The Confederate Powder Works at Augusta, Georgia

By Gordon A. Blaker

An Urgent and Critical Need

The Confederate States of America had many brilliant feats of arms during their brief lives. While the victories of the Confederate Army and Navy are well known, there is another area vital to the survival of the new nation that is largely unknown. The best of firearms and cannon are useless without the gunpowder to send projectiles to their targets. It is the story of Confederate gunpowder and the factory built in Augusta, Georgia (Figure 1) that has gone unheralded in the history of the "Late Unpleasantness."

With the beginning of the war in April 1861, the Confederacy faced a severe shortage of gunpowder. The new nation had a supply of powder sufficient for only one month of active service and only a handful of small, obsolete factories to supply its needs.[1] Fortunately for the South, President Jefferson Davis and his Chief of Ordnance, Josiah Gorgas, quickly realized the seriousness of the problem.

George Washington Rains, a brilliant engineer and West Point graduate, was given the mission to solve the problem. Selecting Augusta as the location for the Confederacy's gunpowder factory, Rains began production only seven months after choosing the site. Over the next three years, the Powder Works produced over 3.1 million pounds of high quality gunpowder, an average of 3,000 pounds per day.

Never for Want of Powder

George Washington Rains (Figure 2) was born to Gabriel and Ester Rains on April 13, 1817, the last of their

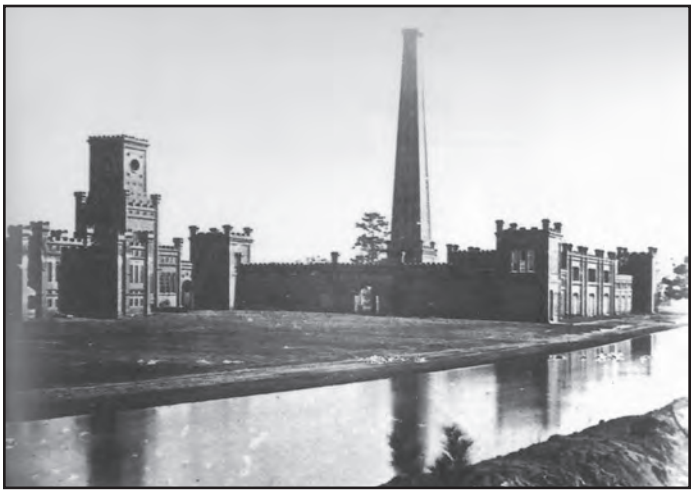

Figure 1. This is the best of only three known photographs of the Powder Works showing the refinery, warehouse and laboratory. (Joseph M. Lee, III)

Figure 2. George Washington Rains in 1861. (Augusta Museum of History)

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five children. The Rains family lived in New Bern, North Carolina where Gabriel was a successful furniture maker and undertaker.[2] George attended the excellent private New Bern Academy where he showed an early aptitude for science.[3] Beginning at the age of 16, George eagerly sought acceptance to the United States Military Academy at West Point. His brother Gabriel, 14 years his senior, had graduated from West Point and was serving at Fort Gibson in the Indian Territory. While awaiting his appointment, George visited his brother on the frontier and spent nearly a year there, where the brothers developed a strong bond that would last the rest of their lives.[4] After frustrating years of waiting, George finally received an appointment to enter the Academy in the summer of 1838. When he graduated in 1842, he was third in his class, first in chemistry, and received the honor of being commissioned in the prestigious Corps of Engineers.[5]

Lieutenant Rains' first assignment was at Fort Warren in Boston Harbor. There he worked on the ongoing construction of the fortifications under the guidance of Colonel Sylvanus Thayer, the distinguished engineer and former superintendent of West Point. While learning much that would prove useful, Rains was bored and in less than a year took the unusual step of requesting a transfer to the artillery.[6]

In the autumn of 1843, Rains reported to Company I, 4th Artillery at Fort Monroe. During his year at Fort Monroe, he was disappointed to discover just how little being an artillery officer had to do with the practice of artillery.[7] In October 1844, Rains returned to West Point to take the position of assistant professor of chemistry, mineralogy and geology.[8] With the beginning of the Mexican War in 1846, Rains was able to secure a transfer to the theater of war, serving under General Zachary Taylor, then on General Winfield Scott's staff and finally as aide-de-camp to Brigadier General Gideon Pillow. During the march from Vera Cruz to Mexico City, Rains saw considerable action, earning two brevets for bravery.[9]

With the end of the war, Rains returned to duty as an engineer officer, serving in Florida, Louisiana, Michigan, Mississippi and finally at Fort Hamilton on New York Harbor. It was there that he met Frances Ramsdell, the daughter of a wealthy industrialist. Following their marriage in 1856, his new father-in-law offered Rains the position of president and partner in the Washington Iron Works and Highland Iron Works in Newburgh, New York. Rains resigned his captain's commission on October 31, 1856 and went to work in manufacturing. Over the next several years he gained valuable industrial experience, became quite prosperous and patented a number of inventions on steam engines and boilers.

When the war came in 1861, the native North Carolinian offered his services to the South. In July 1861, he received a commission as major of artillery with duty to the Ordnance Department under its new chief, Major Josiah Gorgas. Immediately after receiving his commission, Rains was given the nearly impossible mission of solving the Confederacy's gunpowder problem. Rains soon found a very talented young engineer to work with him on creating the best powder factory in the world.

