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The Manufacture of 75 mm Mountain Howitzers in Modern China (1876-1949)

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Abstract

This paper provides a comprehensive overview of the manufacturing history of the modern 75 mm mountain howitzer in China, focusing on the assimilation of foreign technology. The industrialization of China commenced in the late 1870s under the influence of European technology, leading to the establishment of several arsenals for producing mountain howitzers. It is noteworthy that Northwest Industrial Corporation, as one of China's major military enterprises before 1949, played a pivotal role in this historical process. This study presents a comprehensive analysis of the machinery utilized in the production of Chinese 75 mm mountain howitzers, providing insight into the key characteristics of modern Chinese mountain howitzer manufacturing. This highlights the intricate developmental trajectory of China's military industry during 1876-1949.

Keywords

Artillery Manufacturing, China, Technology Transfer, SOMUA Rifling Machine

1. Introduction

The mountain howitzer is a prevalent artillery piece in military operations. Compared to other weapons, the production process for mountain howitzers is notably intricate and requires collaboration across multiple departments. The barrel of a mountain howitzer is the most critical component, requiring internal processing during manufacturing to create rifling that enhances shooting accuracy and range. The performance of the mountain howitzer heavily relies on its barrel, making mechanical processing pivotal in its production while showcasing the level and capacity of manufacturing.

The process of industrialization in modern China commenced following the

First Opium War in the 1840s. Acknowledging the significance of Western scientific and technological expertise, as well as industrial machinery, the Chinese government endeavored to establish arsenals during this period. During this period, China developed and produced mountain howitzers, exemplified by the 75mm mountain howitzers, which epitomized the developmental trajectory of China's artillery manufacturing industry. The evolution of modern China's mechanical processing capabilities for mountain howitzers also mirrors advancements in industrial history.

2. An Overview of 75 mm Mountain Howitzers Manufacturing in Modern China from 1870 to 1937

The Kiangnan Arsenal, the Hanyang Arsenal, the Shenyang Arsenal, and the Taiyuan Arsenal were four prominent mountain howitzer factories in China between 1870 and 1937. These arsenals benefited from regional advantages and had convenient access to raw materials and machinery. The production of approximately 3000 mountain howitzers in modern China was primarily driven by the escalating demand for these weapons during wartime (The Editorial Committee of Armoury Industry in Modern China from the End of Qing Dynasty to the Republic of China, 1998).

From the perspective of technology transfer, prior to the outbreak of the War of Resistance against Japanese Aggression, China primarily derived its mainstream mountain howitzer manufacturing technology from Europe, particularly from Britain, Germany, and France. However, during 1945-1949, there was a notable shift towards Japanese technology. Early imitation of European mountain howitzers primarily included the Hu-made Krupp Type 75 mm mountain howitzer (沪造克虏伯式 75 mm 山炮), the Han-made 10 Type 75 mm mountain howitzer (汉造 10 年式 75 mm 山炮), and the Liao 14th Type 75 mm mountain howitzer (辽 14 年式 75 mm 山炮). The fundamental parameters of these three types of 75 mm mountain howitzers can be observed in **Table 1**.

Table 1. Basic parameters of the Hu-made Krupp Type 75 mm mountain howitzer, Han-made 10 Type 75 mm mountain howitzer and Liao 14th Type 75 mm mountain howitzer.

Artillery Name	Hu-made Krupp Type 75 mm mountain howitzer	Han-made 10 Type 75 mm mountain howitzer	Liao 14th Type 75 mm mountain howitzer
Calibre (Millimeter)	75	75	75
Barrel Length (Millimeter)	1050	1350	1350
Weight (kilogram)	386	610	
Muzzle Velocity (m/s)	280	342	
Maximum Range (Meter)	4300	6000	6350
Breech	Interrupted Screw	Interrupted Screw	Interrupted Screw
Capacity	494	68	72
In Service	1905-1928	1921-1928	1925-1931

The Kiangnan Arsenal, a pivotal facility in modern China for manufacturing mountain howitzers (**Figure 1**), replicated the renowned British Armstrong mountain howitzer between 1867 and 1876 through extensive collaboration with British companies such as W.G. Armstrong & Co Ltd., particularly in machinery procurement to effectively utilize British technology (Li & Lu, 2003). In 1905, the Kiangnan Arsenal developed a domestically manufactured Hu-made Krupp Type 75 mm mountain howitzer (**Figure 2**) modeled after the Krupp 75 mm mountain howitzer (**Figure 3**) (Shi, 2006). The transition from British to German technology is evident in the production of mountain howitzers at the Kiangnan Arsenal.

