettes that were manufactured in the armory. The careful processing is striking. The rosette is gold-plated to protect it from external influences.



Fig. 12: A rosette in two views with a similar shape as in Fig. 11. The inside bears a reversed "L" or "F". Diameter: 19.6-19.8 mm. The underside with clearly visible screwed-in iron disc.
Lou Behling collection.



Fig. 13: 23 (!) rosettes in a cased Pauly/Roux rifle set. Most of them seem to be unfired and still have the bright iron reinforcing inserts.
Photo by courtesy of Amand Leveau.



Fig. 14a : Another rosette with same small "2" stamp as seen in specimen Fig. 11c which indicates Copenhagen Arsenal manufacture. Diameter: 22.4 mm. Antonius Rauch collection.



Fig. 14b: Another rosette with the identical reversed "L" or "F" stamp as seen in specimen Fig. 13b. Diameter: 19.9 mm. Antonius Rauch collection.



Fig. 14c: Rosette with "W" stamp. Diameter: 23.2 mm. Antonius Rauch collection.



Fig. 14d: Rosette with "33" stamp. Diameter: 19.9 mm. Antonius Rauch collection.



Fig. 15a: 15 mm brass case probably for a pistol. Case length: 27.4 mm; Diameter of rim: 20.6 mm; diameter of case: 16.8 mm.

The construction of the head is identical to that of the rosette. Unusual, however, this often fired specimen has no steel reinforcing around the vent hole. The originality of the case is beyond doubt. Under magnification the recess shows quite a lot of impacts of a broad firing pin.



Fig. 15b: A look into the extremely thick-walled cast case. All known cases of this type are made with thick walls. Case wall thickness: 3.4 mm.

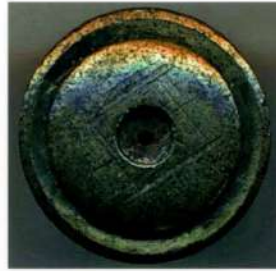


Fig. 16: A somewhat more compact case shape than in Fig. 15a. Case length: 21.9 mm. Case mouth internal: 14.1" – the bore would have been 14.5 or maybe 15.0 mm. Diameter rim: 18.5 mm; Case diameter: 15.6 mm; case wall thickness: 3.1 mm. This case has the regular reinforcing steel insert. Lou Behling collection.

Summary of the period 1813 to 1822

- 1813/14: After the military rejected his system, Pauly turned to the civilian market and continued ignition with compressed heated air. For such a very early "*Pauly et Cie*" hunting and sporting rifle with a narrowly limited production period see pages 24/25. Cartridges for this type of rifle are not known.
- 1814: Pauly moves to London and the company Pauly & Co. is taken over by Henri Roux.
- 1814 and 1816: Pauly's British patents for compressed heated air ignition. Single cartridges for this type of ignition are not known. Exception: one specimen of seven-shot volley cartridge (page 28).
- 1814-1816: Roux developed a lock with percussion ignition and a rosette with extractor groove. The design drawing, kept together with Pauly's 1812 patent, must now be assigned to this period.
- 1816: Roux describes his innovations in the first improvement of Pauly's 1812 patent.
- 1822: Roux summarizes his inventions in the book "*Des Fusils de Chasse*".
- 1820-1822: Complete cartridges with rosettes can be assigned to the manufacture in the Copenhagen Arsenal, Denmark.

**Henri Roux shotgun
(1816-22)**



This cal. 16 mm shotgun made by Henri Roux can be narrowed down to around 1816 to 1822 based on their design features. It has a lock tilting upward and forward (probably first shown in Pauly's British Patent of 1814) and a percussion firing pin (Roux's Patent No. 1372 of 1816). Henri Roux's cartouche is hammered into the damask barrel - HR between crown and laurel twig (see photo). A great peculiarity of this shotgun was expressed in the brass rosette, which can be swiveled in and out on a hinge. Roux certainly wanted to make the gun loading process easier for the shooter.

The impressive engraving *"Invention Pauly"* on the right side of the lock once again illustrates the high recognition that Roux Pauly pays for his invention of the basic principle of a breech-loading weapon with central outside ignition of a cartridge (rosette). Roux follows his homage to Pauly, as he repeatedly emphasized in the book *"Des Fusils de Chasse"*. This very rare Roux shotgun might even be the only known specimen with a movable rosette attached to the lock.



Close up of Henri Roux's cartouche on the damask barrel.*



The top of the damask barrel with Henri Roux's company cartouche.



The open lock with the rosette swung in and out.*



Photos by courtesy of *Visier* gun magazine via editor Matthias S. Recktenwald.
*Photos by courtesy of Peter Grieder. Peter Grieder collection.

chapter seven

Henri Roux 1823 – first use of the percussion cap on a cartridge

The invention of the copper percussion cap by the London gunsmith Joseph Egg (1775-1837), a nephew of Durs Egg, around 1820 set another important milestone in the development of weapons and ammunition. Although he has not applied for a patent for his primer, he is now considered the sole inventor according to all research findings, mainly by De Witt Bailey.*

Henri Roux had just finished his book "*Des Fusils de Chasse*" with the description of all previous inventions and improvements of the Pauly system, when he came up with another real "bang" in 1823. He was the first to put the newly invented percussion cap on a nipple at the base of the metal cartridge. It is anticipated here that in the following years and decades some successors and imitators in Europe and in the USA also applied for various patents for this construction. Examples will be given in later chapters. .

It is extremely surprising that Henri Roux's Patent No. 2166, issued June 26, 1823, found little resurgence in literature, and none at all in the newer. But there is a good description of the patent in the German technical journal "*Polytechnisches Central-Blatt*"** from the year 1835, which is relatively up-to-date. The main innovations are presented here in great detail in words and pictures. The drawings are taken from the original patent in a somewhat simplified form. Instead of the correct year in which the patent was granted in 1823, this source incorrectly specified "1828". The *Polytechnisches Central-Blatt* has taken its presentation from the bulletins of the SEIN.

In his three-page patent dated May 31, 1823 (Fig. 17), Roux again refers to improvements made to the rifle of the Pauly invention. The sheet with the construction drawings attached to the text (Fig. 17, 18), submitted by Roux on June 6, was confirmed on June 26, 1823 by the Secretary of the Interior Ministry with his signature for the grant of the patent.

At the meeting of the "Comité consultatif" on June 21, 1823 (Fig. 19), however, the somewhat sweeping statement was given that the drawings and descriptions disappointed and gave no clarity as to what was to be patented. Details are not given. The fact that the patent was granted after only five days leaves questions unanswered and contradicts the very quick patent grant. In my view, the gentlemen of the commission seem to have misunderstood Roux's patent text and drawings. How could Roux have described it better - especially when it comes to the new cartridge case?

As with the previous Pauly weapon system, the innovation of Henri Roux's rifle had little impact in the history of the firearms. But here, too, the cartridge became a salient feature of Roux's invention and certainly is another most historically significant single event in cartridge evolution.

Roux's cartridge with percussion cap was followed by a whole series of quite similar constructions of such cases, which were also protected by the "imitators" by patents during the following decades until the late 1860s. The design "case with nipple" had not changed fundamentally. All the more reason for Roux's performance today, of course as a result of Pauly. In some literature, all of these cases for receiving the percussion cap are referred to as "primitive centerfire". Examples are described below.

With Roux's patent of 1823, his story suddenly seems to have come to an end. No further improvements were made by him. In 1823, Roux had his workshop at Rue de Faubourg-Montmatre No. 10 and a shop on Boulevard Montmatre No. 10. In 1825, Eugène Picherau took over Henri Roux's workshop at the above address.*** What may have happened to Henri Roux remains a mystery. We can only speculate. Also the subsequent bulletins of the SEIN as well as the encyclopedias or summarizing arms books of the 1830s no longer mention Roux after 1825.

*Cited from *London Morning Post*, 28 July, 1920: Joseph Egg's great-niece stated: "*It was a source of pride to the family that, having invented an essential improvement, he declined to take out a patent, saying it was a good thing and everyone should have benefit from it.*" [De Witt Bailey in *Man at Arms*, No. 6, 2005]

***Polytechnisches Central-Blatt für 1835*, August 12, 1835, Leipzig (pages 549-500); digitized viewable on the Internet.

****Almanach du Commerce de Paris, des Départements de la France et des Principales Villes du Monde*, de J. de La Tynna, years 1823, 1825.

Fig. 17 (on the right): The three-page specification with the detailed explanations. Only the last section on page three with signature and date "*le 31 mai 1823*" came from Roux's hand. Patent specifications are now taking the form we are used to from recent times.

Brevet d'invention
de 10 ans

Détail des figures du fusil à 3 pièces de l'invention Sauly perfectionné Nous Demandons pour le Sr Henri Roux.

(Nota) On a joint les Dessins de l'ancien fusil pour le comparer
aux nouveaux.

La figure 1^{re} représente l'ancienne bascule de profil.

Figure 2^e représente l'ancienne bascule vue en dessous. $A B C$,
La culasse mobile vue de profil. $A B C'$, vue en dessus.

Figure 3^e représente la nouvelle bascule perfectionnée vue
de profil.

Figure 4^e la même bascule vue en dessous. $D E F G K$,
représente le nouveau piston $M R O P$, La nouvelle rossette ou culasse
mobile R , L'enclume $S T V X$, La section pratiquée à la bascule
jusqu'au Sommet de l'endroit où passe le piston, 234. Le ressort à
double branche, qui ramène le piston dans une position fixe en
s'appuyant sur deux points ou symétriquement, au piston. $A B C$, toujours
figure 4, anneau dans lequel entre le piston qui fixe au moyen
d'une petite vis au point A . Cet anneau tourne facilement sur
ses pivots $B. J. C. J.$ tient le piston suspendu pour lui empêcher les
frottements.

Explication des perfectionnements.

Les inconvénients que présentait dans l'usage le fusil à piston
de l'invention Sauly et qui étaient notoires pour tous ceux
qui s'en servaient, consistaient.

1^o Dans le piston qui s'engorgeait facilement en
traversant la bascule au milieu d'une pièce de cuir qu'il
fallait toujours entretenir huilé. La fumée de la poudre
s'attachait bientôt cette partie et rendait le mouvement plus
difficile, et détruisait par cette raison l'effet du grand
ressort ou du marteau qui ne précutoit plus avec assez
de force.

2^o. Dans le bout du piston qui frappait sur l'amorce et qui se fêlait ou se cassait sans qu'on pût s'en apercevoir desuite; ce qui faisait éater et puis la difficulté de démonter ce piston et de le changer.

3^o. Dans l'amorce de poudre fulminante, qui placée dans le bassinet se trouvait en contact avec l'air, se détachait nécessairement un peu par ce contact et qui étant fixé au seul point par une pression, se détachait quelque fois par une secousse.

Par le perfectionnement qu'on présente tous ces inconvénients disparaissent.

Le piston $DEFGK$, figure 3 & 4 peut recevoir à volonté dans la partie DEF , la forme cylindrique, quadrangulaire ou polygonale. La partie $EFGK$, qui est cylindrique, est d'un diamètre double ou triple de l'ancien piston et passe par un trou beaucoup plus grand pratiqué dans le centre de la bascule. L'anneau ABC , figure 4, tient en suspenso le piston et lui permet d'aller en avant ou en arrière en tournant sur ses deux pivots B & C .