A Genius of High Order

Charles Shaler Smith (Figure 3) was born to Frederick and Mary Anne Shaler Smith in Pittsburgh, Pennsylvania on January 16, 1836. His father died in the great Pittsburgh fire in 1845, leaving Mary Anne with two small children and little means of support. She remarried and Shaler, as he would became known, decided he preferred to live with his maternal grandfather, Charles Shaler, a prominent lawyer and judge. Orphaned at 16, Shaler declined the offer of a college education in law by his grandfather to follow his love of civil engineering.[10]

Smith began his new career as a rodman for a railroad survey crew where he proved himself to be intelligent and hardworking. In 1855, he became assistant engineer on Louisville and Nashville Railroad and within a year had moved up to become resident engineer on the Memphis branch. In 1857, he was again promoted to become an assistant to the distinguished Albert Fink, engineer of buildings and bridges. Under Fink, Shaler perfected his architectural and drafting skills. In 1859, he was charged with managing

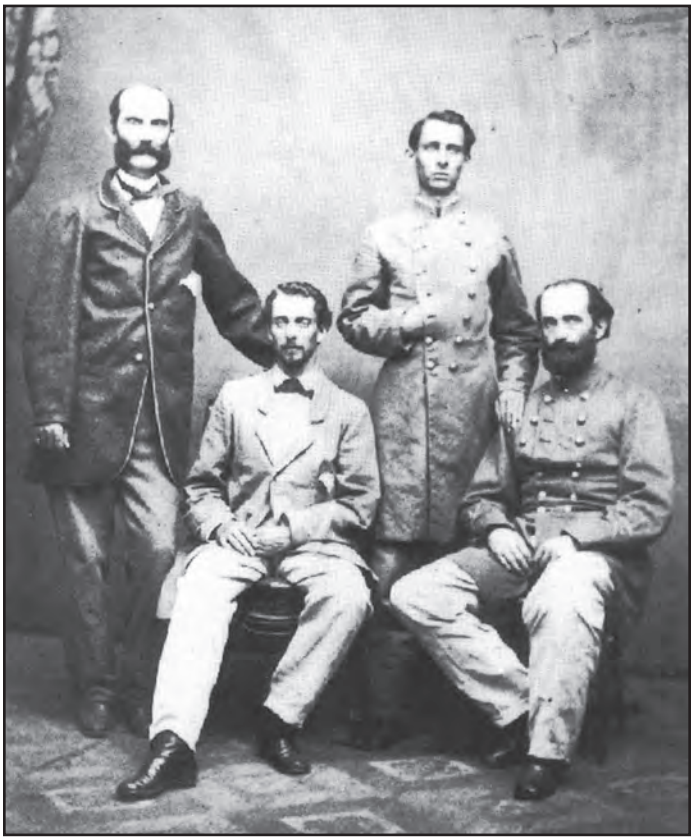

Figure 3. C. Shaler Smith (second from left) and comrades in 1862. (Bryan M. Haltermann)

track and bridge construction for the Tennessee division. In October, he left the Louisville and Nashville to become chief engineer of bridges and buildings for the Wilmington, Charlotte & Rutherford Railroad in North Carolina. In six years, Shaler had risen from rodman to chief engineer.[11]

When the war began, Shaler declined a U.S. Army commission, believing the South was right. He offered his services to the Confederacy and resumed work building bridges for them as a civilian engineer. He came to the attention of Joseph Reid Anderson, owner of Tredegar Iron Works in Richmond, Virginia. Impressed with Shaler's talents, Anderson recommended Shaler to Rains, who was also impressed by the young engineer.[12] Rains appointed Smith chief engineer and later said, "In my young Architect and Civil Engineer, C. Shaler Smith . . . I at once recognized genius of a high order, and placed in his hands my rough sketches of buildings to elaborate and give architectural finish. All know with what result, the fine taste exhibited in the massive and beautiful structures which ornamented the banks of the Augusta Canal, for two miles, bore witness of his success."[13]

The Mission

At the beginning of the war, the Confederacy had an amount of powder that Rains referred to as "scarcely sufficient for one month of active operations."[14] This powder consisted of that seized from United States arsenals in the South and a significant amount purchased by several Confederate States shortly before the shooting began. There were a handful of tiny powder-making establishments in the South, but their operations were outdated and their output intended for local markets and not an army at war. Rains immediately went to work to boost the output of these small powder mills, supply them with the key ingredient, niter (potassium nitrate), also known as saltpeter. At the same time, Rains was to select a site for the construction of a new powder mill to meet all the Confederacy's needs for a prolonged war.

On July 10, 1861, Rains left Richmond for a whirlwind railroad tour of the South. Before departing, President Davis had issued Rains a powerful "carte blanche," giving him unlimited authority to take anything or anyone necessary for him to accomplish his mission.[15] Only 10 days later, he had selected Augusta, Georgia as the future location of the Confederate powder mill. The site he chose was a former arsenal location just outside the city between the Savannah River and the Augusta Canal. With the construction of the Augusta Canal in 1845, the city had become one of the few Southern industrial cities complete with mills, factories and skilled labor. The location offered him everything he was looking for: centrally located with good water and rail links, a good supply of wood for charcoal, a mild climate and lastly a central location far enough from the coast and the enemy lines. Rains said of the location, "All in all, it was remarkable that the most favorable conditions required in the erection of an extensive Powder manufactory were all met at this location, and nowhere else attainable."[16]

During the summer and autumn of 1861, building a new powder factory was only one of Rains' tasks. Because it would take months to construct a new factory, he had to do everything possible to increase the production of powder and niter from the small existing facility. Niter, the key ingredient, was extracted from the limestone caves and Rains worked quickly to accelerate the mining and production throughout the South. In spite of the impressive efforts of mining and producing niter in the South, throughout the war the majority of the Confederacy's niter would come from Europe through the blockade.