The Hanyang Arsenal manufactured the Han-made 10 Type 75 mm mountain howitzer (**Figure 4**), benefiting from favorable transport links and abundant local coal and steel resources, which led to its emergence as one of the most comprehensive arsenals in the 1890s. Through collaboration with Friedrich Krupp AG,

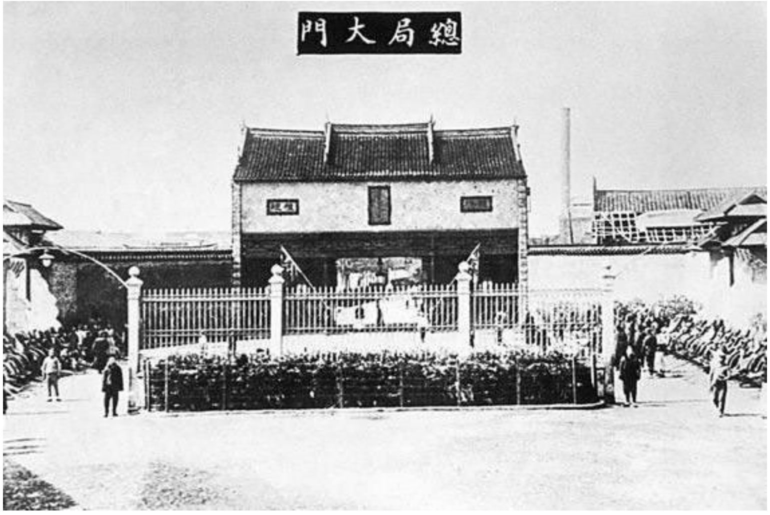

Figure 1. The Entrance of Kiangnan Arsenal (Shanghai Library Ed, 2011a).

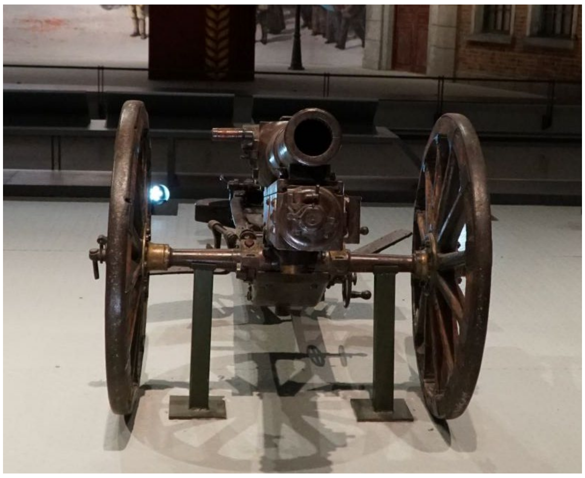

Figure 2. Hu-made Krupp Type 75 mm Mountain Howitzer in the Chinese People's Revolutionary Military Museum (Photo by the author).

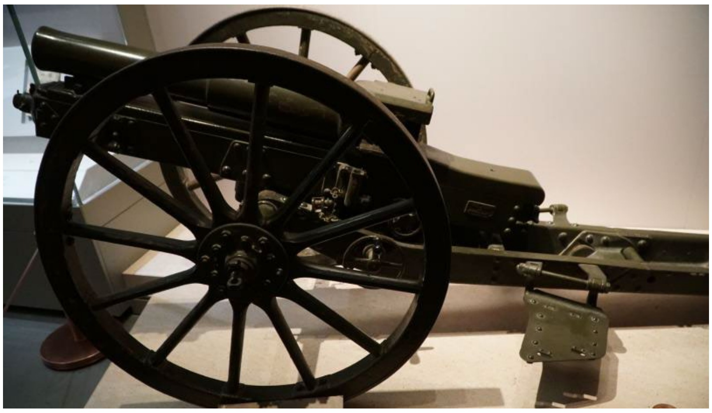

Figure 3. The Krupp 75 mm Mountain Howitzer in the Chinese People's Revolutionary Military Museum (Photo by the author).

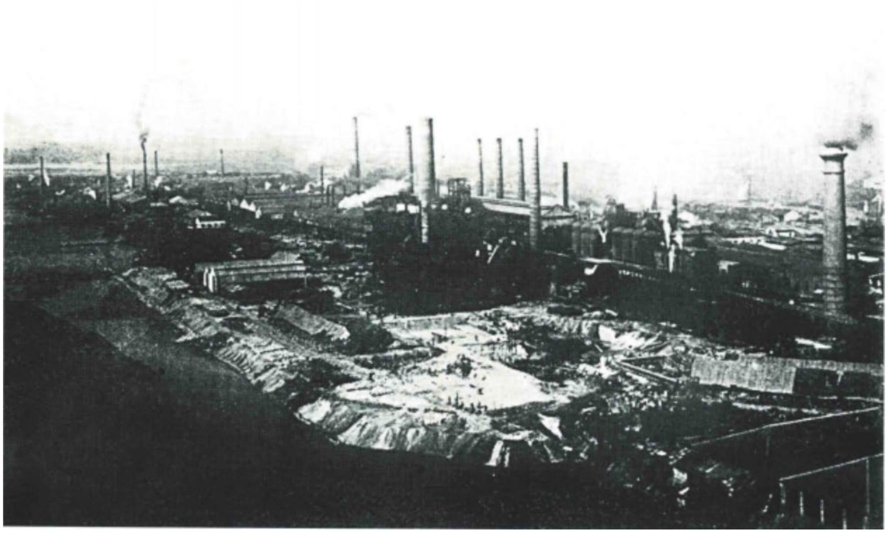

Figure 4. Hanyang Arsenal (Shanghai Library, 2011b).

the Hanyang Arsenal integrated advanced technology and machinery for producing early mountain howitzers (Wang, 2016). We hypothesize that those early mountain howitzers were influenced by the design of the Krupp 7.5 cm Model 1903. In 1921, based on Japan's Taisho 6th Year model, Hanyang Arsenal developed the Han-made Type 10, a 75 mm mountain howitzer(Hou, 2011). It is worth noting that a significant portion of Japan's mountain howitzer was influenced by Krupp's technology.