Un petit ressort à double branches, 234, a pour but de tenir le piston toujours en arrière, de manière à ce que le bout soit constamment à la hauteur de la section ST . ce ressort peut avoir d'autres formes et être placé différemment; mais son action et son but sont les mêmes.

On peut encore laisser le derrière D , de l'ancien piston, de la même forme & laisser subsister la planchette ABC , à laquelle on joindrait une division qui s'étendrait en X pour séparer dans les fusils doubles les deux coups.

La Culasse mobile NOP , portée avec elle une enclume R , percée dans son centre d'une lumière qui aboutit au point P . YZ , est un petit tube à peu près cylindrique en cuivre, ouvert d'un côté & fermé de l'autre qui renferme au fond la poudre d'amorce. Ce tube se place et se fixe avec la main sur l'enclume R .

La Cartouche étant armée de cette culasse mobile ou rosotte ainsi amorcée, se met dans le canon. une section STU , pratiquée dans le dessous de la bascule jusqu'au point G figure 3^o permet à cette bascule de se lever ou de se baisser sans que l'enclume & le tube à amorce soit touché. Dans cet état, on conçoit comment le marteau de la platine frappant sur le piston DGK , percute le tube qui renferme l'amorce qui s'enflamme et lance par la lumière pratiquée à l'enclume une aiguille de feu qui fait détonner la charge.

La perfectionnement consista principalement dans
l'idée bien simple d'armer la Culasse mobile de louchme
& d'y adopter la morce renfermée dans un tube en cuivre.
Le piston attaché à la bascule peut recevoir divers formes
mais son jeu et son action comme on la déjà dit sont
toujours les mêmes.

1^o Avantages: D'éviter le frottement qu'avait l'ancien
piston dans la pièce de cuir.

2^o Ne pas craindre que le bout du piston se casse
ou se fêle, sans qu'on s'en aperçoive, ce qui faisait rater.

3^o Avoir la morce à l'abri de l'humidité, que par
crainte qu'elle s'échappe, & enfin de pouvoir la transporter
et la manier sans accident.

4^o De supprimer l'usage de la fourchette et de pouvoir
mettre ou ôter à volonté la cartouche du Canon sans
effort et sans la détriorer.

Ces avantages très importants & la simplicité
de la manœuvre font croire au possesseur que ces
armes pourront sans inconvénient être employées
à la guerre surtout pour l'usage de la cavalerie
& que de leur côté les chasseurs en seront très
satisfait puisqu'il leur faudra moins de soins
pour entretenir leur fusil & qu'ils seront encore
moins dans le cas d'éprouver des accidents. Il
s'ensuit en conséquence un brevet de perfectionnement.

D. Dix ans

Paris le 31. mai 1823.

Seuri Roux

fabriquant, propriétaire de la
fabrique des fusils de l'impératrice Saubert

En d'artoir N^o 24.

Figure 4^e la même bascule vue en dessous. D E F G K, —
 représente le nouveau piston N R O P, La nouvelle rosette ou Culasse
 mobile R, L'enclume S T V X, La Section pratiquée à la bascule

Fig 17a: Detail of page 1 - "figure 4e" mentions the new rosette *NROP*.

La Culasse mobile N O P. portée avec elle une
 enclume R. percée dans son centre d'une lumière qui aboutit
 au point P. Y Z est un petit tube à peu près cylindrique
 en cuivre. D'un côté ouvert & fermé de l'autre qui renferme
 au fond la poudre d'amorce. Ce tube se place et se fixe
 avec la main sur l'enclume R.

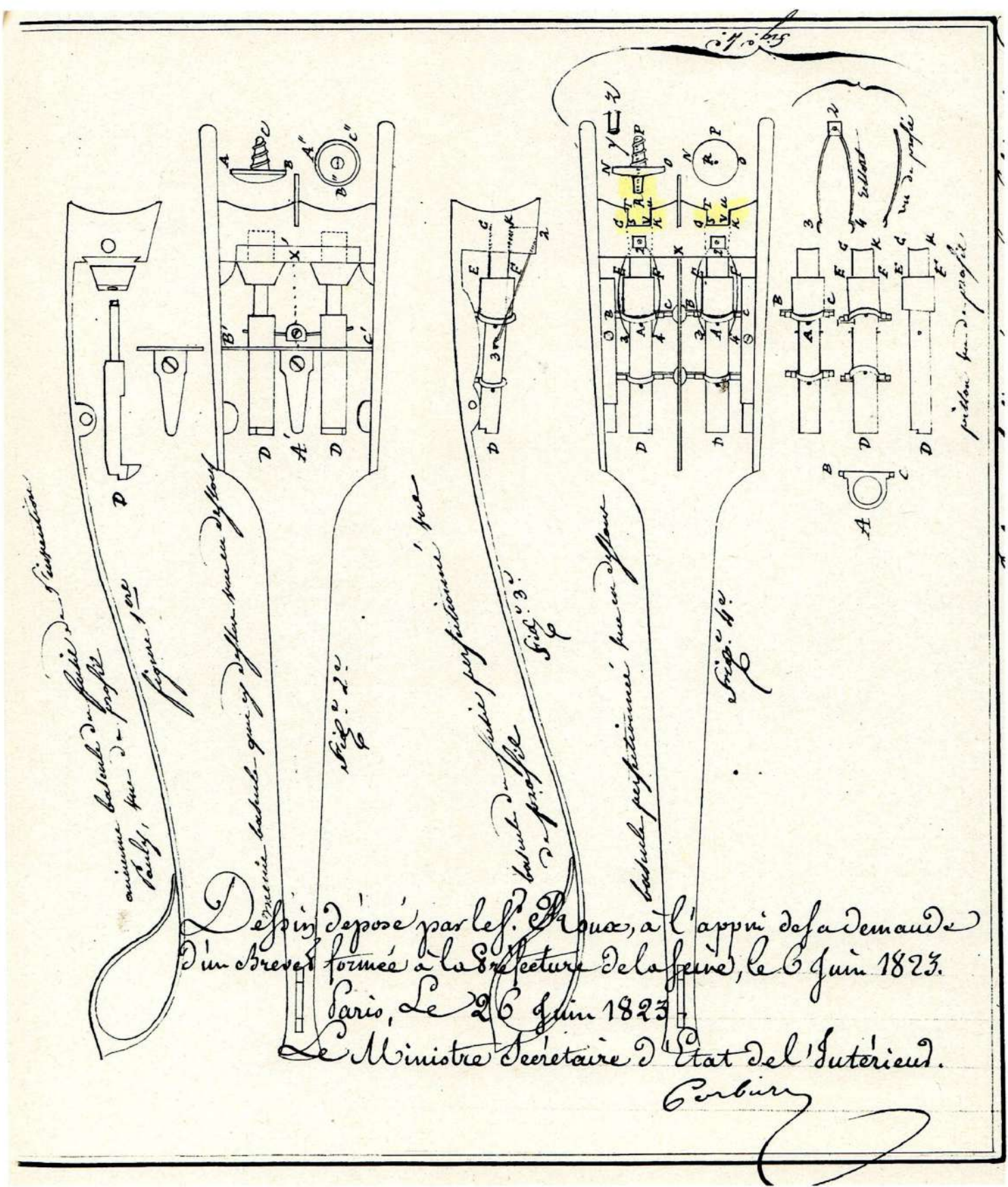
Fig. 17b: Detail of page 2 - The "*culasse mobile NOP*" here refers to the rosette as a movable lock. And on this rosette is the anvil "R" to hold a small copper tube "YZ", sealed on one side, with the ignition substance. This tube is placed on the anvil by hand.

Le perfectionnement consiste principalement dans
 l'idée bien simple d'armer la Culasse mobile de l'enclume
 & d'y adapter l'amorce renfermée dans un tube en cuivre.
 Le piston attaché à la bascule peut recevoir diverses formes
 mais son jeu et son action comme on les déjà dit sont
 toujours les mêmes.

Fig. 17c: Detail of page 3 - Here Roux once again points out the advantages of his "improvement" of the mobile lock, i.e. a rosette with anvil to hold the percussion cap.

— sans accident.
 4^e de supprimer l'usage de la fourchette et de pouvoir
 mettre ou ôter à volonté la cartouche du Canon sans
 effort et sans la détériorer.

Fig. 17d: Detail of page 3 - Another interesting aspect: The fork "*la fourchette*" is now no longer necessary to remove the cartridge.



Déposé par les. Roux, à l'appui de la demande
 d'un brevet formée à la direction de la guerre, le 6 juin 1823.
 Paris, le 26 juin 1823.
 Le Ministre Secrétaire d'Etat de l'Intérieur.

Corbière

Fig. 18: The complete drawing sheet. The old system is shown on the left and the new "basculé (gun lock) perfectionnée" on the right. Below the document bears the final approval date "Paris, le 26 juin 1823" and the signature of the Secretary of the Interior Minister.

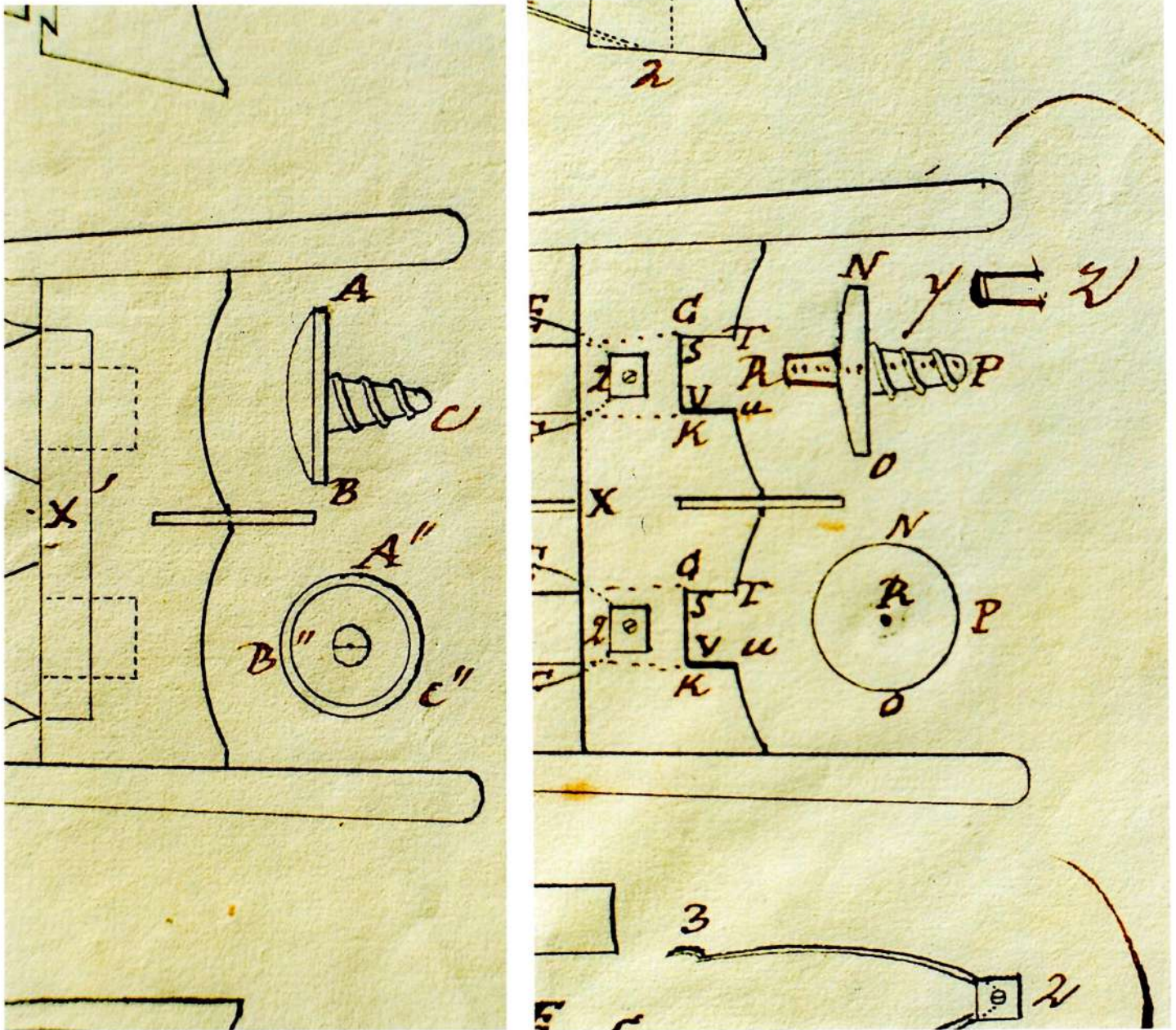


Fig. 18a: Details of the drawings. In this colored version, the contrast between old (left) and new (right) is very clearly illustrated. The pioneering innovation of a rosette with anvil "NOPR" to hold the primer was even marked in red at the crucial points "R" and "YZ".