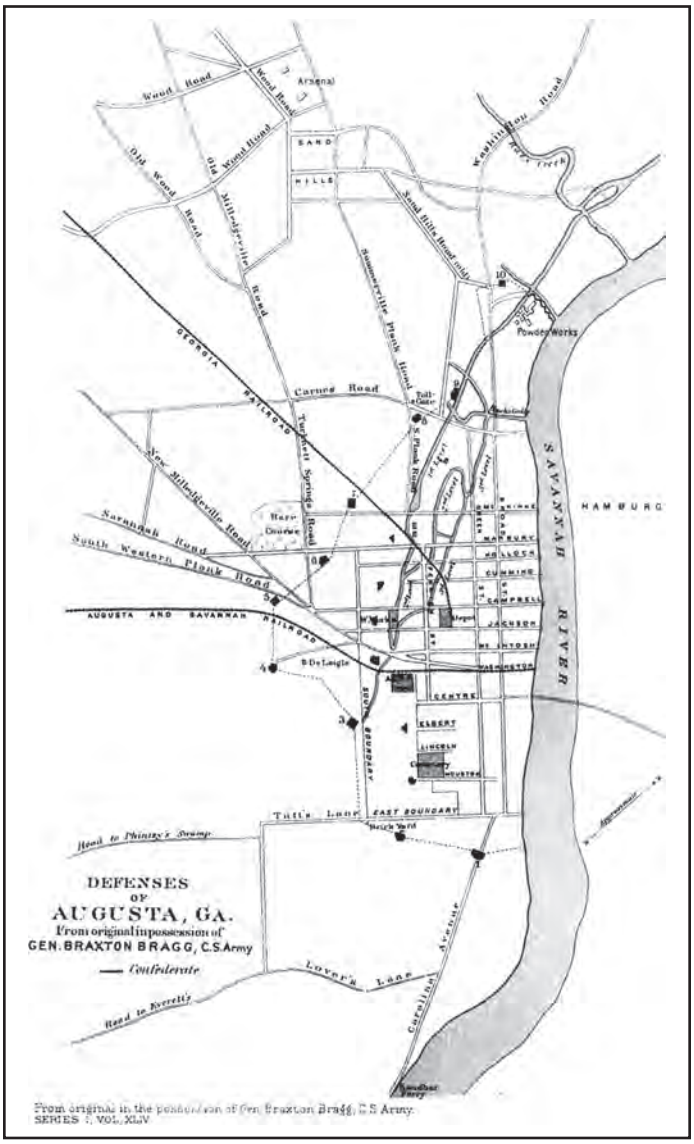

Figure 4. Braxton Bragg's map of Augusta showing the Powder Works (top left), arsenal (top right) and foundry and machine works (center). (Augusta Museum of History)

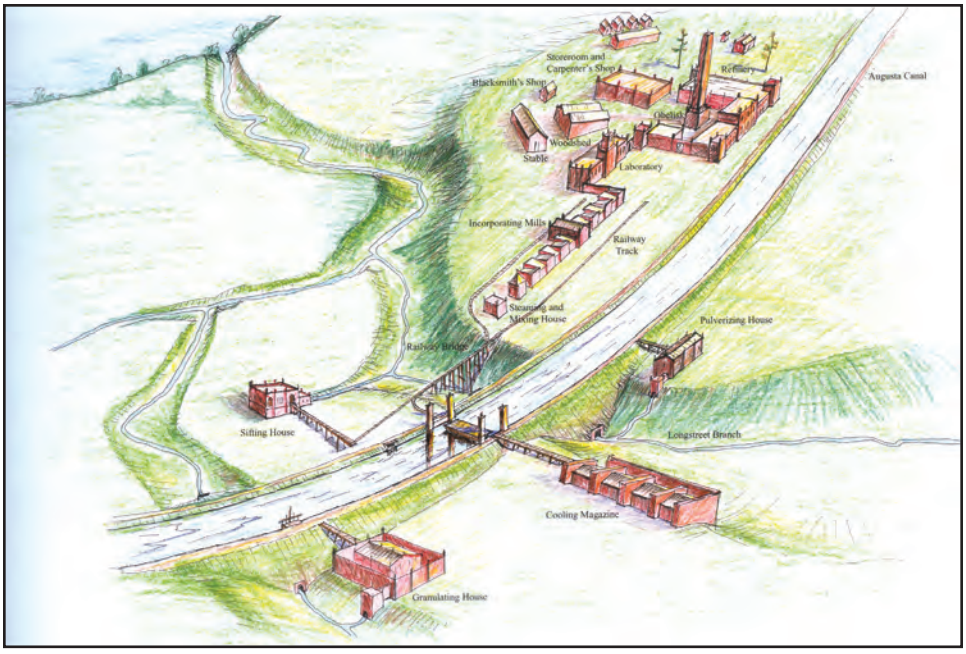

Figure 5. Aerial view of the reconstruction of Powder Works buildings on the old arsenal tract. (Michael C. White)

When Rains received his mission he had no experience in making powder. Fortunately, he discovered a pamphlet and a man who together would be invaluable to Rains and Smith with their immense challenge. The pamphlet was authored by Major Fraser Baddeley, Royal Artillery and was entitled *Pamphlet on the Manufacture of Gunpowder as carried on at the Government Factory, Waltham Abbey*. Unfortunately, the pamphlet contained not a single drawing or illustration to help understand the process. That is where an Englishman named Frederick Wright proved to be the second part of the Waltham Abbey puzzle.[17] Wright had worked at Waltham Abbey and was able to fill in the blanks left by the pamphlet.