The Liao 14th Type 75 mm mountain howitzer was manufactured by the Shenyang Arsenal, established in 1921. In 1925, the Shenyang Arsenal successfully replicated the Japanese 41st Type 75 mm mountain howitzer and designated it as the Liao 14th Type. However, the Shenyang Arsenal was not self-sufficient in production. It sourced materials and machinery from overseas, including Japan, Austria, and Germany (Wang, 2015).

From a mechanical processing perspective, these three arsenals have the capability to manufacture and assemble mountain howitzers. However, due to their limited machinery production capacity, they heavily rely on technology transfer for most of the machinery used in mountain howitzer processing. The domestically produced Hu-made Krupp Type 75 mm mountain howitzer incorporates British and German machinery, the Han-made 10 Type 75 mm mountain howitzer utilizes German machinery, and the Liao 14th Type 75 mm mountain howitzer uses Japanese, Austrian, and German machinery (The Editorial Committee of Armoury Industry in Modern China from the End of Qing Dynasty to the Republic of China, 1998). None of these arsenals had the ability to produce their own machining equipment. An exceptional case was observed at the Taiyuan Arsenal, which demonstrated early development of its mechanical capabilities and subsequently imitated Japanese howitzer post-1945.

3. The Manufacture of the Jin-Made 36 Type 75 mm Mountain Howitzer at NWIC

The Taiyuan Arsenal, which was established by the Qing Dynasty government in 1898 (now located in Taiyuan, Shanxi Province, PRC), was formerly known as the North Western Industrial Corporation (NWIC) before the establishment of the People's Republic of China (**Figure 5**) (Shanxi Literature and History Data Editing Committee, 1964). On August 1, 1933, Yan Xishan established the Northwest Industrial Corporation (NWIC) to consolidate control over Shanxi and expand his influence. As the general manager of the company, Yan Xishan coordinated resources across the entire region. In 1934, NWIC established over 10 civilian and military factories. These facilities not only catered to local needs but also distributed their products nationwide, establishing a dominant industrial conglomerate (Yan & Liu, 1996). Moreover, by camouflaging their activities as civilian-oriented enterprises, NWIC concentrated substantial resources towards manufacturing military weapons and equipment for private armies.

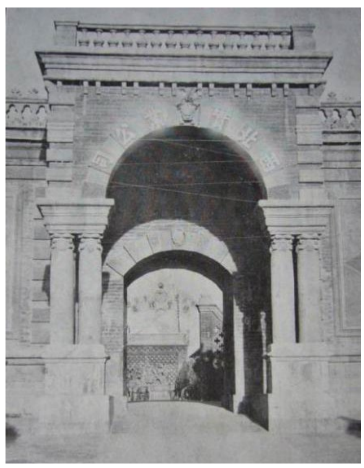

Figure 5. Gate of The North Western Industrial Corporation (Provided by LIU Guihong).

In the 1930s, NWIC gained recognition as one of three major arsenals in China alongside Hanyang Arsenal and Kiangnan Arsenal (Li, 1931). It distinguished itself among a limited number of factories capable of manufacturing advanced weapons and machinery during that period. In 1949, NWIC came under the control of the People's Republic of China. The remaining equipment of NWIC holds significant historical value for studying technological advancements related to early modern weapon manufacturing in China and has been exhibited in a small museum at NWIC. The most renowned and emblematic weapon of NWIC was the Jin-made 36 Type 75 mm caliber mountain howitzer, which was in use during 1946-1949 (Jing, 2000). It is currently being exhibited in a small museum at the NWIC site, alongside numerous other equipment. The museum is situated at the location of the NWIC.

3.1. Imitation and Enhancement of Japanese 75 mm Mountain Howitzer

In 1946, following the victory in the overall War of Resistance against Japanese Aggression, NWIC organized weekly military meetings to expedite the production of new mountain howitzers (Qu, 1946). The objective was to concentrate technical expertise within NWIC and promptly identify issues related to manufacturing or service, resolve challenges expeditiously, and oversee weapon production progress. It is against this backdrop that Jin-made Type 36 75 mm mountain howitzers (晋造 36 式 75 毫米山炮) were developed (see **Figure 6**) (Cao, 1955).