2166

3

Ministère de l'Intérieur.

Comité consultatif des Arts et Manufactures.

Séance du 21 juin 1823

Le Sr. Henry Roux demande un brevet
d'invention et de perfectionnement, de 10 ans,
pour des additions et améliorations aux
fusils à percussion de Pauly.

Les principes définis et la
description que le pétitionnaire a fournis,
à l'appui de sa demande, étant suffisants,
quoiqu'on eût à désirer plus de clarté dans
la position des lettres et des chiffres sur
les figures, rien ne s'oppose à la délivrance
du brevet.

juin 1833

Bureau

Molard aîné

Guillot

Fig. 19: The document of the meeting of the "Comité consultatif" on June 21, 1823, in which the second paragraph still refers to weak points in the drawings and descriptions given by Henri Roux. The patent number "2166" was later added in the top left. As requested by Roux, the term of the patent was ten years. In previous documents of this type, the letterhead was called "Ministry of War" and now "Ministry of the Interior". France had changed from Napoleon's warlike empire to the kingdom under Louis XVII.

Specimens of Roux's 1823 patent cartridges



Fig. 20: A very heavy thick-walled two-piece brass case with an inserted steel nipple acting as the anvil, according to the 1823 patent by Henri Roux. The case mouth is chamfered to accept the round ball. The caliber of the turned case is 16.25 mm. Overall length: 29.9 mm; diameter case: 17.9 mm; diameter rim: 21.0 mm. This is the cartridge which I had formerly erroneously called "Pauly Type III" (see Preface).

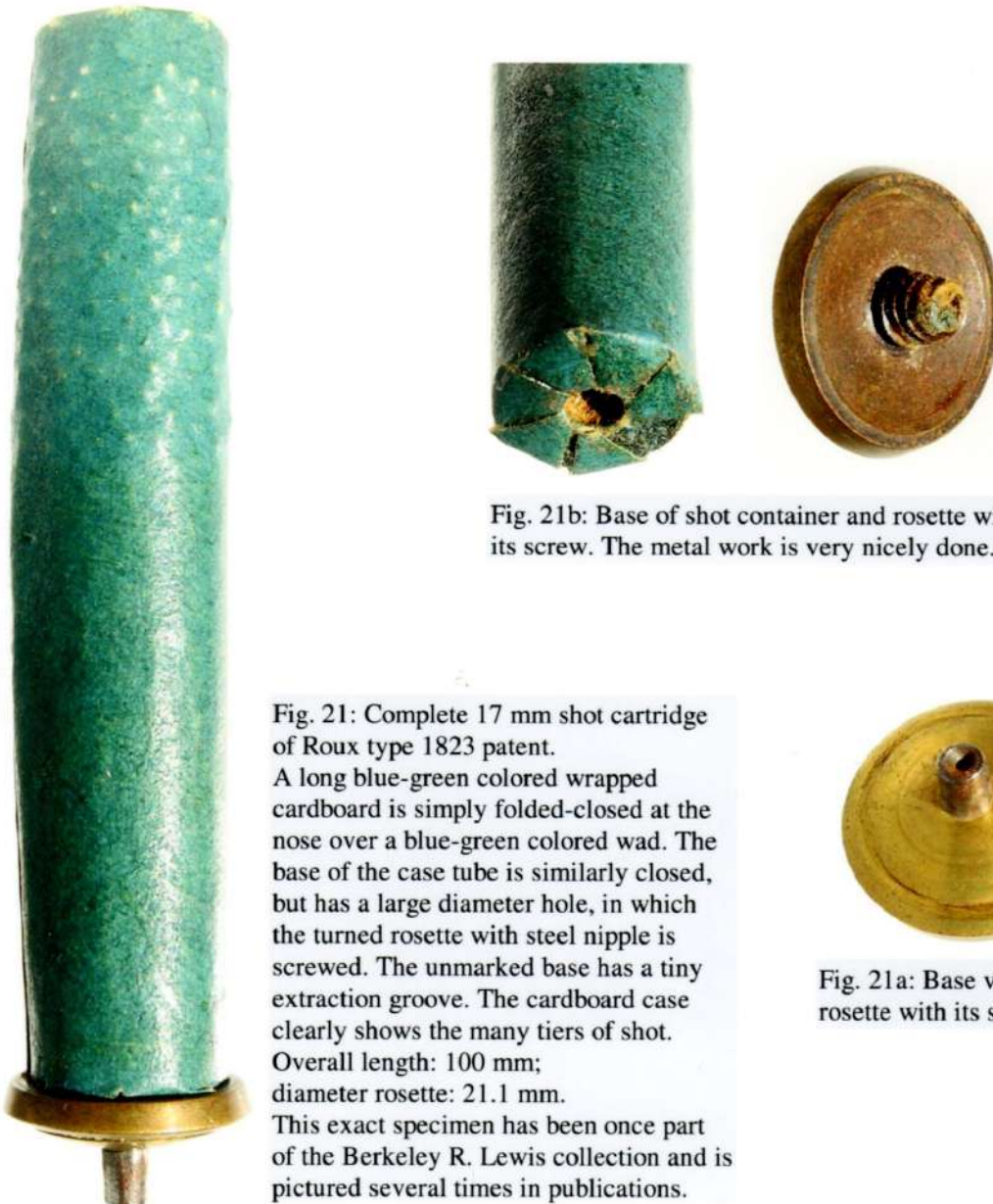


Fig. 21b: Base of shot container and rosette with its screw. The metal work is very nicely done.

Fig. 21: Complete 17 mm shot cartridge of Roux type 1823 patent. A long blue-green colored wrapped cardboard is simply folded-closed at the nose over a blue-green colored wad. The base of the case tube is similarly closed, but has a large diameter hole, in which the turned rosette with steel nipple is screwed. The unmarked base has a tiny extraction groove. The cardboard case clearly shows the many tiers of shot. Overall length: 100 mm; diameter rosette: 21.1 mm. This exact specimen has been once part of the Berkeley R. Lewis collection and is pictured several times in publications.



Fig. 21a: Base view of the rosette with its steel nipple.

Lenoir patent of 1849 – strong resemblance of the cases to that of Roux

This patent by Auguste Léopold Lenoir should be preferred here in the chronological order of developments, since these cases are very similar to those of Roux and can be easily confused. The small difference is in the different angles in the shape of the base (Fig. 22, 22a, b).

Lenoir essentially describes innovations in the gun lock. The cartridge with its characteristic shape is more of a side effect.

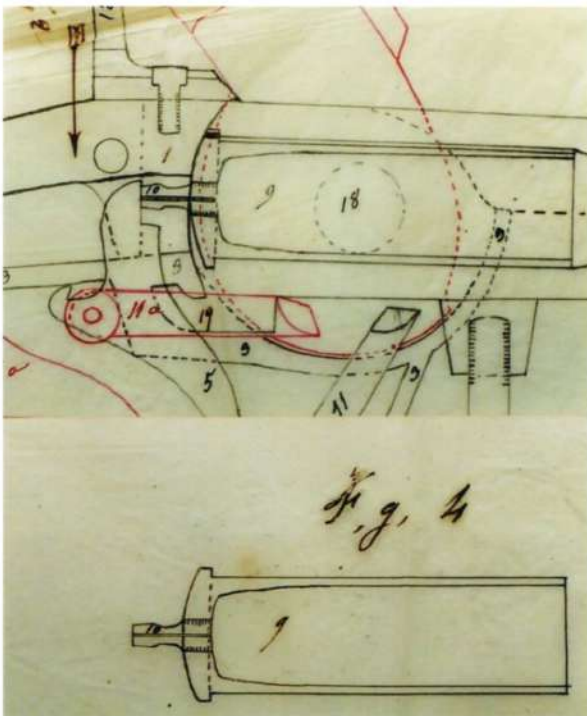


Fig. 22: Two parts of Lenoir's colored patent drawings (patent No. 7848 of February 22, 1849). The case shows the characteristic shape of the base with a slightly different geometry than that of Roux's cases. Roux: conical inlet of the base edge towards the inside with an angle of approx. 45°; Lenoir: Inlet of the base edge perpendicular to the case, i.e. with an angle of 90°.

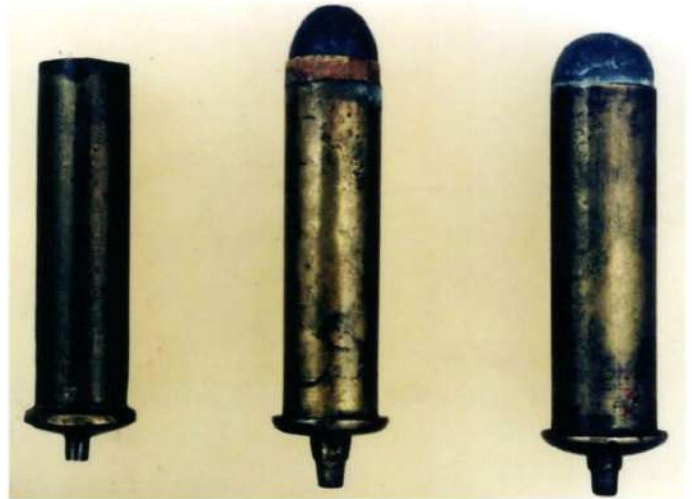


Fig. 22a: Three examples of Lenoir cases. Picture by courtesy of Amand Leveau.



Fig. 22b: Lenoir brass case with steel nipple. Overall length: 64.1 mm; diameter base: 18.1 mm. Antonius Rauch collection.

chapter eight

Moving away from cartridge case with nipple in the period of 1824-28

With the rather sudden disappearance of Henri Roux, new gunsmiths and inventors appeared in the Parisian scene from 1823. In the period from 1825 to 1828, Eugène Picherau and Casimir Lefauchaux made patent supplements, i.e. improvements to the Pauly and Roux systems and patented them. However, there was a move away from the cases with an integrated nipple. Instead, nipples on the outside of the weapon are preferred. A further contribution on the path that has just been taken to the central fire cartridge is therefore not being made by either gunsmith. Nevertheless, they should not go unmentioned in the chronology of events.