While Rains moved around the South, Smith was busy planning the construction of new Powder Works. In early September, Rains, Smith and Miller Grant (an engineer from Savannah and construction supervisor) met in Augusta to coordinate the project (Figures 4 and 5). During Rains' absence, Smith had taken Rains' rough sketches and transformed them into formal architectural plans. Rains and Smith planned for a series of building stretching for two miles up the Augusta Canal. The building would be arranged so that the raw ingredients would be warehoused and refined at the first building nearest the city. As the powder was created it moved from building to building progressively farther and farther up the canal. As the danger increased the buildings were spaced at ever increasing intervals, so that the loss of any one building and operation would not destroy the entire works. Construction began on September 13, 1861.[18]

Producing Powder and its Buildings

The Powder Works consisted of 13 major buildings and a number of lesser buildings. The buildings were both functional and beautiful in the Norman style used by the Smithsonian built in 1855. C. Shaler Smith was chief architect and engineer. Three other men assisted Smith in the planning and supervision of the construction. Miller Grant was an early engineer and architect who probably did not remain in Augusta past the summer of 1862. Albert West was an experienced architect whose exact role remains a mystery. W.H.

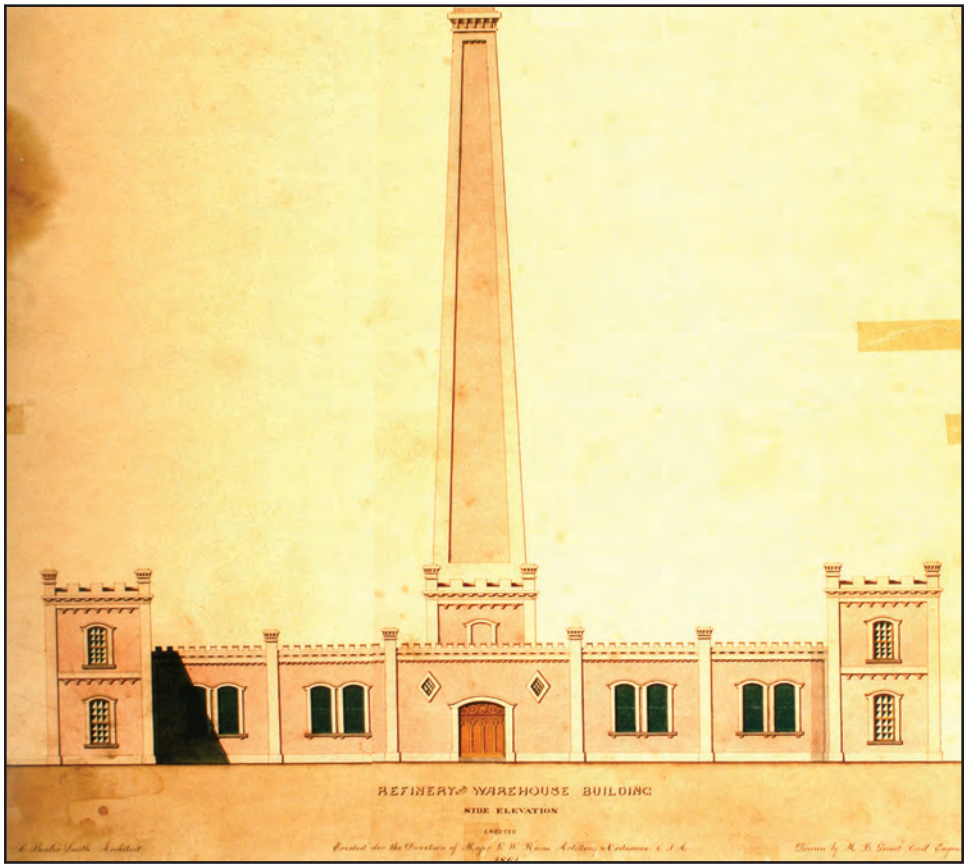

Figure 6. Side view of the refinery and warehouse. (Blanchard Family Collection)