In 1947, NWIC successfully replicated Japan's design and produced their own version of this type. The development process for the 36 Type can be traced back to an earlier model known as the Jin-made 13 Type (晋造 13 式 75 毫米山炮) (see **Figure 7**) (Shanxi National Defense Science, Technology and Industry Office, 1983), which drew inspiration from Japan's design for the Model-41 mountain howitzer (四一式山炮，聯隊砲) (The Editorial Committee of The Archives of Modern Chinese Ordnance Industry Vol.3, 1993). The origin of Japan-designed Model-41 can be attributed to its licensing by Japan (see **Figure 8**), based on Krupp M1908 mountain howitzer technology. Following the Russo-Japanese

Figure 6. The picture on the right shows a Jin-made 36 Type 75mm Mountain Howitzer in the Chinese People's Revolutionary Military Museum (Photo by the author).

Figure 7. The picture on the right shows a Jin-made 13 Type 75 mm Mountain Howitzer in the Chinese People's Revolutionary Military Museum (Photo by the author).

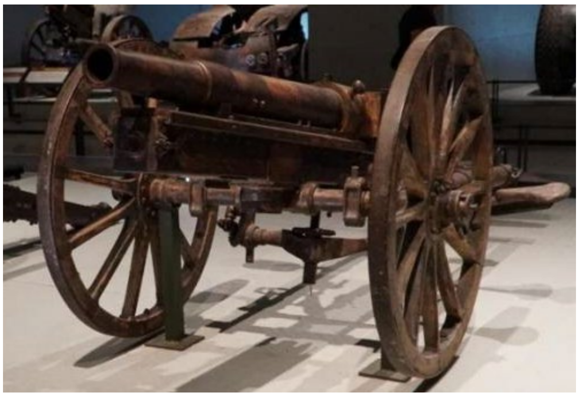

Figure 8. The picture on the right shows a Japanese 41 Type 75 mm Mountain Howitzer in the Chinese People's Revolutionary Military Museum (Photo by the author).

Figure 9. The picture on the right shows a Japanese 94 Type 75mm Mountain Howitzer in the Chinese People's Revolutionary Military Museum (Photo by the author).

War, Japan imported Schneider et Cie's recoil system technology and subsequently upgraded it from its original design to create a more advanced and widely used model known as Japan-designed "94 Type" during World War II (2594 in Japan's Kambu era) (see **Figure 9**) (Cao, 1955). Although initially chosen as a prototype, not all aspects of its design were replicated in actual production of Jin-made 36 Type, a caliber mountain howitzer (Huo, 2014). To streamline the process, they integrated into this outdated design with recoil system from 13 Type, due to NWIC's production capacity constraints (Shanxi National Defense Science, Technology and Industry Office, 1983). **Figure 10** illustrates intergenerational relationships between various types of mountain howitzer. **Table 2** presents the basic parameters of the four types of mountain howitzers (Shanxi National Defense Science, Technology and Industry Office, 1983; The Editorial Committee of The Archives of Modern Chinese Ordnance Industry Vol.1, 1993; Committee of Cultural and Historical Date of the CPPCC National Committee, 2002).

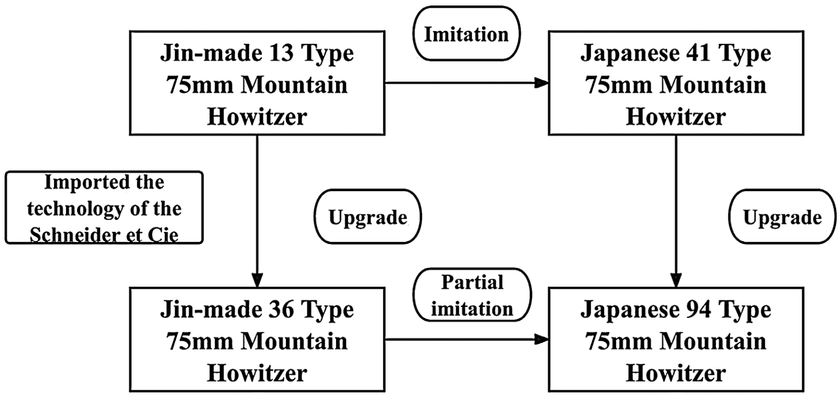

Figure 10. Diagram of four different types of mountain howitzer iterations.

Table 2. Basic parameters of the Jin-made 13 Type 75 mm Mountain Howitzer, Japanese 41 Type 75 mm Mountain Howitzer、Japanese 94 Type 75 mm Mountain Howitzer, Jin-made 36 Type 75 mm Mountain Howitzer.

