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Science and Technology (Portugal)

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This article focuses on the Portuguese war-related science and technology developments during the participation in the Great War by the Corpo Expedicionário Português (Portuguese Expeditionary Corps). It is rare to find research on war-related science and technology topics and Portugal's participation in the Great War. As an attempt to address this gap in the literature, this article will focus on the following topics: chemistry, weaponry, innovation, modernity and war technology.

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Introduction

During the 19th century, the invention of the steam engine, progress in steel production, the implementation of electricity and various discoveries in physics and chemistry allowed the application of several plans, which had been impossible to put into practise up until this time due to a lack of technology and proper materials.[1]

In a time of development and scientific changes with regard to chemistry developments in Europe, it is important to point out General António Xavier *Correia Barreto* (1853-1939), who specialised in chemistry and gunpowder. In 1874, he published the manual *Elements of Modern Chemistry*, which

had successive editions. This manual led him to be designated as a specialist in the study of gunpowder. In 1885, he was given the task of studying a new type of gunpowder, a smokeless one, in order to end the Portuguese dependence on the gunpowder invented by Alfred Nobel (1833-1896) in 1863.[2] Also in 1885, Correia Barreto published *Chemistry and Gunpowder*, which was officially adopted by the Portuguese government. It is due to this officer that the chemical formula for smokeless gunpowder was discovered, which eventually led to the construction of the gunpowder factory in Chelas in 1898, where Correia Barreto was made director in 1909. Known as “Barreto Gunpowder”, this smokeless substance was adopted by Granada in Spain and later by Brazil.[3]

Correia Barreto was also president of the commission responsible for studying how Portuguese guns could be altered in order to improve their shooting accuracy and make them more usable in undercover positions. It is important to emphasize that this was one of the first times that Portugal studied combat means and technics of entrenching positions that would later come to characterize the Great War.

Portuguese Armament in the Great War

Automation in machine gun operation occurred in 1883 with the appearance of the Maxim machine gun that functioned with a recoil when shooting. The energy that was directed into the mechanism of the gun through powder combustion gas pressure did not demand exterior action for its functioning.[4] The French developed Hotchkiss, which was air cooled with a 30-cartridge magazine. The English used the 7.7 mm Vickers, an upgrade of the Maxim, which was water cooled and fed by belts of cloth where the round had been placed. To equip infantry, they adopted the Lewis Light machine gun that was air cooled with a round magazine.

The 6.5 mm Mauser-Vergueiro rifle was bought by Portugal in 1903 in Germany to equip the Portuguese Army. It incorporated a breech developed by Captain Alberto José Vergueiro (1851-1908), which had significant improvements relative to the older breech.[5] When producing it, Vergueiro was inspired by drawings of the Mannlicher rifle.[6] This weapon became a symbol of Portuguese military operations in Africa, specifically Angola and Mozambique. In 1916, Portugal received the 7.7-mm m/1917 and m/1917A Lee-Enfield Mk III with minor alterations from Great Britain, in order to arm two divisions of the Portuguese Expeditionary Corps (CEP) that were marching to France.[7] The organization of the CEP was constituted by 51-mm light mortars and 76-mm medium mortars, as well as Newton type 152-mm medium mortars and heavy mortars of 236-mm.

Since the German victory in the Franco-Prussian War in 1870, Europe had been led to a situation of growing tension between the biggest European powers, namely, Great Britain, Germany, France and Russia. This tension originated in colonial issues between the first three nations, and led to a number of alliances in Europe, an arms race and the mobilization of several armies, that in turn led to a conflict that ravaged Europe from 1914 to 1918.

After the Portuguese Revolution of 5 October 1910, the new regime tried to implement military reforms with the aim of modernizing the army and consolidating the new republic. The military reforms of 1911 transformed the permanent army into a militia army. Compulsory military service was introduced and a board of militia officers was also created.

Although, in the first half of the 19th century, Portugal had obtained a good level of manufacturing activity and was using bronze in the creation of the army's arsenal, the country was incapable of keeping up with technological innovations in the field of weaponry due to its lack of raw materials and technical and scientific knowledge in manufacturing and steel-use. This situation led the Portuguese military industrialists to manufacture equipment (uniforms and harnesses) and also war materials (ammunition and light weaponry). Regarding heavy weaponry, Portugal was dependent on foreign countries.[8] Between 1904 and 1906, the 7.5-cm Schneider cannons were imported from France. They were, at the time, the most technologically advanced. Some years later, these same cannons were requested by France and were put into use as Portugal entered the Great War.