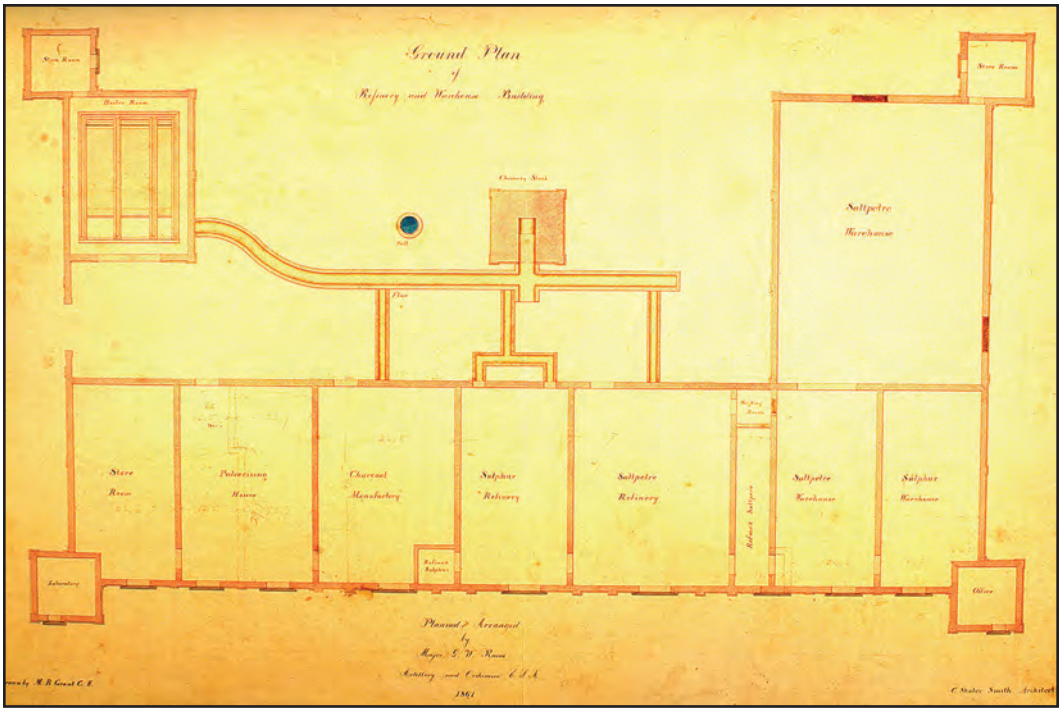

Figure 7. Ground plan of the refinery and warehouse. (Blanchard Family Collection)

Johnson was the principal draftsman and almost half of the surviving architectural drawings are his work.[19]

The initial construction of Powder Works was from September 13, 1861 until production of powder began on April 10, 1862, a period of less than seven months. Although production began, construction was not complete because many of the first buildings used in the steps of powder making were temporary wooden structures gradually replaced by permanent brick buildings during the next two years.

The first building constructed was the warehouse and refinery (Figure 6) where the raw materials were stored and refined. It was a three-walled structure with an open side towards the river and a square tower on each corner (Figure 7). The towers served as the offices and the open back faced the woodshed, which held the wood to be made into charcoal. At the center of the open courtyard was a massive 150-foot tall square chimney (Figure 8). The chimney was fed by a number of underground flues from each of the rooms, which used heat in the refining process. Rains called this structure the "grand monumental obelisk" built to impress approaching visitors to the Powder Works. It was in this building the three ingredients, charcoal, sulfur and niter were first stored and then refined to the highest possible level of purity (Figure 9).

The second building in the sequence was the last major one constructed, not being designed until late 1862. It was intended to be the laboratory for the Powder Works, but records indicated it was never fully completed or used. Even incomplete, it was an impressive structure made of over half a million bricks and standing seventy feet high. The top of the square was intended to house a clock, which was never installed. The top did have a flag pole, from which flew a large Confederate flag (Figures 10 and 11).

The largest of all the buildings was the incorporating mills, stretching nearly 300 feet along the canal. This building consisted of 12 individual incorporating or rolling mills with six on each side of the central engine house (Figures 12 and 13). The engine house contained some of the Powder Works most massive machinery including a 17-foot diameter, 16-inch thick gearwheel, connected to a 12-inch drive shaft which ran beneath the mills in a brick tunnel and provided power to each of the mills (Figure 14). Also in the engine house was a victim of Rains' *carte blanche*, a new 130-horsepower steam engine, which had been destined for an Atlanta factory before being appropriated by Rains. Each

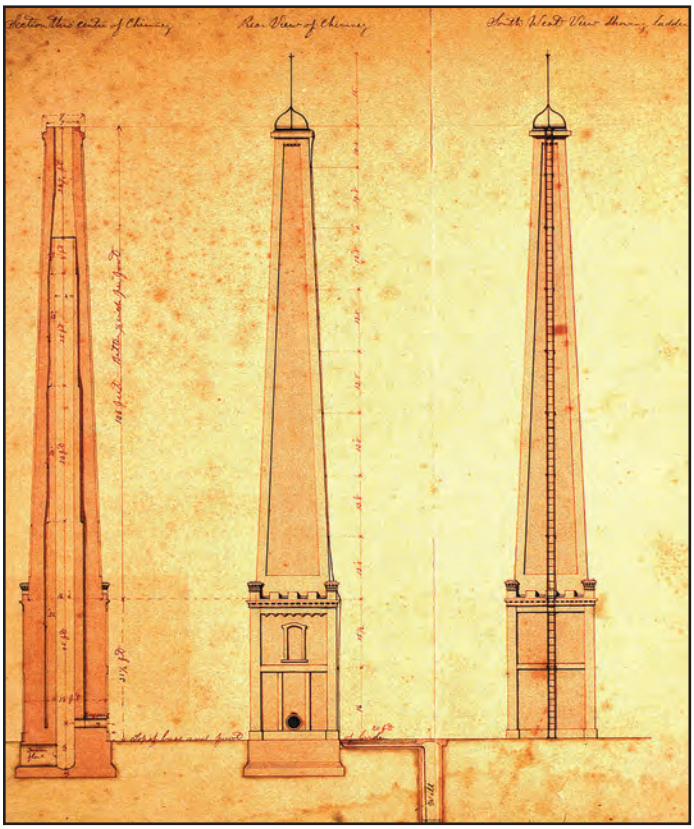

Figure 8. The chimney or "grand monumental obelisk." (Southern Maritime Collection)