Artillery Name	Japanese 41 Type 75 mm Mountain Howitzer	Jin-made 13 Type 75 mm Mountain Howitzer	Japanese 94 Type 75 mm Mountain Howitzer	Jin-made 36 Type 75 mm Mountain Howitzer
Calibre (Millimeter)	75	75	75	75
Barrel Length (Millimeter)	1350	1375	1560	1560
Weight (kilogram)	540	591	544	536
Elevation	−8 - 11	−8 - 25	−8-25	-
Muzzle Velocity (m/s)	342	335 - 342	350 - 390	355 - 370.7
Maximum Range (Meter)	6300 - 7100	5100 - 6400	8300	6000 - 7500
Breech	Interrupted Screw	Interrupted Screw	Horizontal Sliding	Horizontal Sliding
In Service	1908 - 1945	1924 - 1949	1935 - 1945	1946 - 1949

According to the minutes of several NWIC weapons conferences, the alternative models for the new mountain howitzers were predominantly of Japanese origin rather than being more technologically advanced European designs. We believe that there are three primary reasons for this phenomenon. Firstly, it can be attributed to the educational background of NWIC's employees, as both their technical committee and military conference participants mostly have a Japanese study background with many individuals graduating from Tokyo Institute of Technology (東京工業大学) (Shanxi National Defense Science, Technology and Industry Office, 1983). Secondly, following the victory in The War of Resistance against Japanese Aggression, China received a substantial amount of materials from the Japanese army including a considerable number of mountain howitzer shells. The imitation Japanese mountain howitzer could be employed to offset any deficiency in ammunition during the period of Japanese occupation in Shanxi; Japanese engineers and technicians who had been stationed there remained after Japan's surrender. Yan Xishan subsequently rehired these skilled professionals, thereby facilitating a more streamlined manufacturing process for the Japanese mountain howitzer. Consequently, it was consistently observed that the chosen model always exhibited influences from Japanese design rather than European alternatives.

3.2. The Machinery Process of the Jin-Made 36 Type 75 mm Mountain Howitzer at NWIC

The 36 Type mountain howitzer barrel was manufactured at the North Western Locomotive Works (西北机车厂) (affiliated with NWIC), as shown in **Figure 11**, **Figure 12**, and **Figure 13**. Steel materials were provided by the North Western Steel Plant (西北炼钢厂) and the North Western Yuh-Tsai Steel & Machine Work (西北育才炼钢机器厂) (Cao, 1955).

The steel was transported to the North Western Locomotive Works, where the casting department of the locomotive works produced alloy steel blocks in accordance with its own standards. These blocks were then transferred to the forging department, where they underwent pressing and hammering processes to eliminate impurities and pores, resulting in uniformly sized blanks. Throughout machining and forging stages, heat treatment procedures were repeatedly applied

Figure 11. The Workers Manufactured 36 Type Mountain Howitzer Barrels in 1947 (Provided by LIU Guihong).

Figure 12. The Workers Manufactured 36 Type Mountain Howitzer Barrels in 1948 (Huo, 2014).

Figure 13. The Workers Manufactured the carriages of 36 Type Mountain Howitzer in 1947 (Provided by LIU Guihong).

to eliminate any remaining defects from previous processes while preparing for subsequent ones.

Machining is a crucial process in the production of howitzer barrels, necessitating the utilization of various types of machines. After drilling was completed, reaming is necessary to enlarge the hole diameter close to that of the bore size while also polishing its inner surface up to a circumference of 1560 mm using appropriate tools. The final step in processing the inner surface involves carving rifle lines on a clamped and fixed howitzer barrel using a rifle machine tool that performs both straight line motion and rotation simultaneously. This encompasses most of the mechanical processing steps involved in manufacturing a howitzer barrel (Lee, 1934).

The manufactured barrel was then equipped with the powder chamber, gun bolt, and other structures. Subsequently, various parts such as the howitzer carriage frame, reloader, elevating machine etc., were assembled onto the barrel, culminating in final assembly (**Figure 14**) and painting (**Figure 15**). Upon passing quality inspection, the mountain howitzer would be packed into the warehouse to signify successful completion of the manufacturing process (Lee, 1934). **Figure 16** depicts various processes of the 36 Type Mountain Howitzer.

The equipment used in the production of the 36 Type mountain howitzer primarily relied on two sources. A significant portion of the standard equipment used by NWIC was internally manufactured (Cao, 1955) and is showcased at the NWIC Museum, featuring a diverse array of mechanical apparatus, many of which were produced by precursor companies or subsidiaries of NWIC. We hypothesized that certain machines might have been employed in the manufacturing process of the 36 Type mountain howitzer and continued to be preserved

Figure 14. The 36 Type Mountain Howitzer assembly workshop (Provided by LIU Guihong).

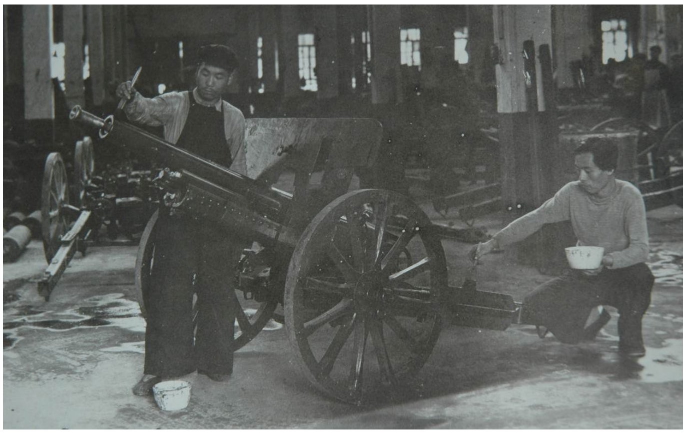

Figure 15. The Workers Manufactured the carriages of 36 Type Mountain Howitzer in 1947 (Provided by LIU Guihong).

