



American Gas Masks for American Soldiers — *Gas Mask Production in the World Wars*

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As the United States mobilized forces to deploy overseas during World War I and World War II, American leaders thought those forces should be outfitted with equipment, including gas masks, made in the United States. During World War I, the majority of U.S. forces were issued masks made in the United States; however, during World War II, all U.S. forces received them.

World War I

The United States was unprepared for the chemical warfare of World War I. When we declared war in 1917, we had no gas defense equipment on hand. On 21 May 1917, a rush order was placed for 25,000 masks to be shipped overseas to the First Division. These masks were based on the British small box respirator (SBR), the then standard British mask that used a noseclip and a mouthpiece. The medical department, then responsible for gas defense, turned to the Bureau of Mines for help with the mask design. When the design was completed in July 1917,

production began in Boston, Massachusetts; Brooklyn, New York; and Akron, Ohio.¹ This was a national effort. Unfortunately, the masks were unacceptable and were sent back because the facepieces were easily penetrated by chloropicrin. U.S. forces stationed in France were then issued the British SBR and the French M2 mask.²

But more masks were needed to equip the American Expeditionary Force. The Gas Defense Service of the Surgeon General's Department (established 31 August 1917) was tasked to produce 1.1 million masks. The Hero Manufacturing Company,

Philadelphia, Pennsylvania, one of the numerous contractors and subcontractors hired by the Gas Defense Service, performed the final mask assembly.

During the war, improvements to the SBR's basic design were continual. The next mask produced and accepted for use by the American Expeditionary Force was the Corrected English (CE) mask. About 2 million CE masks were produced between June 1917 and March 1918. The CE mask was the same basic design as the SBR, with added improvements such as Triplex® safety glass for the eye lenses. This was the first major use of safety glass. Further improvements resulted in the development of the Richardson-Flory-Kops (RFK) mask. The RFK was used until the end of hostilities, with over 3 million produced. When World War I ended on 11 November 1918, 40,000 masks were being produced daily.³

Improvements in mask design eliminated the need for the noseclip and the mouthpiece. The improved wearability and vented air over the eye lenses eliminated fogging problems. The inspiration for this design change was the French Tissot mask, which was comfortable but bulky due to the large canister worn on the back and fragile due to its thin, natural-rubber facepiece. American designers adapted the French Tissot mask design to mass production. Improvements included adding fabric (stockinette) to the rubber sheets to strengthen the facepiece, attaching a standard infantry canister, and changing the outlet valve. Two models were adopted: the Kops-Tissot (KT) and the Akron-Tissot (AT) masks. The KT, designed by a former corset designer, had a production of 197,000 before the armistice and the AT mask, which used the RFK outlet, had a production of 291,000. The final design, using the best ideas from the AT and KT, was the Kops-Tissot-Monro (KTM) masks, of which 2,500 were produced before the armistice.⁴ In all, 5,692,499 masks of all types were produced by the end of 1918.⁵

With five different masks (and 12 filter canisters) produced in less than 18 months, Chemical Warfare Service (CWS) leaders thought that changes to the mask design could be easily and quickly implemented if there was a government mask production plant. Mask production was not an easy task, because changes were constantly being made, so the CWS decided to centralize production. On 20 November 1917, the Secretary of War authorized the establishment of a gas defense plant in Long Island City, New York, which was run by Mr. R.R. Richardson, a dollar-a-year man. By the summer of 1918, the plant occupied five large buildings, totaling over 1 million square feet. There were 12,000 employees, of which 8,500 were women. To ensure extra care in manufacturing, Mr.

Richardson hired workers who had relatives in the American Expeditionary Force, believing that they would take extra care in the production process. The plant workforce, which included both military and civilian personnel (a first in the war), was very efficient, producing masks for about 50 cents less than the Hero Manufacturing Company.⁶ The total mask production was 3,666,683 by the Gas Defense Plant and 2,025,816 by the Hero Manufacturing Company.⁷

Interwar Years

By the end of World War I, the Army had decided on one standard gas mask—the KTM. Production was so efficient and improvements so quick that masks in the hands of soldiers were almost immediately obsolete. As a result, soldiers were allowed to keep their masks as a memento of their service.⁸

During the interwar years, production was transferred to Edgewood Arsenal, Maryland, and mask production was continued on a limited basis. Funding was scarce, but research continued, and by 1938 an injection-molded mask had been successfully developed. The KTM was redesignated the MI Service Gas Mask and was further modified and improved to become the MIA2 mask. The blue filter canister of 1918 was further refined through stages until the MIX became the standard in 1938.⁹ The MI service gas mask was the mask for general issue to all soldiers not otherwise authorized a special type of mask. Other special mask designs included a diaphragm mask for soldiers needing to communicate and an optical mask for soldiers needing to use optical instruments.