Eugène Picherau

In his two patents No. 2498 dated January 23, 1825 (Fig. 23) and No. 2564 dated March 31, 1825 (Fig. 24a, b), Picherau again turned away from the case with nipple and percussion cap that had just been invented by Roux. Instead, he takes a different approach to the Pauly weapon system. He first placed the nipple on the outside of the frame of the weapon and then, together with the hammer, on the hinged breech.

Even if Picherau no longer pursues the path that Roux has just taken in the development of the central fire cartridge, he was the first to design an external nipple for primers on a breech loader.

The previously mentioned *Polytechnisches Central-Blatt* from 1835 also confirms Picherau's patent amendments by turning away from the case with the nipple and towards the outside nipple placement on the frame. This also applies to Lefauchaux below.

Picherau's activity as a gunsmith also appears to have been limited after 1825, since Casimir Lefauchaux already wrote in his patent application in 1828 "Picherau, former gunsmith".

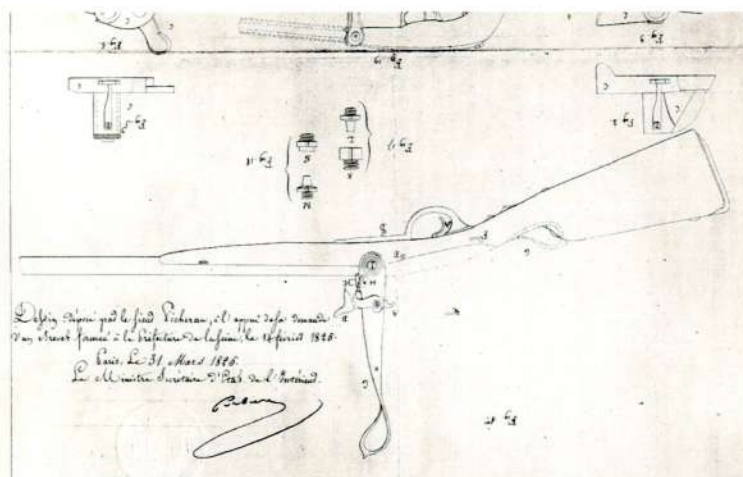


Fig. 24a: The drawings of Picherau patent No. 2564 dated March 31, 1825, signed by the Secretary of the Interior Ministry. The nipples (Fig. 17, Fig. 18) now lie together with the hammer on the lock which can be opened upwards.

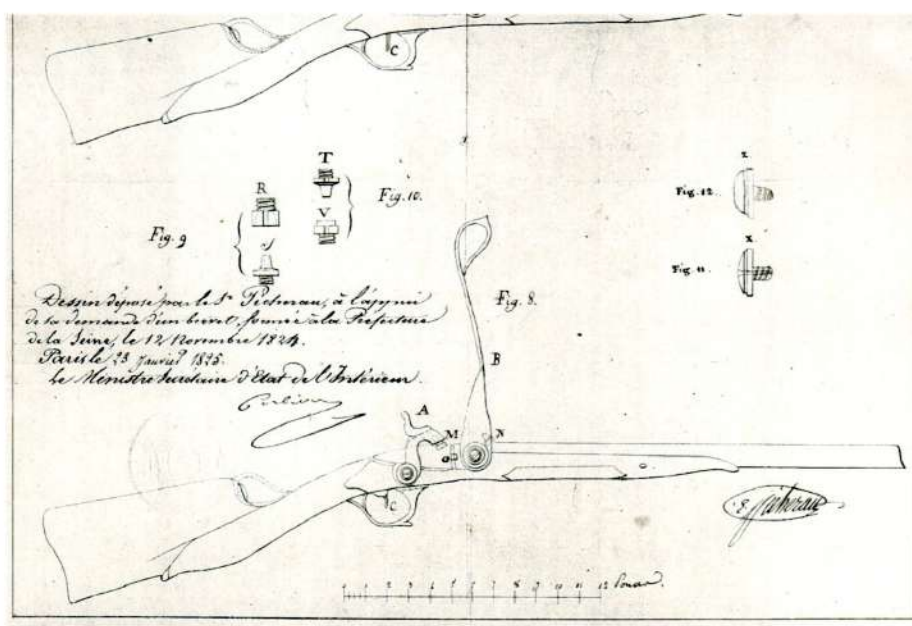


Fig. 23: The drawings of Picherau patent No. 2498 dated January 23, 1825, signed by the Secretary of the Interior Ministry. The nipples (Fig. 9, Fig. 10) and the hammer (A) lie on the frame (M, N). The rosettes previously developed by Pauly and Roux can be used (Fig. 11, Fig. 12).

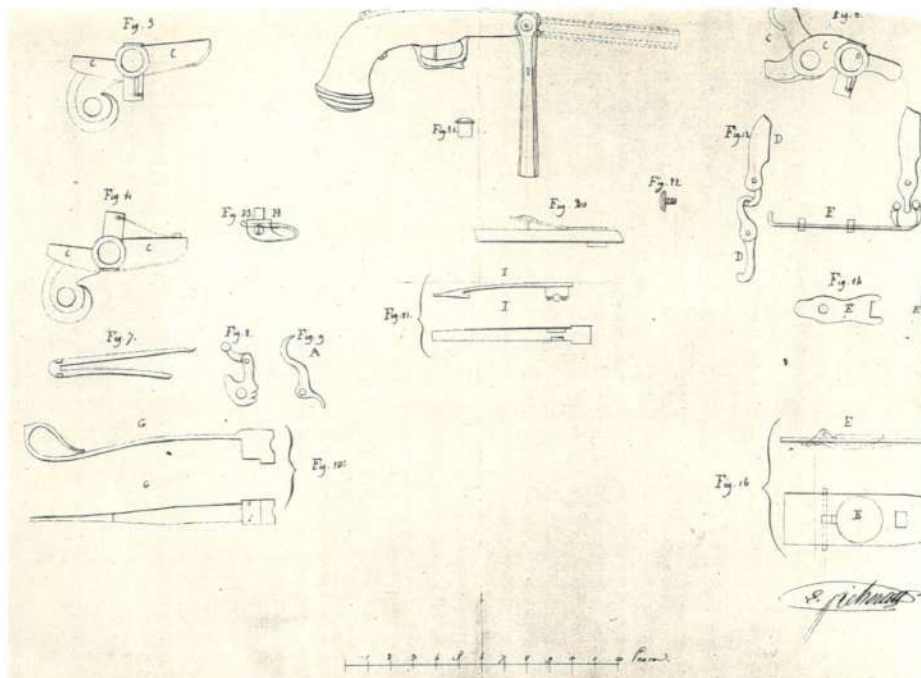


Fig. 24b: In the second sheet of Picherau patent No. 2564, he again shows a case for the pistol and a rosette for rifles or pistols (Fig. 11, Fig. 12), developed by Pauly and Roux.

Fusil de voyage — Canne à feu

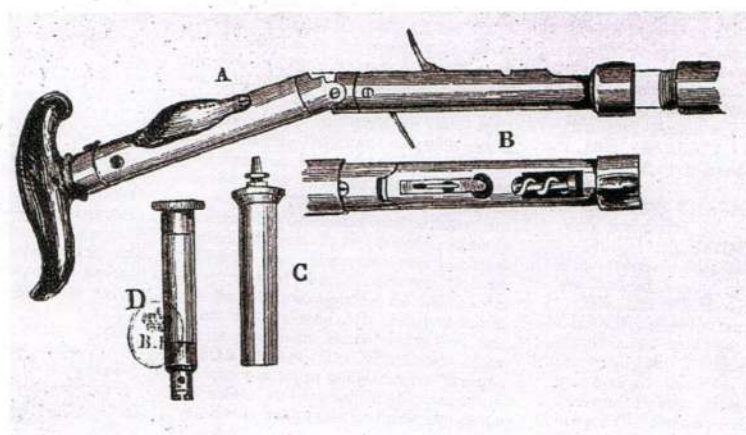


Fig. 25: This picture from a book shows such a so-called "Picherau" steel case (C) for use in a walking stick gun. "Picherau" is not mentioned in that source.



Fig. 26: So-called 16.26 mm (.64) "Picherau" steel case. Total length: 120 mm. Antonius Rauch collection.

There are no references in the original documents to the long steel cases with nipples sometimes attributed to Picherau as shown in various publications. Amand Leveau and I do not know who started to dub them "Picherau". Today some of those steel cases come together mostly as four in small leather cases with wooden inserts.

Casimir Lefaucheu (1802-1852)

The improvements Lefaucheu made to the Pauly, Roux and Picherau systems are described in his patent No. 3590 of May 29, 1828 (Fig. 27). It also refers to hammers and nipples on the outside of the gun.

Lefaucheu had his company at Rue Jean Jacques Rousseau No. 1. He started as an apprentice in Pauly's workshop in 1814, just before Pauly left France.

Well-known weapons *à la Pauly*, manufactured by Picherau or Lefaucheu, have inscriptions like "*Invention Pauly / Perfectionné Picherau*" or "*Invention Pauly / Perfectionné Lefaucheu*" on the frame.

It should not go unmentioned that Jean Louis Deboubert's patent of September 20, 1820 already describes a muzzle-loading weapon with a nipple on the frame (see Winant, p. 47-48). Such weapons are known today. [Deboubert 1776-1854]



Fig. 28: A blind rosette (without ignition orifice) which could be used in Picherau or Lefaucheu guns following lock improvements of the Pauly system. Nipples on the outside of the frame or on the lock made ignition via the rosette unnecessary. The rosette bears a large "2" stamp. Diameter: 21.8 mm. Antonius Rauch collection.