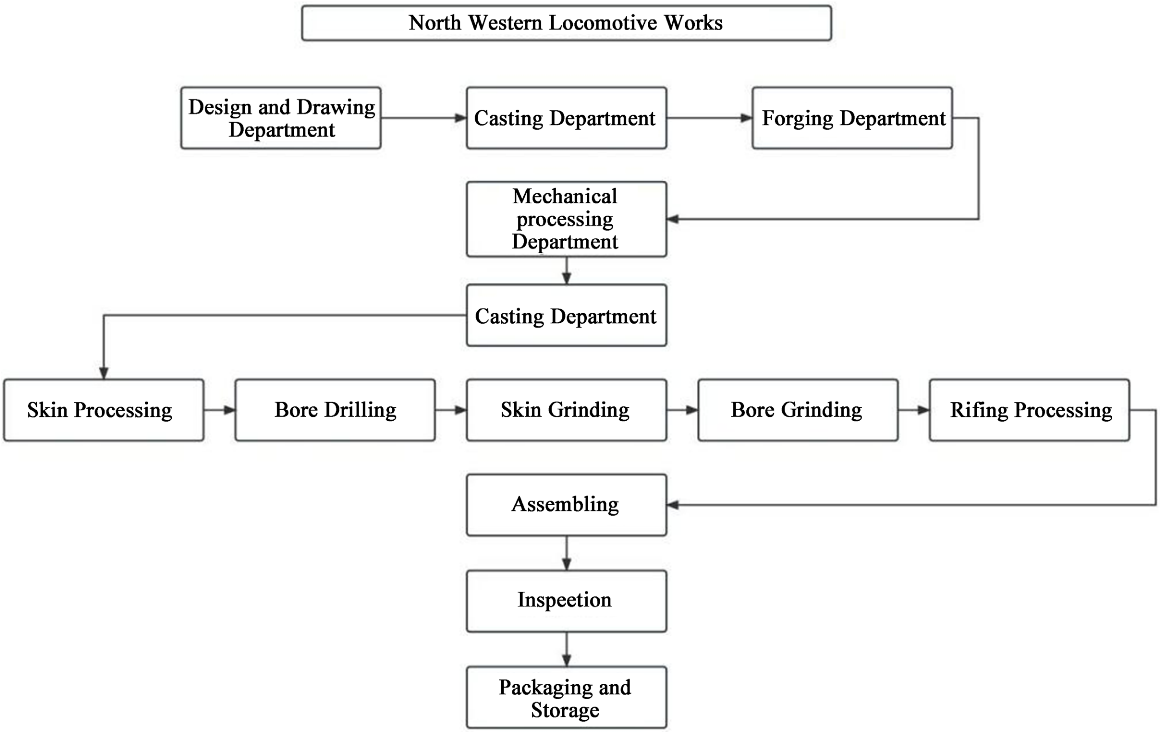

Figure 16. Manufacturing process diagram for the 36 type mountain howitzer.

Figure 17. A vertical milling machine manufactured by NWIC in 1917.

after 1945. In 1917, NWIC manufactured a vertical milling machine (Figure 17) modeled after a lightweight Japanese vertical milling machine with a worktable size of 420 × 200 millimeters, capable of utilizing various cutting tools for metal plane cutting, outer circular cutting, and groove machining. Furthermore, the boring machine (Figure 18), produced in 1946, exemplified equipment specifically designed for grinding work on howitzer barrel recoil tubes. The preserved equipment at the NWIC Museum indicate that NWIC began manufacturing machinery for howitzer processing in the 1910s, some of which were based on

Figure 18. A boring machine manufactured by NWIC in 1946.

Japanese models to enhance howitzer production and played a crucial role in ensuring independent manufacture of NWIC's mountain howitzers. The war significantly impacted operations, resulting in losses, particularly advanced equipment such as rifles. After 1946, reconstruction efforts were undertaken and assistance was sought from the KMT government (Shanxi Literature and History Data Editing Committee, 1964), while foreign aid became another source for procuring machinery used in the production of 36 Type mountain howitzers.

Significantly, a rifling machine provided by SOMUA, a subsidiary of Schneider et Cie in France, held great importance. The SOMUA rifling machine was introduced and utilized for barrel processing until the early 21st century, establishing it as one of NWIC's most invaluable heritages.

3.3. The SOMUA Rifling Machine for the Processing of 36 Type Barrels at NWIC

The SOMUA rifling machine measures approximately 15 meters long and 2.5 meters wide (see Figure 19). The main structure of the machine is equipped with

Figure 19. SOMUA Rifling Machine for Rifling the Barrel of the 36 Type Mountain Howitzer (Photo by LIU Guihong).

automatic controls, power drives, and automatic indexing capabilities. The cutting tool is securely mounted on a head that precisely fits into the bore. After each stroke, the barrel undergoes indexing while the tool progressively advances until it reaches full depth within all grooves. This machine can effectively be used for rifling processes in Howitzers with bores measuring 75, 76.2, 85, 100, 105, 120 and 125 millimeters as well as other multi-caliber firearms.