The Portuguese Republic tried to keep up with the most important technological innovations before the war through the creation of a Heavy Machine gun School, a Military Car Park and the Military Aeronautics. However, when it came to cutting-edge weaponry, the balance was clearly negative for the Portuguese Army and the Navy. Despite the ambitious rearmament and modernization plan inspired by the thoughts of second lieutenant Fernando Augusto Pereira da Silva (1874-1943) and approved by the Parliament in 1912, they were never materialised because of financial constraints.[9]

Portugal joined the First World War with an army oriented to territorial defence rather than participating in foreign missions. It consisted of eight artillery regiments equipped with the most modern materials acquired between 1904 and 1906 due to a colossal financial effort by the monarchy.[10] When steel replaced other alloys in the manufacturing of artillery pieces, Portugal started to decline in its ability to manufacturing their own weaponry; hence, the spending of large sums of money to acquire artillery material from foreign countries. After the Great World War (where the Portuguese artillery had an important role) and by the end of the Second World War, there were not many major developments in the Portuguese artillery. This is because most of the artillery pieces with which Portugal had finished the Great World War were maintained. Instead, the most important military improvements occurred at a tactical level, giving more importance to the mobility of weapons and the application of traction through motorized vehicles.

Artillery

Between 1889 and 1908, the Portuguese Army adopted some of the technical and scientific innovations that were happening elsewhere in Europe. One of the most important aspects was related to the renewal of weapons through four government programmes. One of those programmes focused specifically on artillery, resulting in the acquisition of the Schneider-Canet 7.5 cm (TR) piece,

which was considered revolutionary for that time. Of French origin, the Portuguese government bought this piece in 1904 to equip the Field Artillery and replace their equipment, then the A.E 8 cm (MP) m/74 and A.E. 9 cm (MK) m/78 in the Light Field Regiments. This piece was only acquired that year due to the secrecy of experiments performed in France to test it. This piece was considered the best invention after the improvement of the striation in cannons, and was considered to be a lot better than the German piece Krupp T.A. m/1900 75 mm calibre, which had been acquired four years earlier.[11] This innovation increased shooting power and precision and was adopted for weapon manufacturing by the great powers Germany and Great Britain. It was a quick-firing piece that presented a hydraulic system (hydro-pneumatic), and was so effective that the garrison did not need to aim again after each shot. Also, this piece had a Nordenfelt interrupted screw breech that could be opened to extract the shell with one simple movement. At the same time the gas residue effect caused by the previous shot helped to expel the projectile. This shooting system allowed a rate of fire of about fifteen shots, a rate that was increased to twenty shots in later models. Table 1 overviews the technical characteristics of this piece:

Origin	**France**
Beginning of Service	1904
Calibre	7.5 cm
Weight	1,084 kg
Barrel Length	2.7 m
Cannon Weight	339 kg
Projectile Weight	6.5 kg
Rate of Fire	15 T/m
Initial Speed	500 m/s
Range	6,000 m
Traction	By horse
Crew	6 Military

Table 1: Technical Data for the 7.5-cm Piece Schneider-Canet T.R. m/1904[12]

During the conflict in 1917, the Schneider House supplied the same model (7.5 cm T.R. m/1917) to equip the artillery batteries group from the Divisionary Artillery of the Portuguese Expeditionary Corps, who joined the battle on 9 April 1918. The 15 cm T.R. Schneider-Canet-du-Bocage mechanical traction battery, acquired in France to equip the Portuguese Army, represented the most advanced technology in terms of modern cannon building techniques.[13] The medium and large calibre cannons had considerably increased their weight due to the installation of recoil limitation systems, which made it impossible to move them through animal traction. Hence, it was necessary to adopt mechanical traction, as some motor vehicle projects had already been developed. According to *Revue d'Artillerie*, there had already been some proposals for the small calibre

cannons, like the Hotchkiss calibre 8-mm and the Lebel (8X50R), and others of medium calibre that could be towed by mechanical traction. On the page of that same article, it says:

L'Armée portugaise paraît être la Première qui soit arrivée à ce point de vue à une solution: sur l'iniciative d'un officier du génie, le Colonel du Bocage elle vient de faire étudier et construire dans les établissements de Schneider & Cie une batterie d'obusiers de 150-mm destinée au camp retranché de Lisbon.[14]