In an attempt to solve the mobilization problems encountered during World War I, the Army planned production requirements based on future mobilization needs. The plan called for the mobilization of 400,000 soldiers (Army and National Guard) within 30 days, 1 million soldiers within 4 months, and a peak of 4 million soldiers within 14 months. In 1924, to facilitate production, five procurement districts were set up: New York, Boston, Pittsburgh, Chicago, and San Francisco.¹⁰ As Edgewood Arsenal had limited capability for expansion, CWS planners knew that production would have to be expanded to fully equip a wartime army. By the early 1930s, CWS planners were already planning to contract out production to civilian firms to produce up to 900,000 masks a month.¹¹

At the start of World War II, the gas mask situation was much improved from that of 1917. In 1939, the United States had a standard service mask, the MIA2; a standard training mask, the MI (later redesignated M2); experience in mask production; and plans to expand production rapidly. Specifications and

blueprints to produce masks were also on hand.¹² On 26 October 1939, the CWS had 523,761 service masks on hand with an additional 227,836 on order (based on a projected need of 1,298,085). Of the 547,000 training masks required, the CWS had 34,000 on hand, with none on order.¹³

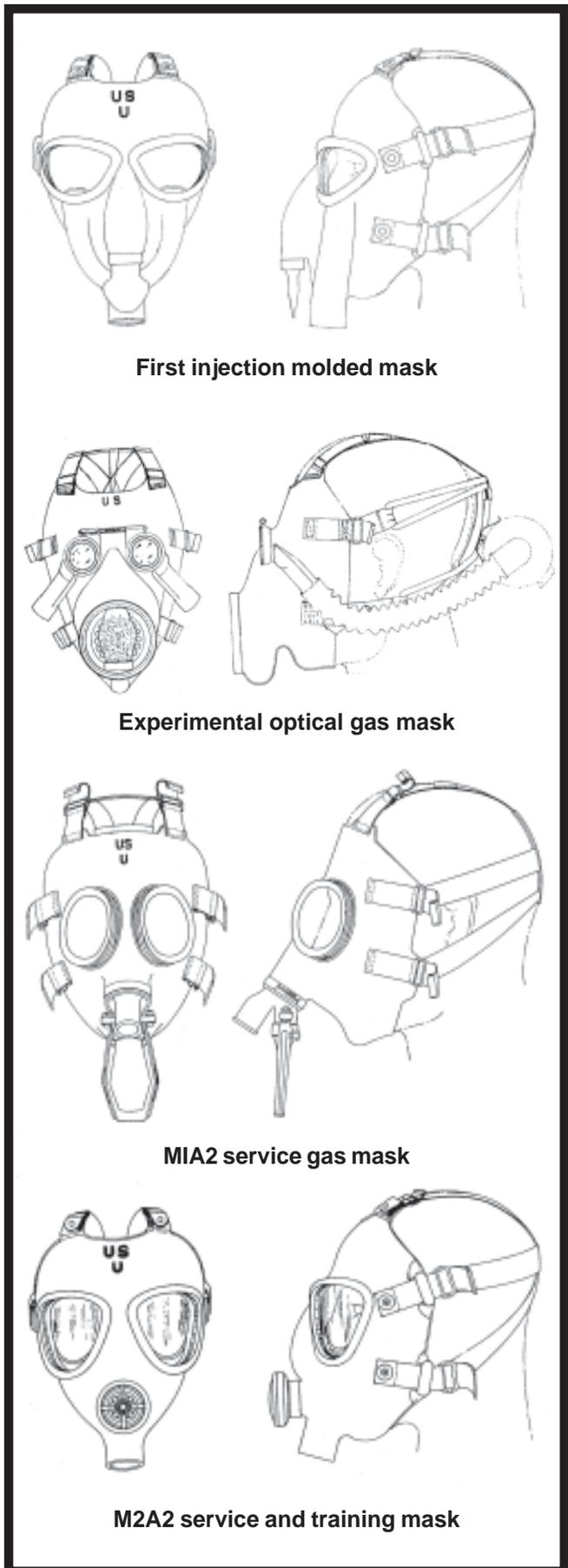
World War II

The first service mask produced in quantity for U.S. forces during World War II was the MIA2. It was a big improvement to the World War I design, which featured a facepiece cut from flat stockinette, covered with rubber sheets, and painstakingly assembled by hand and a chin seam cemented, taped, and vulcanized (baked). The filter was attached to the facepiece with a 27-inch hose. The training mask, the M2A1, was a seamless, molded, rubber mask with a front-mounted filter canister. The M2A1 was quickly adapted for mass production.¹⁴

To expand the technical knowledge of mask production, the CWS was funded to support educational contracts. These small contracts were designed to give businesses experience in mask production, while keeping the bulk of production at the Edgewood Arsenal. The first educational contract went to the Goodyear Tire and Rubber Company® in 1939 for the production of 3,000 masks. Workers from Edgewood Arsenal—technically skilled at mask production—provided their expertise to the businesses, and many remained as technical inspectors.¹⁵ Other educational orders went to the Firestone Tire and Rubber Company® and Johnson & Johnson Company® for 10,000 masks each. The educational contract program was completed in 1941.