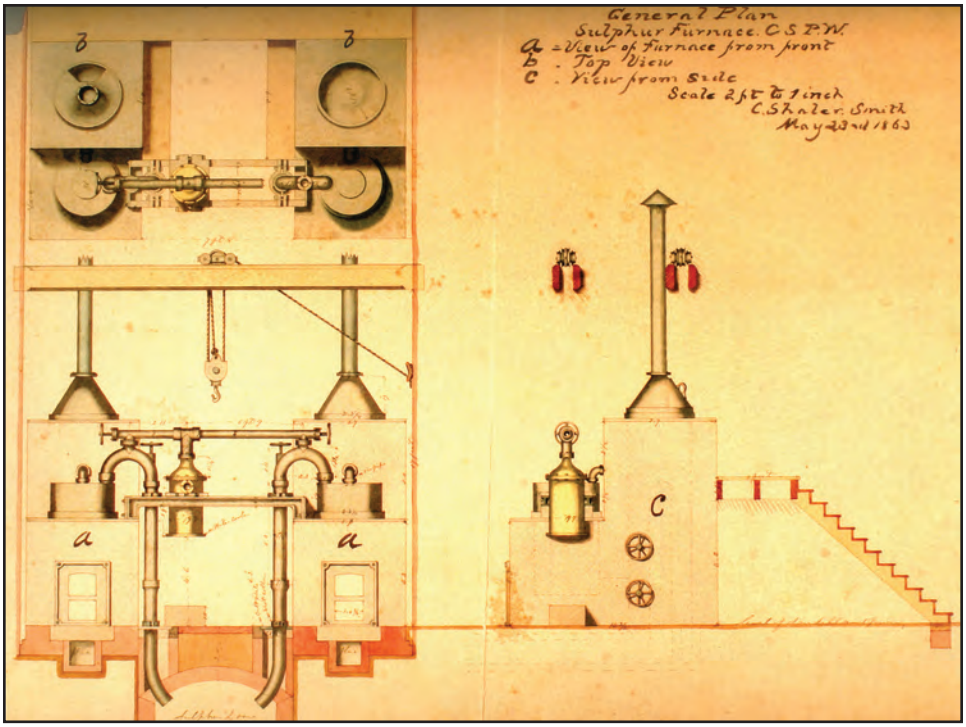

Figure 9. Furnaces for refining sulphur. (Blanchard Family Collection)

Once the mixing was complete, the powder, now known as a mill cake, was removed from the beds in the incorporating mills and put on wooden carts. The carts were very similar to those used in mining except they were constructed entirely of wood for safety. A wooden track system ran along both sides of the incorporating mills to allow for easy movement of the powder mixture. The track system merged at the end of the incorporating mills and ran across a trestle over the Longstreet Branch, a creek that flowed through a culvert under the Augusta Canal. Once across the trestle, the track turned sharply toward the canal. The track crossed the canal over a bridge that could be raised to allow the passage of boats (Figure 15).

The track ran to the cooling magazine where the mixture cooled and dried. This appears not initially part of the process, but was one of many changes and improvements that Rains made to improve the quality of the powder (Figure 16). It was constructed in the spring of 1863, replacing a temporary wooden structure. The building had four chambers and was dug into a hillside to keep the building cool.

of the 12 mills housed a circular iron bed seven feet in diameter. Two iron rollers, six feet in diameter, 15 inches wide and weighing five tons each, were used to roll around the bed to thoroughly crush and mix the ingredients. The rollers ran over the mixture ten times every minute and each batch was mixed for an hour. The more thoroughly the powder mixture was mixed or incorporated, the more efficient the powder. The mixture was kept slightly damp to avoid becoming too dry and creating dust. Powder dust was the great danger in the Powder Works because it was so easily ignited.

Because explosions could and did occur in the mills, a number of safety measures were incorporated in the design and construction. First, the incorporating mills were designed so the mills faced in opposite directions. The walls between each of the mills were between 4 and 10 feet thick while the outer wall and roof were constructed of light-weight wood, zinc and glass. In the case of explosion, the light wall and roof would blow out while the thick brick walls protected the mills on either side. As an additional safety precaution, 30-gallon barrels sat atop each pair of rollers. An iron rod connected all the barrels in the six mills on either side of the engine house. If one mill had an accident, all the mills on that side would be doused with water. During the Powder Works' three years of operation, the mills had three minor accidents, which caused minor damage and proved the success of the safety measures.

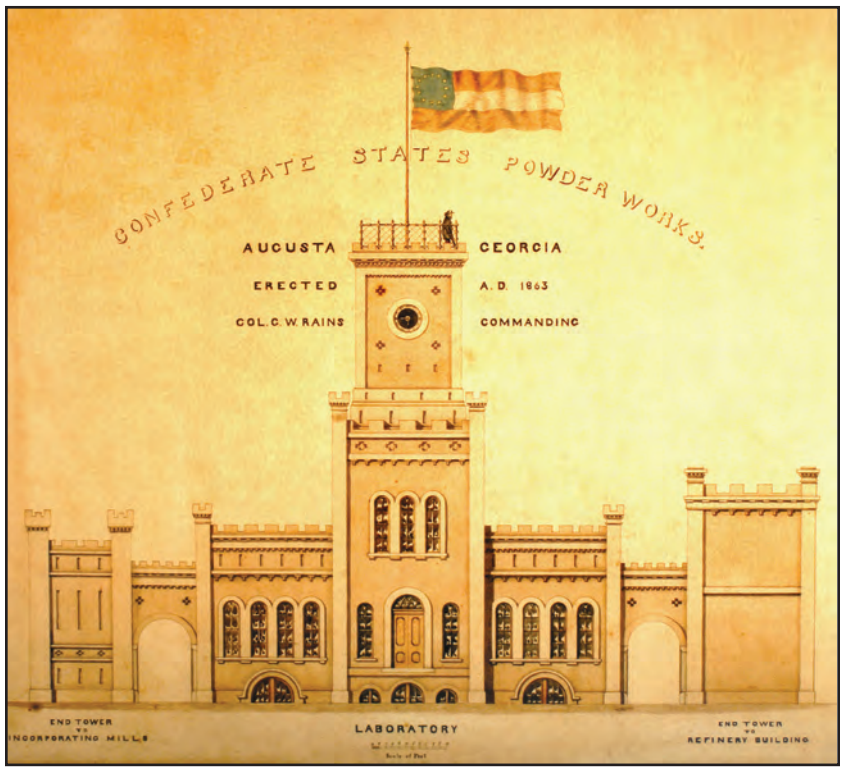

Figure 10. The front of the laboratory. (Professor and Mrs. Douglas Cumming)