The fact that the surname Bocage appears in the piece is due to the experiments conducted in 1902 in France by Coronel Carlos *Roma du Bocage* (1853-1918) regarding his mechanical traction of pieces project. The use of cars in war and its constant developments predicted its use in the army to give mobility to troops and war material. Therefore, Roma du Brocage started experimenting. He organized a train, called Train Schneider-Canet-du-Bocage, with four cannons that were towed by a tractor with a car engine using alcohol or diesel fuel.[15] Roma du Bocage would be the first man in the world to develop mechanically towed artillery. The shooting and traction experiments that happened simultaneously with the finalisation of the project were supervised by Roma du Bocage himself, together with artillery officers Lieutenant Colonel José Silvestre de Andrade (1852-1907), Major Joaquim Lobo d'Ávila (1822-1901) and Captain Eduardo Pellen (1861-1945). The latter continued to be connected to the project as we can confirm by the detailed report stored at the Historical Military Archive (AHM 46/1/874/11). The creation and the implementation of the project was carried out by the French house Schneider & Cie. The Schneider family bought the Creusot manufacturing complex in 1836, and had begun the manufacturing of artillery pieces before the Franco-Prussian War began in 1870.[16]

The principle construction of the piece was very similar to the Schneider-Canet system used in field artillery weaponry. It presented a fast manoeuvring breech with a security mechanism against premature impacts and combustion lags. The hydraulic brake was placed between the cannon and the trunnion and it incorporated an extensive recoil route that allowed for greater stability. The recovery was made through a compressed air exchanger, which was independent from the weapon brake. The service of the cannon was easy, simple and fast. Table 2 describes some other details of its structure.

Origin	**France**
Beginning of Service	1904
Calibre	15 cm
Total Weight of the Howitzer in Battery	3,365 kg
Cannon Weight (Complete)	1,335 kg
Total Length of the Howitzer	2,103 m
Length of the Striated Part	1,683 m
Ballistic Data Projectile Weight	40 kg

Maximum Load Weight	1,625 kg
Initial Speed	360 m/s
Range	8,000 m
Traction	By horse
Crew	6 Military

Table 2: Technical Data for the 15-cm Schneider-Canet-du-Bocage T.R. m/1904 Howitzer[17]

After acquiring the 7.5 cm Schneider material and the 15 cm Schneider-Canet-du-Bocage Howitzer, the Portuguese Army was also equipped with modern versions of the 7.5 cm mod/1917 French piece and the 11.4 T.R. mod/1917 Howitzer. This material originated from the Austro-Hungarian Monarchy and was widely used during the Great War. In this case, it was given by Great Britain in 1917 in order to equip the Fourth Battery of each of the Divisionary Artillery groups. These pieces consisted of a howitzer tube and ammunition car. The howitzer tube was built in nickel steel; it was 1.60 metres long and had thirty-two striations inside. The steel breech was prism shaped. On the top was the shooting device and on the bottom was the impact device. The recoil system was automatic and variable and was made of a hydraulic brake with three steel springs that, through the compression and distension movement, made the shock after shooting weaker. It also had two aiming devices: one for direction and another for inclination. It had a distance indicator where the topographic distances, ballistic distances and charges were referenced.[18] Table 3 presents some of the technical characteristics of this piece.

Origin	**Great Britain**
Beginning of Service	1917
Calibre	11.4 cm
Tube Length	1.60 m
Howitzer Weight	1,364 kg
Projectile Weight	15,850 kg
Initial Speed	313 m/s
Range	6,400 m
Traction	By horse
Crew	6 Military

Table 3: Technical Data for the 11.4-cm T.R. m/1917 Howitzer[19]

The Portuguese participation in the First World War through the Portuguese Expeditionary Force led the Portuguese artillery to be in a similar position, technologically speaking, to their more developed European counterparts, like France and Great Britain. In addition to the most recent version of the 7.5 cm (TR) French piece, the Portuguese artillery received the Obus 11.4 cm T.R m/1917 from Great Britain. It equipped the Fourth Battery of the Divisional Artillery Groups (the other three were

equipped with the TR 7.5 cm material). This obus was known as Bonifácio and it served the Portuguese Army until the beginning of the 1940s.

Conclusion

The Allies, France and Great Britain, started the conflict with a shortage of artillery material and consequently requested some material from the Portuguese government (7.5 cm Schneider-Canet T.R. m/1904), which the army used to complete their artillery units. This was necessary because the existing materials were old-fashioned and scarce. Several documents verify that the Portuguese government would only agree to send the requested material if it was accompanied by Portuguese artillerymen. However, according to the English Alliance, they were also willing to send a division.