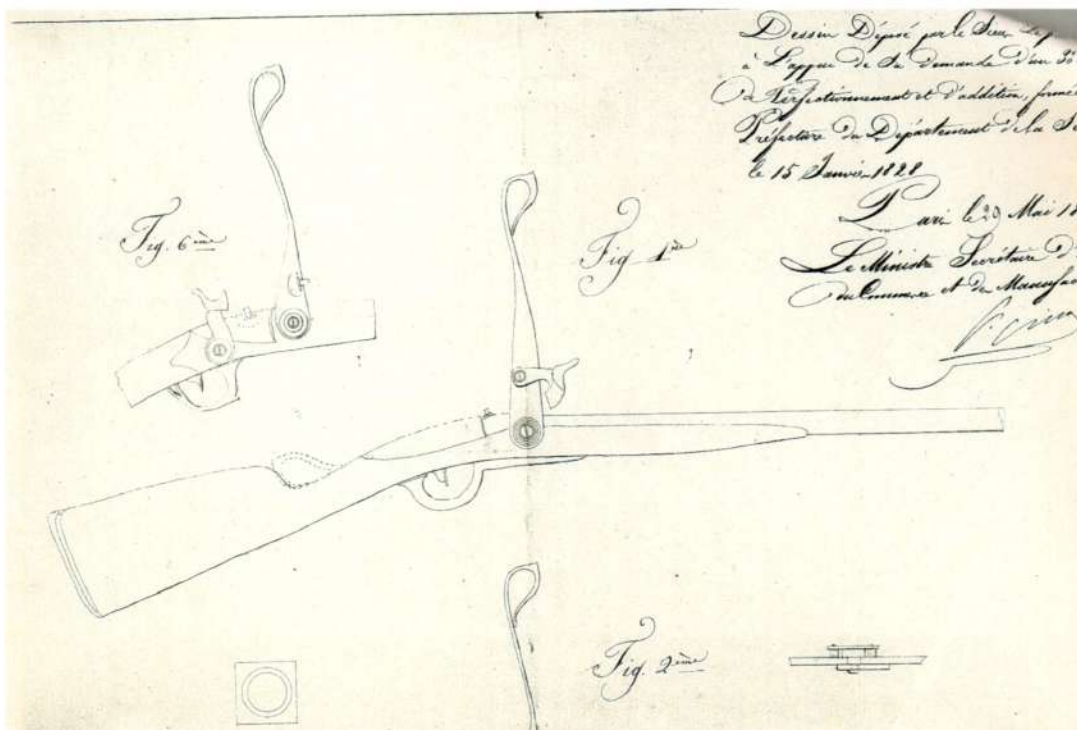


Fig. 27: The drawings of Lefaucheu patent No. 3590, signed by the Secretary of the Ministry of the Interior on May 29, 1828. As with Picherau before, Lefaucheu also shows the hammer and nipple either on the frame or on the hinged lock. He uses different forms of the hammers.

chapter nine

Continuation of the case design with nipple – Clément Pottet 1829

Only Clément Pottet, with his patent No. 3930 dated March 12, 1829, takes up the concept of a case with an integrated nipple "[...] *cette arme se charge par derrière avec des cartouches préparées et amorcées* [...]". He was the second after Roux to use this type of cartridge ignition. The INPI only contained the colored patent drawings and no written explanations of his inventions. Clément Pottet was a former foreman at Pauly and was therefore very influenced by his ideas.

In his patent drawings, in addition to a case with nipple for percussion caps, Pottet also shows the old design, in which the loose priming compound can be pressed into a recess in the base.

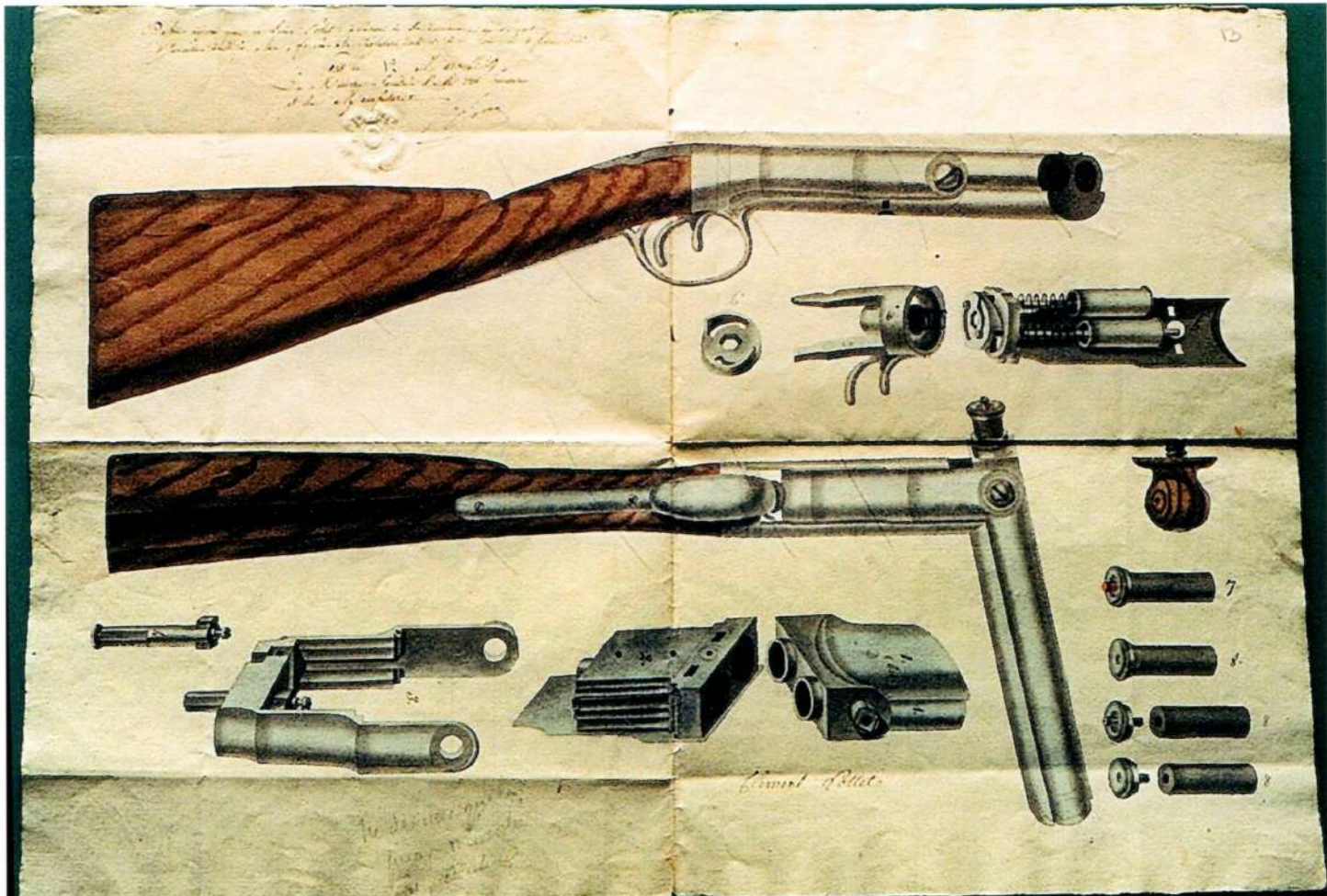


Fig. 29: Clément Pottet's colored sheet with the drawings of a rifle and the cartridges designed for it. Pottet's name is in the lower right half. The writing on the top left is unfortunately no longer legible.

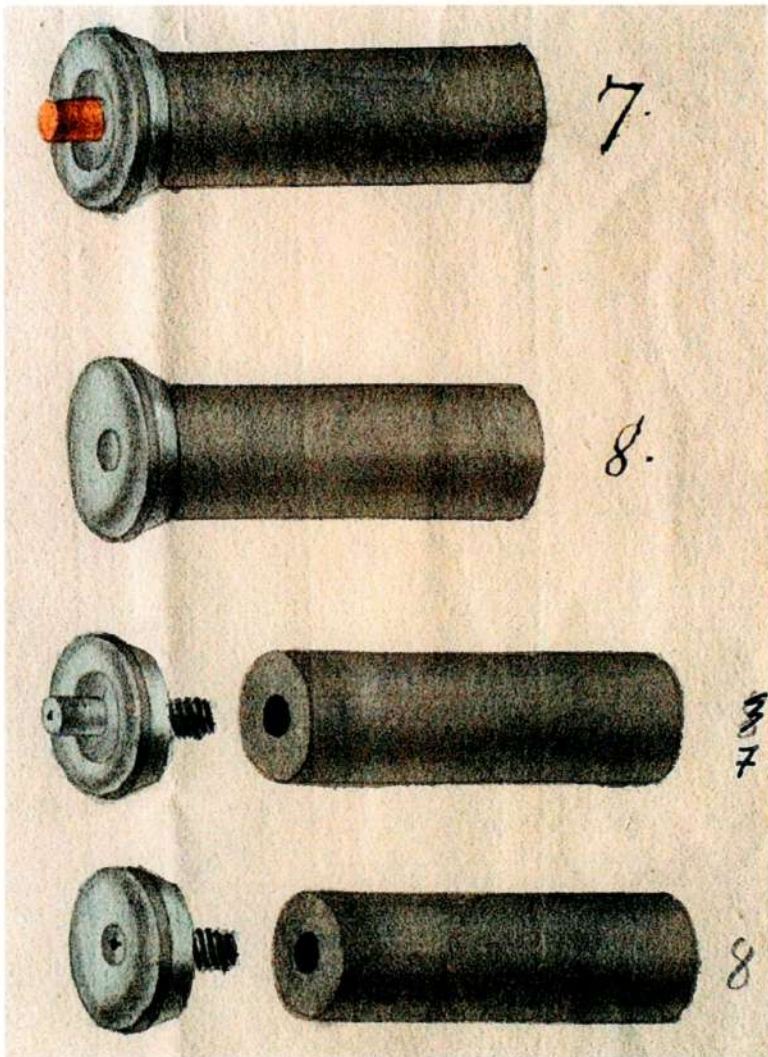


Fig. 29a: A section with the drawings of the two different types of cases from a slightly corrected version. In comparison to the entire sheet (Fig. 29), the disassembled case is subsequently correctly numbered 7. The bottoms of the cases are shown in the patent specification as unscrewable.



Fig.30a: 12.7 mm (.50 cal.) Pottet for pistol. Turned heavy thick-walled and tapered brass case with extraction groove over a finely knurled rim. The original hexagonal copper percussion cap is marked with a raised "G" (G = Gevelot). Case length: 20.0 mm. Base diameter: 18.9 mm.



Fig. 30b: Hexagonal "G" (Gevelot) marked copper percussion cap.

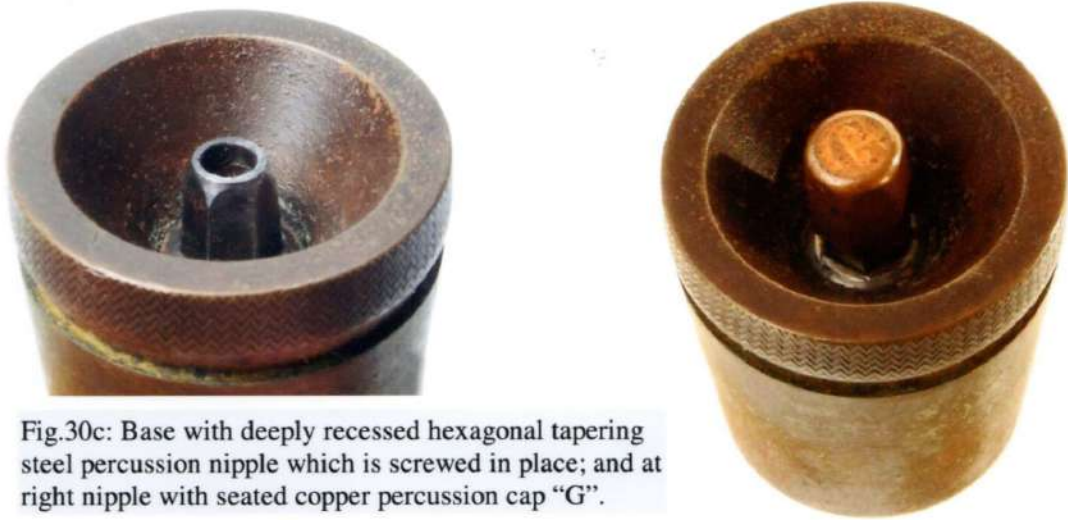


Fig.30c: Base with deeply recessed hexagonal tapering steel percussion nipple which is screwed in place; and at right nipple with seated copper percussion cap "G".



Fig. 30d: The interior of the case mouth is slightly threaded to help secure the round ball, and the base shows the end of the domed nipple.