With funding finally approved, all service mask production shifted to the improved M2A1.¹⁶ Full-scale production of the fully molded M2A1 began in late 1940, with additional technical difficulties resolved, and the redesigned mask used the same facepiece as the training mask.

The M2 mask was a technically outstanding mask but was heavy (about 5 pounds), bulky, and inconvenient. After improvements in the charcoal, the CWS designed a new mask—the M3 lightweight service mask. This new mask had a shorter hose and a smaller canister (the M10), yet it provided almost the same protection as the M2 mask and weighed only 3 1/2 pounds.¹⁷ This mask was quickly adopted, and by the end of 1943, it had replaced the M2 mask in production. Initial M3 facepiece production problems led to the adoption of the M4 lightweight gas mask, an M2 facepiece overhauled and assembled with lightweight mask parts (filter, hose, and carrier). M4 production started in 1944.



Mask Production During World War II

Production Year	Service Mask	Combat and Snout Mask	Optical Mask	Lightweight Mask	Diaphragm Mask
1938	18,734				
1940	315,218				
1941	2,272,912		116,689		1,173,600
1942	3,929,552		11	12	356,983
1943	3,955,927	1,282		4,395,142	882,015
1944		517,221	90,844	6,078,825	
1945		313,685		2,572,430	
Total	10,492,343	832,188	207,544	13,046,409	2,412,598



Despite the superior products, soldiers in the field wanted a still lighter mask. Jungle fighters and paratroopers used the M2 training gas mask instead of their M2 service gas masks due to the lighter weight and compactness.¹⁸ By 1942, the CWS had created a laboratory at the Massachusetts Institute of Technology in Boston, Massachusetts. They examined the problem and conducted a series of tests, determining that a cheek-mounted canister was the best answer, thus ultimately designing the M5-series mask. The M5 assault gas mask used a modified M3 facepiece with a cheek-mounted M11 canister and was made of neoprene. Production started and stopped in 1944 due to problems with the molding of the facepiece and its tendency to become rigid in cold weather. To provide a quick replacement for the M5 assault gas mask, the CWS adopted the M8 snout-type gas mask as an interim standard article. This mask was an M2 or M3 facepiece with an adapter installed to accommodate the M11 chin-mounted canister. All of these masks were produced in 1945.

Conclusion

During World War II, the CWS manufactured almost 27 million gas masks for soldiers. They planned for mobilization before the start of the war and then adapted as necessary to produce the mask the Army wanted. During World War I, commercial firms produced some masks, but more were produced at the government plant. During World War II, more than 90 percent of the masks produced were by commercial firms. The CWS instituted lessons learned from their World War I experience and put mask production in the hands of commercial firms.

Endnotes

¹ Benedict Crowell, *America's Munitions*, Washington, D.C.: Government Printing Office, 1919, p. 417.

² "The Chemical Warfare Service: From Laboratory to Field," U.S. Army, Center of Military History, Washington D.C., 1959, pp. 19-20.

³ Robert D. Walk, "Mask History—Infantry or General-Purpose Mask," *Army Chemical Review*, February 2001, p. 24.

⁴ *Ibid.*, pp. 24-25.

⁵ Crowell, p. 431.

⁶ *Ibid.*, pp. 426-427.

⁷ *Ibid.*, p. 429.

⁸ Chief of Chemical Warfare Service, American Expeditionary Forces, Memorandum, Subject: Warning to Troops, 20 December 1918.

⁹ Chemical Warfare Technical Committee (CWTC) Conference Number 1, Item Number 1, "Canister, Service, MIX, and Mask; Gas, Service, MIA2-IX-III A1—Subcommittee Report on Standardization," 2 February 1937.

¹⁰ "The Chemical Warfare Service: From Laboratory to Field," U.S. Army, Center of Military History, Washington, D.C., 1959, p. 230.

¹¹ *Ibid.*, p. 314.

¹² *Ibid.*, p. 233.

¹³ Office of the Assistant Secretary of War Statistics Branch, "Statistical Report Number C-17-40," 26 October 1939, <<http://www.fdrlibrary.marist.edu/psf/box6/a71a08.html>>, (3 February 2003).

¹⁴ "The Chemical Warfare Service: From Laboratory to Field," U. S. Army, Center of Military History, Washington D.C., 1959, p. 316.

¹⁵ *Ibid.*, p. 315.

¹⁶ *Ibid.*, pp. 316-317.

¹⁷ *Ibid.*, pp. 81-82.

¹⁸ Walk, p. 25.

References

The following images are used as references: Chemical Warfare Service Specification Sheets C5-2-76, 2 March 1933; C5-2-211, 22 December 1937; C5-2-38, 23 April 1929; C5-2-207, 13 October 1937; and C5-2-401, 28 December 1941.