The SOMUA rifling machine served as a prime example of the prevalent mountain howitzer rifling broaching process from the 1920s to the 1940s. This machine employs multiple cutters derived from a single-point cutting tool, allowing for simultaneous machining of up to half of the required number of grooves. This innovative method was initially successfully employed in manufacturing French Howitzers in 1918 and allowed for rough-cutting and finishing grooves using a series of cutting tools divided into segments forming a set of broaches. The SOMUA rifling machine utilizes multiple cutter technology for manufacturing mountain howitzers. This technological approach remained dominant throughout much of the 1930s (Anonymous, 1920). During this period, it is worth noting that the Shanghai Arsenal (formerly known as Kiangnan Arsenal) also employed a rifling machine with a structure similar to SOMUA's, which was purchased abroad in the 1910s (see **Figure 20**). However, unlike SOMUA's use of multiple cutters, the Shanghai Arsenal used single-point cutting tools, resulting in a more time-consuming rifling process (Lee, 1934).

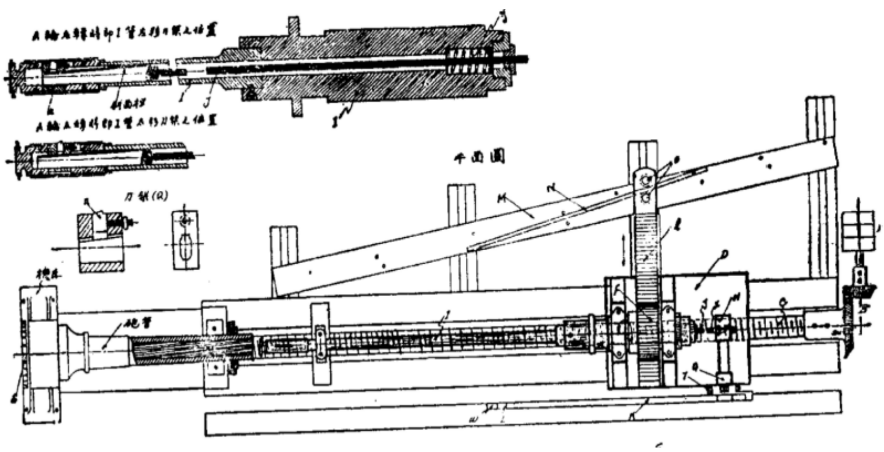

Figure 20. The Rifling Machine's Three-View Drawing by Shanghai Arsenal (Lee, 1934).

In addition to its primary structure, the SOMUA rifling machine was also equipped with an electric motor that provided the necessary power for its operation. The information displayed on the nameplate of the electric motor can be identified (see **Figure 21**).

The dynamical system of this SOMUA rifling machine was manufactured by CHAMPAGNE SUR SEINE, which served as a wholly-owned subsidiary of Schneider et Cie. Most motors for Schneider machinery were produced in the early 20th century (**Figure 22**).

Figure 21. Motor Name Plate of the Electric Motor for the SOMUA Rifling Machine (Photo by author).

Figure 22. Workshop in CHAMPAGNE-SUR-SEINE (Grant, 2018).

SOMUA, an abbreviation for Société d'outillage mécanique et d'usinage d'artillerie, served as a subsidiary of Schneider et Cie in France. Established in 1861 as a equipment tool manufacturing enterprise, it later came under the control of Schneider in 1914. Situated in Saint-Ouen, a suburban district of Paris, this company gradually developed into a prominent manufacturer specializing in light weapons, equipment, and vehicles (Dominique, 1995).

During the first half of the 20th century, Schneider demonstrated a strong interest in entering the Chinese market by actively promoting sales of their diverse range of products, including weaponry and other manufacturing equipment. The advertising poster in **Figure 23** represents Schneider's marketing efforts targeted at the Chinese market during the early 20th century. The presence of the SOMUA rifling machine provides concrete proof of Schneider's trade endeavors and technology transfer to China. However, the journey undertaken by the SOMUA rifling machine to reach China was arduous, with its ownership changing hands multiple times before ultimately being acquired by NWIC for service since 1947.

The acquisition of the SOMUA rifling machine was first purchased by NWIC but was acquired by Liu Xiang (刘湘, 1889-1938), the chairman of Sichuan Province. He purchased it with the intention of establishing a local artillery factory during the 1930s. The machine currently retains a Chinese nameplate bearing Liu Xiang's signature "为母国前途奋勉之", which signifies unwavering commitment to the future of our motherland through diligent endeavors (see **Figure 24**).