LePage 1832 – third cartridge with nipple at base?

Perin and Henri LePage were gunmakers and inventors in Paris. They made improvements in breech loading firearms and cartridges in 1832. Perin and Henri LePage were not brothers. Louis Perrin or Perin was the brother-in-law of Henry LePage. He called himself Perin LePage and also used this name to sign the patent applications. Patent No. 5010 of July 13, 1832 describes a cartridge with a brass base, into which a small brass tube is inserted laterally or from behind, which contains the ignition compound (Fig. 32).

However, whether the cartridge shown in Fig. 31 falls under the aforementioned Perin and Henry LePage patent remains very questionable. This brass case was used by Berkeley R. Lewis in his publications as "LePage". He may have referred to the small picture in Bartlett & Gallatin, 1878 (Fig. 33), on which a side projection can be seen and considered this to be an extractor rod.

The patent specifications with all their additions unfortunately do not give any indication as to whether the case shown, intended for a nipple, is a further development of LePage. Or should it have been just one single attempt as an experimental to follow the development of a case with an integrated nipple just started?



Fig. 31c: The case mouth is threaded to secure the round ball.



Fig. 31a: 18 mm LePage(?)

Very heavy thick-walled turned case of one-piece construction with tapering body, massive rim, and deeply concave base. A separate, cylindrical projection off the rim (an extraction handle) is centrally perforated and ground flush in the inside of the base. The case is in unfired condition. Case length: 30.4 mm; base diameter: 24.2 mm. Ex Berkeley R. Lewis collection. Unique, the only known specimen in private hands. A single longarm which chambers this cartridge is reportedly in the Smithsonian collection with one similar round to accompany the gun. But that, however, still has to be confirmed.

Fig. 31b: The bottom of the base has a threaded hole which once probably held a percussion nipple.



Fig. 31d: The upside down markings on the case opposite of the projection: on rim "MA / L", and on case body "2399". The significance of those deeply stamped markings is not known.

Demande d'addition et de perfectionnement au brevet de Dipann accordé à M^{rs} LePage (Perrin et Honoré) le 13 juillet 1832 sous le n^o 5010. Et aux brevets d'addition et de perfectionnement qu'ils ont également demandé le 2 mai 1832 et le 30 juillet 1834.

- N^o 1. Cartouche portant culot en cuivre et tube d'amorce sortant carrement sur l'angle au niveau du fond du culot.
 N^o 2. Cartouche pareille à celle ci-dessus, mais coupée près de sa base pour laisser voir la pénétration intérieure du tube d'amorce.
 N^o 3. Cartouche comme celle ci-dessus portant son tube d'amorce au centre par derrière.
 N^o 4. Cartouche portant son tube d'amorce par derrière et de côté au niveau de la paroi intérieure du culot.

L'avantage que présente la réunion du tube au culot, sont: 1^o de supprimer le chemin sur laquelle s'abat le chien et qui souvent se casse. 2^o d'éviter au chasseur le soin d'amorcer la cartouche portant son amorce. 3^o d'éviter tout feu au dehors tout le feu de l'amorce se portant en dedans sur la charge. 4^o Le feu de l'amorce ne cravant pas la cartouche, le tube de papier restant intact le feu n'a pas la possibilité de passer entre lui et les parois du canon pour arriver à l'ajustement. 5^o le tube restant intact sans aucune déposition de cuivre le chasseur n'a pas à redouter le éclat de la capsule qui lui revenant lui souvent sur les mains et par fois sur le visage. Tous les tubes doivent être fermés avec celui qui porte la cartouche N^o 1 et N^o 4.

Fig. 32a: Excerpt from the patent application by P. and H. LePage; under "No. 1 to No. 4" their cartridges with the different arrangements of the tube containing ignition compound are described. It relies on additions of May 2, 1832 and July 30, 1834 to original patent No. 5010 of July 13, 1832.

Je joint à la demande d'un brevet d'addition et de perfectionnement au brevet de 10 ans accordé le 13 juillet 1832 à M^{rs} LePage (Honoré) et Perrin pour un fusil de chargeant par la culasse.

Ce di en cuivre fixé au derrière de la cartouche s'élargissant par l'effet de la déformation s'appuie de ses bords contre les parois du canon et s'oppose à tout échappement de la moindre parcelle de feu ou de crasse, ce qui n'a jamais été obtenu jusqu'à ce jour. Le petit bout de tube sert à le retirer du canon.

La cheminée placée sur le canon dardant son feu sur la cartouche au dessus de ce di allume la poudre.

Paris 30 juillet 1834

LePage

Wm

Fig. 32b: On the last page of the document again highlighted in the summary the important additional additions to the basic patent No. 5010 of July 13, 1832. It is signed "Paris, 30 July 1834".

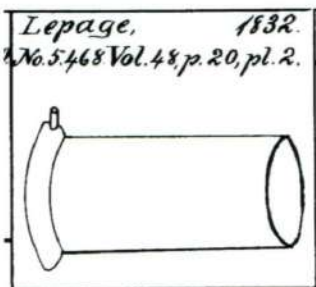


Fig. 33: LePage 1832 patent drawing taken from Bartlett & Gallatin, 1878. Here the patent number is given as „No. 5468“.

With Pottet and LePage as well as with Lenoir, the further development of a rigid, not yet flexible case with nipple towards modern central fire cartridges seems to have come to a standstill in Europe. Here other paths such as pinfire, needle fire and various types of inside priming were first taken. What has happened overseas, in the USA, will be briefly described in the following and final chapters.

chapter ten

Cartridge cases with nipples in the United States of America (1858-1869)

In the United States, ammunition manufacturers, who had to adapt to the common weapons of the military and those of hunters and marksmen, were long behind the developments in France described above.

Until the end of the Civil War in April 1865, the paper cartridge for muzzle-loaders dominated by a large margin. Metal cases with separate ignition and rimfire cartridges for breechloaders were mostly used only by the cavalry during the Civil War.

But George Woodward Morse set the next major milestone with his invention of a reloadable cartridge in 1858 (more on this in the section "G. W. Morse").

In the chronology of the introduction of cases with nipples followed inventions such as those of

- Thomas Wrenn Cofer, CSA (1861)
- Myron Moses (1862)
- James Bakewell (1863)
- .58 cal. steel chamber for Union "Coffee Mill" gun (approx. 1862-64)
- John Logan & D. W. Eldredge (1869).

A representative selection of cartridges and their patents is described below.

George Woodward Morse - the "father" of the modern centerfire cartridge

George W. Morse developed the first fully functional metallic centerfire cartridge. Morse himself wrote that the cartridge, not the firearm, was the very soul of his invention. He took the idea for his breechloader from the Minié ball itself and intended to use the same principle to develop a breech-loading firearm which, when fired, would be sealed at its breech by the expansion of the cartridge. It must be self-contained and comprise powder, ball and percussion cap.

The primary features of the cartridge:

- It holds its own primer.
- It is capable of sealing the breech-joint against escape of gas when fired.
- It has a flange strong enough to allow its extraction from the chamber.
- It is reloadable.

George W. Morse (1812-1888) lived in Louisiana in 1840 and became a state engineer from 1852 until 1855. Having received his first cartridge patent in 1856 Morse was in touch with several manufacturing companies to get his ambitious project on the way. The cartridges were mainly made by Nathan M. Muzzy (Worcester, Mass.), Springfield Armory, Frankford Arsenal, Augustus Brown or Brown & Bros. (Waterbury, Conn.), and Marshall & Co. (Atlanta, Georgia). With the beginning of the Civil War in 1861 Morse turned to the Confederacy, and the U.S. government abandoned the Morse experiments. Morse's further stations were in Harpers Ferry, Nashville, Atlanta, and finally Greenville, South Carolina where Morse built his brass-frame carbine of .50 caliber and the cartridges at the South Carolina State Military Works between September 1863 and April 1865.*

*Seigler, Robert E.: *The Best Gun in the World – George Woodward Morse and the South Carolina State Military Works*, 2017

Unfortunately, Morse never patented the *combination* of his gun and cartridge invention in the U.S. Morse's breechloader was a few critical years ahead of its time. Nevertheless, Morse made a most important contribution to the development of modern firearms: the metallic, centerfire, pre-primed reloadable cartridge.

With his three cartridge patents (incl. No. 15,996 [Oct. 28, 1856]), Morse held the basic U.S. patent on features of the modern centerfire cartridge, i.e. flexible metal case, crimped-in bullet, and a primer pocket in the head to receive a percussion cap, itself sealing the primer opening.

George Woodward Morse's U.S. cartridge patents

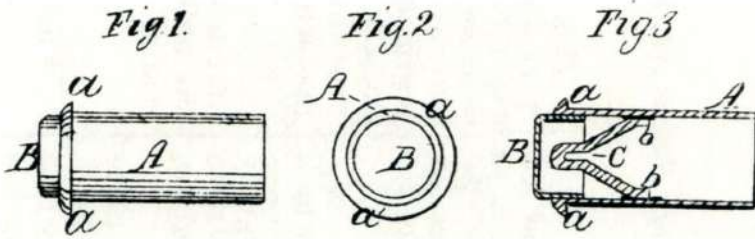


Fig. 34: No. 20,214 (May 11, 1858)
 "Improvement in Cartridge Case" –
 Pronged or V-form anvil of heavy-gauge
 wire inside of the case and its closing
 with a metallic head cup.

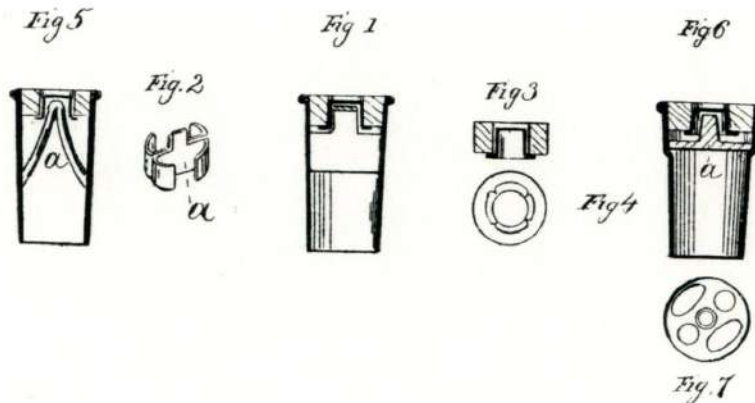


Fig. 35: No. 20,727 (June 29, 1858)
 "Improvement in Cartridge Case" – Claim: "1. The
 tige (anvil) secured in the cartridge case, and 2.
 The combination and an arrangement of the
 percussion cap and perforated disc."

Unfortunately, Morse was forced to disclaim the first of his two claims, because of an existing patent of M. Chaudron, March 9, 1855.

Morse offers here three styles of an anvil, and in practice he continued to experiment with the best design. Morse established in this patent the essential features of the modern centerfire cartridge and they were used in all of his firearms from 1857 until 1865.

In Morse's British patent No. 1164 (Nov. 19, 1858, to date from May 25, 1858) the two improvements of firearm and cartridge were combined.

A selection of a few typical Morse cartridges



Fig. 36: .54 Morse, steel case, type I c
 One-piece construction; sheet steel case with
 vertical solder seam and formed with a flared
 base; non-ferrous cone anvil (type I c); gutta-
 percha washer between two thin fabric layers
 and raised "GD" marked copper cap;
 characteristic pointed Morse-type lead bullet
 ("dome" shaped). Case length: 35.6 mm.