Due to the persistent requests for pieces made to Portugal coupled with the fact that the government would only answer these requests if they were supplied by Portuguese artillery men, the Auxiliary Division to France was born. General Jaime Leitão de Castro (1852-1926) was named its commander and Artillery Major Roberto da Cunha Baptista (1874-1932) its Chief of Staff. The Auxiliary Division was made up of groups of three 7.5 cm T.R. batteries, one obus 15 cm battery, one ammunition column and an initial deposit of personnel, animals and material in the operations base. According to this, the artillery had a total of 720 officers and 21,741 enlisted personnel. The enlisted personnel worked as riflemen, in saddlery, as locksmith, as locksmith and blacksmith, as drivers, cyclists, amanuensis, servants and orderlies.

With this short study we intend to open new research perspectives regarding technical and scientific aspects of the Great War. Arguably these are hardly considered in contemporary history, especially in history related to science and technology. Portugal entered the war with a minimal capacity in what comes to artillery pieces because, at the end of 1914, the Portuguese government gave many of their pieces to the French government. However, the Portuguese participation in the Great World War demanded that its artillery, from the technological point of view, be at par with Portugal's Allies. This was made possible as a result of a great financial effort in order to acquire some artillery pieces before and during the conflict. The biggest improvement occurred with regards to the mobility of the weapons being used, and more generally with regards to the application of traction through motorized vehicles performed by Roma du Bocage.

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Notes

1. ↑ Gomes, Nuno Santa Clara/ Armamento, Armas/Afonso, Aniceto /Gomes, Carlos de Matos (cord.): Portugal Grande Guerra, 1914-1918 [Portugal in the Great War 1914-1918], Lisbon 2003, p. 165.
2. ↑ Correia Barreto, António Xavier: Os Presidentes do Parlamento Português [The Presidents of the Portuguese Parliament] (Fernando de Sousa e Conceição Meireles Pereira), vol. II - I República (1910-1926), Lisboa 2012, p. 465 e 466.
3. ↑ Correia Barreto, Os Presidentes do Parlamento Português [The Presidents of the Portuguese Parliament] 2012, p. 467.
4. ↑ Gomes / Armas e Armamento [Weapons and Weaponry], Portugal Grande Guerra [Portugal in the Great War 1914-1918] 2003, p. 165.
5. ↑ Telo, António José/Álvares, Mário/Vergueiro, Espingarda Mauser: Armamento do Exército Português, Armamento Ligeiro 1 [Mauser Vergueiro Rifle]: [Portuguese Army Weaponny, Light Weaponry], Lisbon 2004, p. 91.
6. ↑ Ibid.
7. ↑ Telo, António José/Álvares, Mário/Espingarda, Lee-Enfield: Armamento do Exército Português, Armamento Ligeiro 1[Lee-Enfield Rifle]: [Portuguese Army Weaponny, Light Weaponry], Lisbon 2004, p. 108.
8. ↑ Telo, António José: Como foi Portugal para a Guerra: O instrumento militar e a conduta da guerra [How Portugal went to war: The Army and its usage], Nova História Militar de Portugal (dir. Manuel Themudo Barata e Nun Severiano Teixeira). Lisbon 2004, p. 23.
9. ↑ Ibid.
10. ↑ Salvado, Nuno Miguel Lopes Duarte /Barbosa, Filipe Carrazedo: A evolução nas armas de artilharia de campanha em Portugal até à criação da Otan [Artillery evolution in Portugal before the creation of NATO], 2004, p. 9.
11. ↑ Telo, António José: Os Começos do Século [The beginning of the Century], 2003, pp. 350-385.
12. ↑ O Nosso Material de Artilharia (1924-1925) X, RA, 21 (231-242), p. 45
13. ↑ Pellen, A nova bacteria de 15cm T.R. e o seu fabric 1904 [The new Schneider Canet 15cm T. R. gun and its manufacture], p. 11.
14. ↑ "The Portuguese Army seems to be the first to arrive at a solution: on the advice of the military engineer Colonel du Brocage, they have studied and constructed within the Schneider & Cie establishment a battery of howitzers of 150-mm destined for the camp entrenched at Lisbon" (Translated by author). Rubin, cit. Revue d'Artillerie, Avril 1904, p. 324.
15. ↑ The following article was published regarding his experiments: du Bocage, Roma: Baterias Móveis de Praça [Bocage, Mobile Artillery], 1902, pp. 433-440.
16. ↑ J. G.: Bateria Automóvel Sistema Schneider-Canet-Bocage1904 [Schneider Canet-Bocage system – Artillery transportation vehicle 1904, pp. 23-25.
17. ↑ O Nosso Material de Artilharia (1924-1925) [War weaponry artillery] X, Revista de Artilharia [*Artillery Science Magazine*], 21 (231-242), p. 45.
18. ↑ Carvalho, Algumas: Palavras sobe o Obus 11.4 cm, Modelo Inglez [Thoughts about the Howitzer 11,4 cm English model], 1922, p. 29. Further information should be found in the following books: Hogg, Ian V./Thurston, L.F.: British Artillery Weapons & Ammunition, 1914-1918, London 1972; Clarke, Dale: British Artillery, 1914-19, Osceola 2004; Strong, Paul/Marble, Sanders: Artillery in the Great War, Barnsley 2011.