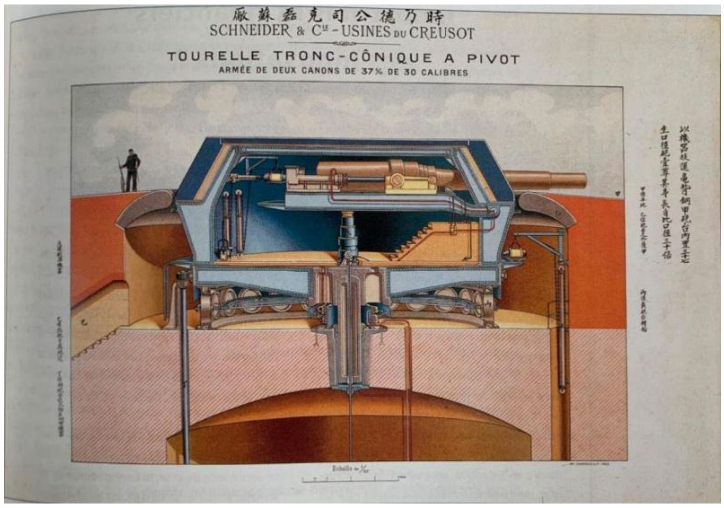

Figure 23. Chinese Advertisement by Schneider et Cie (Dominique, 1995).

Figure 24. Chinese Name Plate of SOMUA Rifling Machine (Photo by author).

In 1930, following thorough deliberation and analysis, they opted to engage in a collaborative effort with Schneider (Edited by Sichuan Provincial Annals Editorial Committee of Sichuan Provincial Committee of CPPCC, 1980). Liu Xiang's decision to collaborate with Schneider was based on three factors. First, when comparing mountain howitzer of the same caliber, Schneider's products were lighter and more convenient for disassembly and transportation. Second, the arsenal technician's proficiency in French led him to favor Schneider as his primary selection. Third, in order to enhance its market presence in China, Schneider extended support to Liu Xiang by helping establish an artillery factory and offering provisions for procuring additional equipment necessary for artillery manufacturing from them.

However, the outbreak of The War of Resistance against Japanese Aggression in 1937 significantly impacted on the establishment of Liu Xiang's arsenal. Despite some equipment already being transported to Vietnam, the war hindered their delivery (Committee of Cultural and Historical Date of the CPPCC National Committee, 2002). Recognizing the machinery shortage in China and the urgent need for efficient utilization, the OAMW engaged in negotiations with Liu Xiang's relatives regarding ownership of these items after Liu Xiang's passing (Anonymous, 1938a; Anonymous, 1938b; Anonymous, 1938c).

Due to their substantial size and weight, the OAMW made a strategic decision to establish the 52nd factory along the Yunnan-Vietnam Railway as an optimal location for accommodating these equipment. However, during the War, the 52nd factory was unable to engage in mountain howitzer production (The Editorial committee of Armoury Industry in Modern China from the end of Qing Dynasty to the Republic of China, 1998). After the War of Resistance against Japanese Aggression, NWIC consistently sought assistance from the KMT Government to address the equipment shortages related to the production of new type mountain howitzers. The OAMW transferred this SOMUA rifling machine to NWIC, which played a pivotal role in the production of the 36 Type. The machine has been in operation on the production line for nearly six decades. Consequently, even after nearly a century, this machine remains in excellent condition. In 1948, a total of 113 Howitzers of the 36 Type were produced; therefore, based on the scale of manufacturing equipment available at that time, it can be inferred that most of these Howitzers were likely manufactured using the SOMUA rifling machine (Committee on Milltary Affirs, 1945).

The SOMUA rifling machine exemplified the prevailing technique for mountain howitzer rifling broaching during the 1930s and served as tangible evidence for trading and disseminating this technology. In contrast to limited trade channels and technology transfers that safeguarded core technologies in the early 20th century, Schneider et Cie offered a comprehensive range of technologies including artillery design blueprints, manufacturing blueprints, relevant technical information, as well as manufacturing equipment and tools during their trade negotiations with Chinese clients. Although this particular trade did not eventually happen, it represented a more technologically monopolistic form of trading that partially reflected characteristics seen in technological exchanges between mature Western military industries and China during this period.

4. Conclusion

The development of mountain howitzer production imitation technology in modern China has undergone significant transformations. China has transitioned from dependence on European weapon technology to embracing Japanese technology. This change in the origin of firearm production technology in modern China not only involves reevaluation and selection of external sources of knowledge, but also signifies substantial advancements in China's indigenous military technology.

Compared to other Chinese arsenals, the NWIC stands out in the mountain howitzer manufacturing industry due to its comprehensive industrial chain. The crux of this industry chain lies in the specialized machinery manufacturing for mountain howitzers.

Following the establishment of its own machinery production, NWIC enabled China to progressively develop independent capabilities for manufacturing artillery machinery after 1910. While it could replicate foreign machines for producing simple machinery, its capacity for precision machinery manufacturing remained relatively limited before 1949.

After establishing its own machinery production, NWIC enabled China to independently manufacture artillery machinery after the 1910s. While it could replicate foreign machines for producing simple machinery, its capacity for precision machinery manufacturing remained relatively limited before 1949.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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