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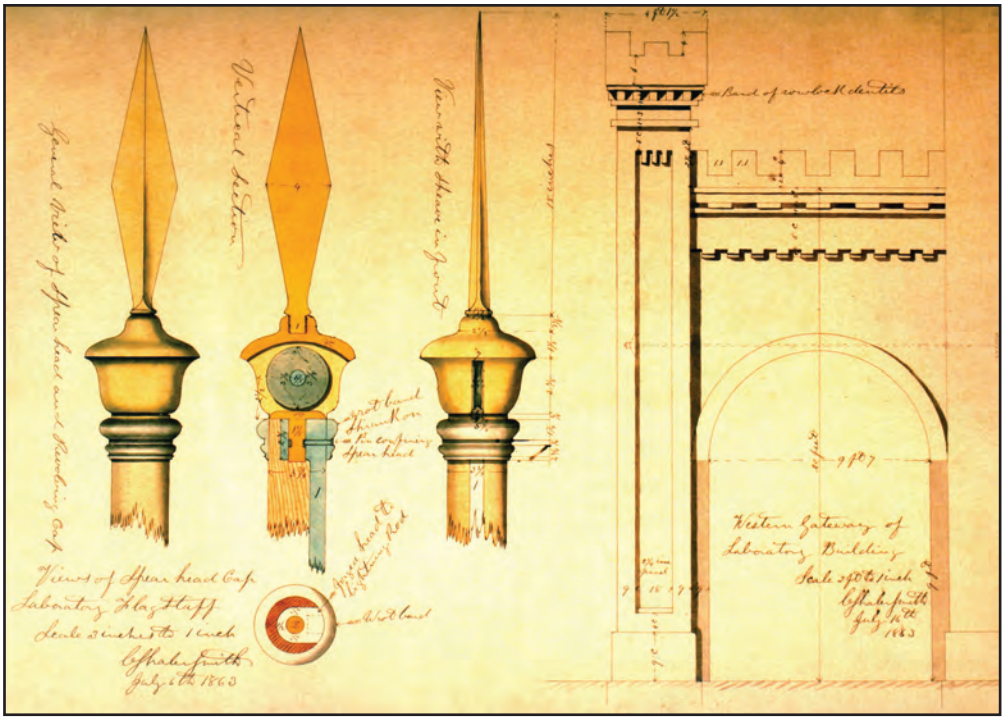

Figure 11. Plan of the flagpole top, with incredible detail. (Blanchard Family Collection)

Next, the hardened mill cakes were broken up by going through rollers to become "mealed" powder. The powder was then pressed, increasing its density. Pressing served two important purposes: by increasing the density it was less likely to produce dust, and denser powder was less susceptible to absorbing moisture. The mealed powder was loaded into a box where it was hydraulically pressed. The box was pressed first from one end and then the other to approximately 70 tons of pressure per square foot. The press house, also known as the pulverizing house, was located next to the cooling magazine on the opposite side of the canal. At various times the operations in the building used horsepower, water-power and steam turbine power.

The sixth step of the powder making was granulation. The powder was moved by one of the two boats used by the Powder Works. The specially built boats were 36 feet in length and included awnings to keep the powder protected from sun and rain. The boats were towed by mules or horses walking along the towpath. Slaves were used for moving the powder from building to building up the canal. Granulation broke the powder into the grain size necessary to function efficiently in the different weapons. Grain size ranged from the "mammoth" grains of 0.6 to 0.9 inches used for large seacoast guns down to dust, which was removed and recycled. The powder cakes were dropped through a series of bronze rollers and sieves that separated the powder in the required grain sizes.

The granulating house was one of the temporary wooden buildings that served through most of the war, 28 of 36 months. Fortunately, the permanent brick granulating building was completed when the temporary building vanished on August 27, 1864. On that date the building held 4,113 pounds of powder and the equipment was not in use. Seven workers were outside waiting for the boat with a guard and boy nearby. The explosion destroyed everything and killed all nine persons, raising a column of fire and debris 500 feet high. The blast was focused upward by a dense growth of pines around the building left to serve as a buffer. Although the cause was never determined, Rains attributed it to smoking as the foreman of the building had been called away when the explosion occurred.[20] This was the only fatal accident at the Powder Works during its three years of operation.