19. ↑ Carvalho, J.M.R.V.: Algumas Palavras sobre o Obus 11,4 cm Modelo Inglez [Thoughts about the Howitzer 11,4 cm English model], [*Artillery Science Magazine*], XIX, 1922, (217), p. 29.

Selected Bibliography

Bull, Stephen: **Encyclopedia of military technology and innovation**, Westport 2004: Greenwood Press.

Carvalho, José Maria Rebelo Valente de: **Algumas Palavras sobe o Obus 11,4 cm, Modelo Inglez (Thoughts about the Howitzer 11,4 cm English model)**, in: Revista da Artilharia 19, 1922, pp. 25-38.

Clarke, Dale / Delf, Brian: **British artillery 1914-19. Heavy artillery**, Oxford 2005: Osprey.

G., J.: **Bateria Automóvel systema – Schneider – Canet-Bocage (Schneider Canet-Bocage system – Artillery transportation vehicle 1904)**, in: Portugal Militar, Revista Mensal Ilustrada 2, 1904, pp. 23-25.

Gomes, Carlos de Matos: **Morteiros a arma das trincheiras**: Portugal e a Grande Guerra, 1914-1918 (Portugal in the Great War, 1914-1918), Lisbon 2003: Diário de Notícias, pp. 215-217.

Gomes, Carlos de Matos: **Armas e Armamento (Weapons and weaponry)**: Portugal e a Grande Guerra, 1914-1918 (Portugal in the Great War, 1914-1918), Lisbon 2003: Diário de Notícias, pp. 165-166.

Hogg, I. V. / Thurston, L. F.: **British artillery weapons and ammunition, 1914-1918**, London 1972: Allan.

Pellen, Eduardo: **A nova bacteria de 15cm T.R. e o seu fabrico (The new Schneider Canet 15cm T. R. gun and its manufacture)**, in: Revista de Artilharia (Artillery Science Magazine) 1, 11-24.

Salvado, Nuno Miguel Lopes Duarte; Barbosa, Pedro Filipe Carrazedo: **A evolução nas armas de artilharia de campanha em Portugal até à criação da Otan (Artillery evolution in Portugal before the creation of NATO)**, in: Boletim da Escola Prática de Artilharia 11, 2004, pp. 9-21.

Sousa, Fernando de / Pereira, Maria da Conceição Meireles / Queiroz, António José (eds.): **António Xavier Correia Barreto**: Os presidentes do parlamento português (The presidents of the Portuguese parliament), volume 2, Lisbon 2012: Assembleia da República, pp. 465-480.

Strong, Paul / Marble, Sanders: **Artillery in the Great War**, Barnsley 2011: Pen & Sword Military.

Telo, António José / Álvares, Mário: **Espingarda Mauser-Vergueiro (Mauser Vergueiro Rifle)**: Armamento do Exército Português, Armamento Ligeiro, volume 1 (Portuguese Army weaponry, light weaponry, volume 1), Lisbon 2004: Prefácio, pp. 88-93.

Telo, António José / Álvares, Mário: **Lee-Enfield (Lee-Enfield rifle)**: Armamento do Exército Português, Armamento Ligeiro, volume 1 (Portuguese Army weaponry, light weaponry, volume 1), Lisbon 2004: Prefácio, pp. 108-111.

Telo, António José: **Os Começos do Século (The beginning of the century)**: Nova História Militar de Portugal, volume 4, Lisbon 2003: Círculo de Leitores, pp. 350-385.

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