Fig. 37: .54 Morse, copper case, type I c made at Frankford Arsenal
One-piece drawn copper case with a heavily rolled rim; non-ferrous flat two-pronged single wire “wishbone” anvil forming a cone with vent hole (type I c); fabricated rubber washer; simple large copper percussion cap; original smooth pointed lead bullet. Case length: 38.0 mm.



Fig. 38: .69 Morse, brass case, type I a
One-piece construction; drawn brass case flared at base to rim; rubberized fabric washer and copper cap; smooth pointed lead bullet; form of anvil is the single brass wire “hairpin” type (type I a), see X-ray. Case length: 39.2 mm; overall length 53.8 mm; bullet diameter: .676 inch; exterior case mouth diameter: .720 inch; rim diameter: 21.7 mm.



Berk. Lewis: “.69 cal. Morse conversion was the only arm issued to the Army for official use”. Designed for the M 1858 Conversion .69 cal. of the Springfield M 1842 Rifled Musket.



Fig. 39: .50 Morse carbine (CSA), type I c
One-piece drawn brass case, notched twice at the base and rolled upward to form a rim; two-pronged sheet brass forms a cone anvil (type I c); rubberized fabric washer; copper “top-hat” cap; flat-nosed lead bullet with one exposed groove; brass case with one manufacturing (casting) flaw. Case length: 38.1 mm.
The .50 cal. Morse cartridges were used by the Confederate States of America in the Morse bronze-frame carbines, which were manufactured by the State Military Works in Greenville, South Carolina, from about June 1862 until the end of 1864. Also about 20,000 cartridges were manufactured at Greenville.



Fig. 40: .58 Confederate Morse forager shell, type I c
Head of a .50 CSA Morse carbine cartridge cut off and soldered into one end of a probably cast (or drawn?) .58 inch brass tube, which has some manufacturing (casting) flaws; two-pronged sheet brass forms the cone anvil (type I c), which is identical to that one used in the .50 CSA Morse cartridge; fabric washer and copper cap; the case, which is made into a forager shell, is empty as are all the 21 shells still remaining in Bonham’s cased Morse set. Case length: 55.5 mm; interior case mouth diameter: .578 inch (14.68 mm).
This cartridge has once been part of the cased three barrel Confederate brass frame Morse set presented to Milledge Luke Bonham (ca. 1864), who was Governor of South Carolina from 1862 to 1864. The cased set is on exhibition at the South Carolina State Museum, Columbia, SC.



Fig. 41: .55 Morse, solid steel base with integral nipple, type II
 Drawn brass tube soldered onto a turned tall solid steel base with an integral percussion nipple; it comes without rubber washer and cap; replacement lead bullet cast from an original Morse mold. Case length: 39.9 mm. Type II is an improvement of type I.



Fig. 42: 16 Gauge Morse shotshell, solid steel base with integral nipple, type II
 Two-piece case; a drawn brass tube is soldered onto a turned solid steel base with an integral nipple; the steel base forms a rim; it comes without rubber washer and cap. Case length: 55.9 mm; rim diameter: 20.8mm. Ex Berkeley R. Lewis collection.



Fig. 43: 12 Gauge (Morse-type?) shotshell "PAT PEND"
 Two-piece case: drawn brass tube fixed on a turned steel base which has a screwed-in steel percussion nipple with hexagonal base; impressed "PAT PEND" head stamp (means "patent pending"); the rim of the steel base is crudely knurled. Overall length: 72.7 mm; rim diameter: 22 mm; length of steel insert: 8.2 mm.

Thomas Wrenn Cofer, Confederate States of America (1861)



Two views of same cartridge.

Fig. 44: .36 cal. for Cofer split-cylinder revolver
Two-piece construction with drawn brass case, which is flanged towards the rear, and a separate, inserted steel percussion nipple at the cone base of the brass case. The case wall shows a dense pattern of vertical striations in the brass, a characteristic of all known authentic specimens, which seems to have been caused when the case was drawn. Case length: 39.5 mm; overall length: 50 mm. The bullet is a Colt-type replacement. Extremely rare; there are only five authentic specimens known to exist, which all came from Cofer split-cylinder revolver serial number 7.

This cartridge has a traceable, direct collector lineage back to 1942 and the original revolver: Wm. Maynard (Springfield, Mass.); Jim Standish (1942); H. P. White; Berkeley R. Lewis; Paul E. Parsons; Buttweiler Vol. XI-2-41 (1996).

Thomas Wrenn Cofer was a Confederate gunsmith from Portsmouth, Virginia. He operated his business until the fall of Portsmouth to the North in May 1862. He received CSA patent No. 9 (August 12, 1861) for his split-cylinder revolver and cartridge.

Myron A. Moses (1862)

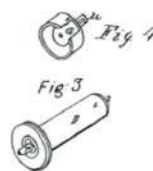
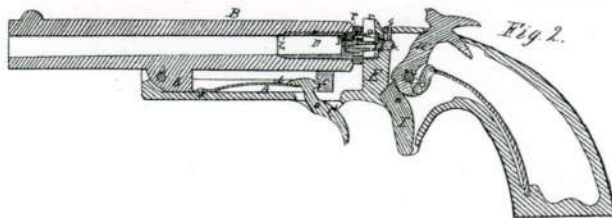


Fig. 45: .38 cal. for Moses rifle
Turned one-piece steel case with thick integral rim and with inserted (screwed?) steel percussion nipple. The base is marked "PATENT / 60". Length: 51 mm.

.51 cal. for Moses rifle or shotgun
Length: 88 mm.

These shells came with a cased gun that had both rifle and shotgun barrels.

Myron A. Moses
U.S. Letters Patent No. 36,571 (September 30, 1862)
"Improvement in breech-loading firearms" – The cartridge case is part of the patent. Moses predominant claim was the intermediary cup between the hammer and the percussion cap which supposedly reduced the fouling at the juncture.

James Bakewell (1863)

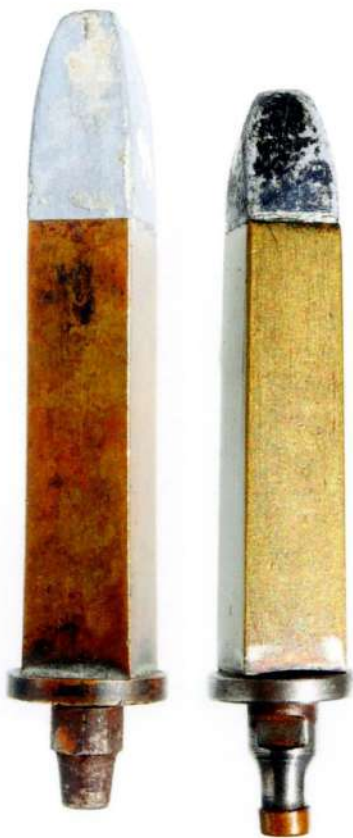


Fig. 46a: .38 cal. Bakewell (with integrand base disk) [left] Straight drawn (red) brass case and round base disk of one-piece construction. In it is fixed a steel percussion nipple, half of it octagonal. Long rectangular bullet with slight twist to the left. Overall length: 67 mm.

Fig. 46b: .347 cal. Bakewell with steel base disk Slightly tapered drawn (yellow) bras case is fixed to a cylindrical steel disk containing a steel percussion nipple having two flat sides at its base. Short rectangular bullet with pronounced twist to the right. The nipple bears a small copper percussion cap. Overall length: 65 mm. Only known example (ex Berkeley R. Lewis collection, No. 115).

William Bakewell of Pittsburg, Pennsylvania
U.S. Letters Patent No. 39,109 (July 7, 1863)
"Improvement in metallic cartridges" – Metallic shell polygonal in cross section with round base and nipple.

.58 cal. steel chamber for Union "Coffee Mill" gun (circa 1862-64)

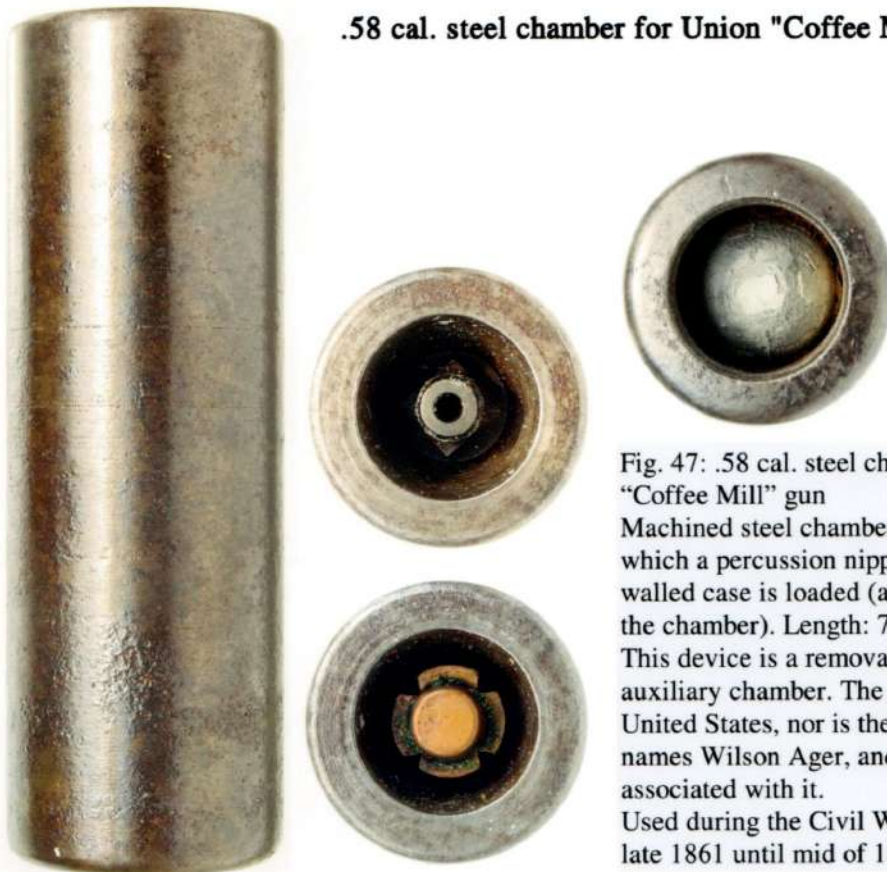


Fig. 47: .58 cal. steel chamber for Union Repeating "Coffee Mill" gun
Machined steel chamber piece with a recess into which a percussion nipple is screwed. The very thick-walled case is loaded (an elongated bullet is seen in the chamber). Length: 73 mm.
This device is a removable breech piece, also called auxiliary chamber. The gun was never patented in the United States, nor is the true inventor known. The names Wilson Ager, and William Palmer have been associated with it.
Used during the Civil War with limited success from late 1861 until mid of 1864.

John Logan & D. W. Eldredge (1869)



Fig. 48: 12 Gauge, Logan & Eldredge 1869 patent Two-piece shell; drawn brass case; deeply impressed "PAT" headstamp seems to be hand stamped; the insert with an integral percussion nipple is fixed inside the case with a deep knurled crimp; the inserted base piece is made of a non-magnetic alloy, the integral nipple, however, is counterbored and has a steel bushing (slightly magnetic); the head shows three file marks. Case length: 63.7 mm. Very rare.

Manufacturer unknown.
 There are at least two variations of the hand stamped "PAT" (on head or on side of case wall). Those cases were possibly made earlier than the one with the bunted patent date head stamp "PAT'D DEC 7 1869" (one specimen known with such a stamp).
 The name "Eldredge" is often misspelled "Eldrigde".

Fig. 1

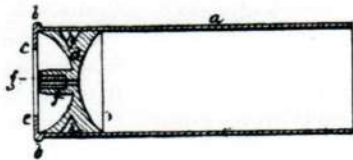


Fig. 2

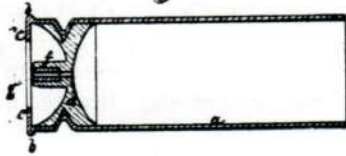


Fig. 3



John Logan & D. W. Eldredge
 U.S. Letters Patent No. 97,537 (December 7, 1869)
 Improvement in metallic cartridges – Metallic shotshell having metallic base piece holding percussion nipple. Secured to the case tube by crimping or soldering points.

chapter eleven

A new era begins in 1866 – the real start of the modern centerfire cartridge

With the end of the Civil War in 1865, the new era of the modern central fire cartridge began in 1866 as part of the changes from the obsolete muzzle-loaders to the breech-loaders. Two names that have had a decisive impact on the further development deserve to be mentioned at the end of all explanations:

Stephen Vincent Benét of the Frankford Arsenal
- Drawn copper case with primer pocket [Figs. 44, 45] -
Ordnance Memorandum 14, Plate XVI, 1873

Hiram Berdan
- U.S. patent No. 52,975 (Feb. 27, 1866) [Figs. 46, 47].

They gave new impulses and consistently continued what their big predecessors John Alexander Forsyth, Jean Samuel Pauly, Henri Roux, George Woodward Morse had done before, and *“they stood on the shoulders of giants”*.

If the inventors in the USA lagged behind development for a long time, they became the leaders in the design of modern central fire cartridges from 1866. They were definitely one year ahead of the cartridge designs of European manufacturers.

The Primers

The various ammunition companies in the USA very quickly found procedures to be able to produce reliable one-piece drawn brass cases with primer pocket. They started to prevail in the 1870s and became standard in the early 1880s. At the same time, the development of primers went hand in hand with three ingenious inventors:

- Alfred Charles Hobbs (Union Metallic Cartridge Company)
U.S. patent No. 183,925 (October 31, 1876)

- John Gardner (Winchester Repeating Firearms Company)
U.S. patent No. 208,589 (October 1, 1878)

- Alfred James Hobbs (Union Metallic Cartridge Company)
U.S. patent No. 256,684 (April 18, 1882)

The primers finally invented by John Gardner and Alfred J. Hobbs (son of A.C. Hobbs) shaped the centerfire ammunition for many decades until well into the 20th century. And the A.J. Hobbs primer is still used today after several modifications.

With the two very reliable primers by John Gardner (1878) and Alfred J. Hobbs (1882) the *“Frontier”** was closed on the way to the modern centerfire cartridge, exactly after 70 years (Jean Samuel Pauly 1812 - Alfred J. Hobbs 1882).

*Based on a sad wording related to the “Westward Movement” in the USA when the U.S. Census of 1890 declared the closing of the American Frontier after the massacre at Wounded Knee Creek on the Pine Ridge Reservation and the end of the Indian Wars.



A.C. Hobbs 1876 primer.



John Gardner 1878 primer.



A.J. Hobbs primer 1882, and later modified form.

The important characteristics of the modern centerfire cartridge

Outside ignited, reloadable, self-contained, drawn one-piece brass case with integrated pocket for taking the primer (cup with anvil).

Stephen Vincent Benét
Frankford Arsenal



Fig. 44: .58 U.S. Musket, short case, "Benét"-type primer pocket
Drawn one-piece copper case with a narrow primer pocket with a central flash hole (not primed). The faint ring around the primer pocket which may appear to be a battery-type cup, however it is not. There is also a shallow but distinct impressed ring between the center and the rim. Elongated rounded nose lead bullet with no exposed groove. The X-ray shows the primer pocket and a relatively short bullet with two grease grooves. The only specimen known to me.

This style of case resembles the Benét primer pocket as illustrated in *Ordnance Memorandum No. 14* (1873), Plate XVI ("Benét's Centre Primed Experimental, Frankford Arsenal, Jan-Apr 1866"). While commanding Frankford Arsenal in 1866, Col. Stephen Vincent Benét had invented a cartridge case with a primer pocket consisting of one continuous piece of metal, avoiding a separate cup inserted at the head (as seen in Berdan's 1866 patent). Unfortunately for him, Benét did not apply for a patent on this outside primed centerfire cartridge case and primer.

A milestone invention of outside primed centerfire cartridge!

Remarks.

The principal feature of this cartridge is the forming of the pocket of one continuous piece of metal. It is believed to have been invented and successfully carried out at the Frankford Arsenal by Col. S. V. Benét, comd'g. in 1866. It is now one of the principal features of Ordnance Cartridge, he having come to the Arsenal and obtained the necessary information, taking with him samples & sizes of tools and afterwards applying it to his cartridge, which previously had a separate cup inserted at the head.

PLATE XVI.

CENTRE BENÉT'S PRIMED.

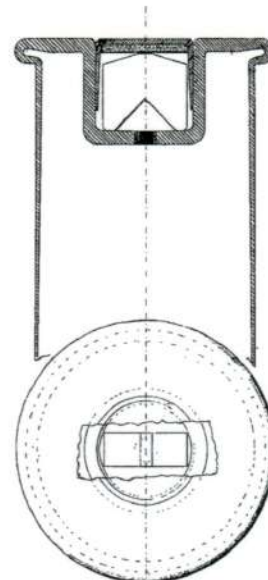


Fig. 45: Plate XVI from: *Ordnance Memorandum No. 14*, 1873.

FRANKFORD

EXPERIMENTAL.

JAN 1866 APR

ARSENAL

Hiram Berdan

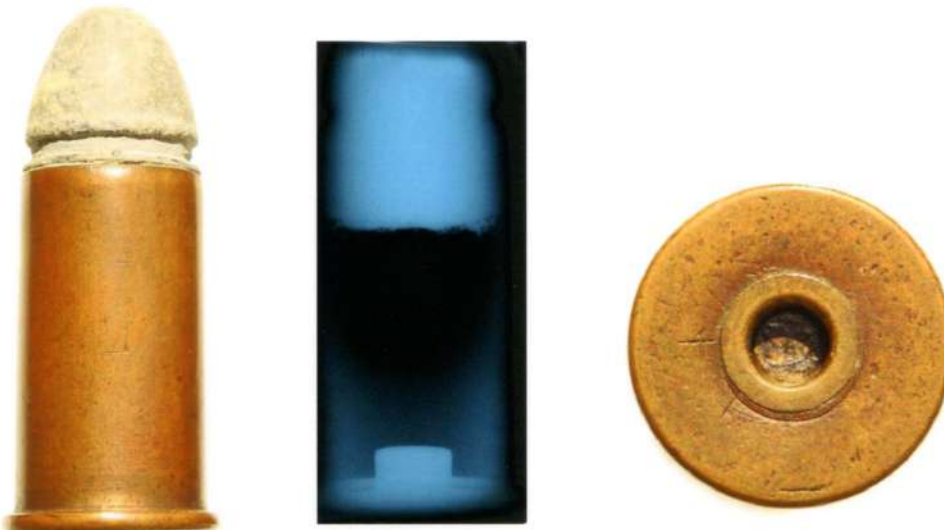
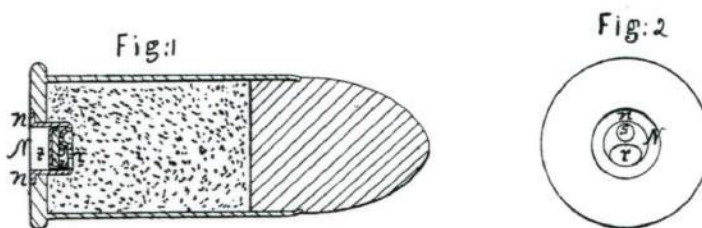


Fig. 46: .58 U.S. Musket, short case, Berdan 1866 patent Centerfire; drawn copper case with a separate inserted brass (copper?) battery cup (inserted outside primer pocket) having a raised off center anvil; the very flat primer, a flat shaped capsule of priming material is well pressed below the surface of the thick folded flat head which has two tick marks at one side. The head has no ring, however, shows its folded construction; elongated brass bullet with one exposed wide groove.
Case length: 30.86 mm; rim diameter: 18.6 mm; rim thickness: 1.9 mm.
The X-ray negative shows the deep primer pocket with square edges.
Ultra rare (probably no more than two complete specimens known to exist).

Colonel Hiram Berdan developed rather than invented the Berdan cartridge case. He (associated at that time with U.M.C.Co.) learnt much about the manufacturing process of cartridge cases under the supervision of Colonel S.V. Benét (designer of the inside-primed ignition system) during a visit at the Frankford Arsenal. He must have also been familiar with Benét's outside center primed cartridge using a case with a pocket of one continuous piece of metal (see Fig. 44, and Fig. 45: *Ordnance Memorandum No. 14, 1873, Plate XVI*).

There is some information on Hiram Berdan being in Springfield, Mass. during late 1865 or early 1866 working with the firm of C.D. Leet. Leet was making some cartridges for him but no calibers are mentioned. Only experimentally used with converted muskets, ca. 1866. Gas leakage caused problems in the extraction of the cartridge and ruptures of some of the cases.

H. Berdan.
Cartridge.
N^o 53388. Patented Mar. 20. 1866.



Witnesses:

J. W. Coombs
Henry J. Brown

Inventor:

H. Berdan

Fig. 47: Hiram Berdan, assignor to the Berdan Fire Arms Mfg. Co. U.S. Letters Patent No. 53,388 (March 20, 1866)

Improvement in priming metallic cartridges - Metallic, externally primed with battery cup primer having sunken cap below head surface.

The patent mentions both priming methods: percussion cap, and simple pressed-in fulminate.

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Here it must be pointed out again that in some of the literature listed below, the development history, in particular of the weapons and cartridges of Pauly and Roux, is sometimes only insufficiently and unfortunately also incorrectly reproduced.

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As already mentioned in the Preface, the description of the history of development in France from 1812 to 1832 (Pauly, Roux, Picherau, Lefauchaux, Pottet, LePage) is based on the evaluation of the original French documents in the Institut National de la Propriété Industrielle (INPI), Paris.

Pauly's British patents from 1814 and 1816 are freely available on the Internet.

Autor's note: If the interested reader finds too much speculation or inconsistency in what has been shown so far, it should be noted. The essence of the hypothesis is that it can be refuted or confirmed by reliable facts. It is up to the reader to also think about it and, if necessary, to inform the author at geoprie20@gmx.de.

One final comment from the author concerns the entire creation of this book. In addition to all the grateful help and support from the aforementioned persons and institutions (see *Acknowledgements*), research, translation (between French, German and English), writing, proofreading, editing and photography were all in one hand. As an editor, the author was also the designer and lay-outer of the work – “all in one”. The conversion of a printed master copy of the book into a pdf file was done with professional help. Because of this, the author asks for certain leniency when the attentive reader discovers shortcomings in the book.

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