After granulation, the mixture was known as "foul-grain" powder and contained too much moisture and dust to be reliable and efficient. The seventh step was known as dusting, drying and glazing. These processes were done at the dusting, drying and glazing houses—two long brick

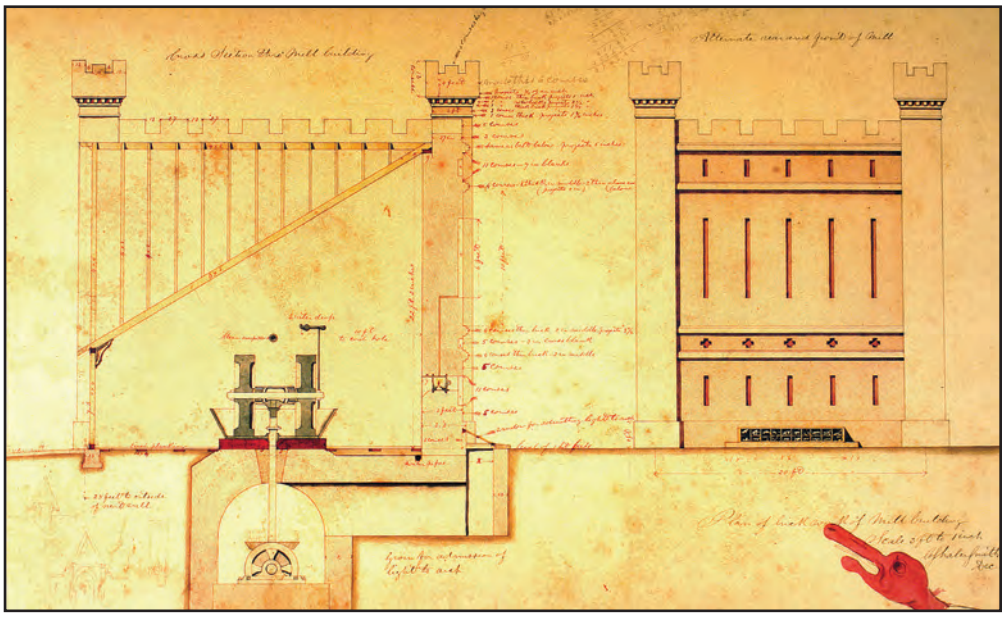

Figure 12. Engine house of the incorporating mills. (Blanchard Family Collection)

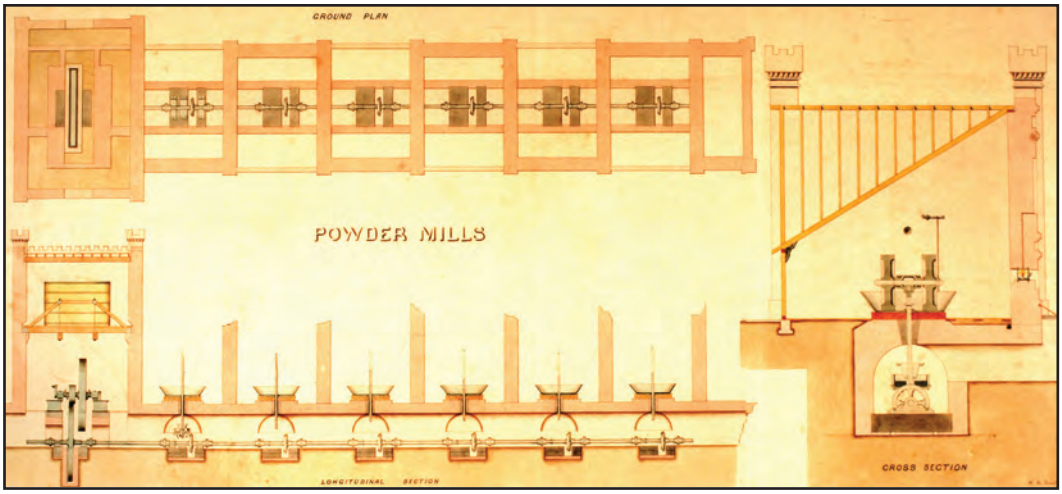

Figure 13. Layout of the incorporating mills. (Blanchard Family Collection)

buildings located side by side. Dusting separated the grains from the dust by means of a dusting reel that spun the dust out through the cloth of the spinning reel. Glazing polished the grains and removed the sharpest edges making a tough exterior more resistant to moisture. Rotating the grains in barrels for a number of hours performed the glazing process. Drying was done either by exposure to sunlight or heating to approximately 140 degrees. Both methods were employed at various times with the steam-heated drying room being the best method (Figure 17).

The powder was now finished and from the dusting, drying and glazing houses traveled up the canal 1,500 feet to the packing house. There the powder was weighed and packed in boxes, barrels, kegs or canisters. Traditionally, powder had been packed in barrels, but Rains discovered boxes were better and designed a box one foot square and two and one-half feet long.[21] They were stronger, more could be packed into a space and they did not roll away at the wrong time. Gradually, boxes replaced the less desirable barrels. Kegs held 25 pounds and metal canisters half a pound. The containers were loosely packed to avoid caking.

From the one surviving example, we know containers were marked with paper labels identifying the type of powder, weight and source as "Govt. Powder Works, Augusta, Ga." Smaller labels were added at the time of packing, showing the month and year of packing (Figure 18).

The packed powder was then transported to the magazine three-quarters of a mile farther up the canal. The building was located about 100 yards from the canal and surrounded by a high wooden fence. It was the only permanent building made of wood, and the only one without an existing drawing. It had a capacity of 100 tons, but records indicate the most it ever held was 65 tons. A railroad spur connected the magazine with the main Georgia Railroad line.

Production at the Powder Works

In its three years of operation, the Confederate Powder Works produced 3,378,118.2 pounds of powder. Another 272,505 pounds were received from various sources. When production ended, there were 59,236.5 pounds remaining on hand.[22]

Approximately 70 percent of the powder shipped was for artillery and 30 percent for small arms. A wide variety of powder was made with the three largest categories (87 percent) being Columbiad, cannon and rifled-musket.

The following tables provide additional details on the production and shipment of powder.

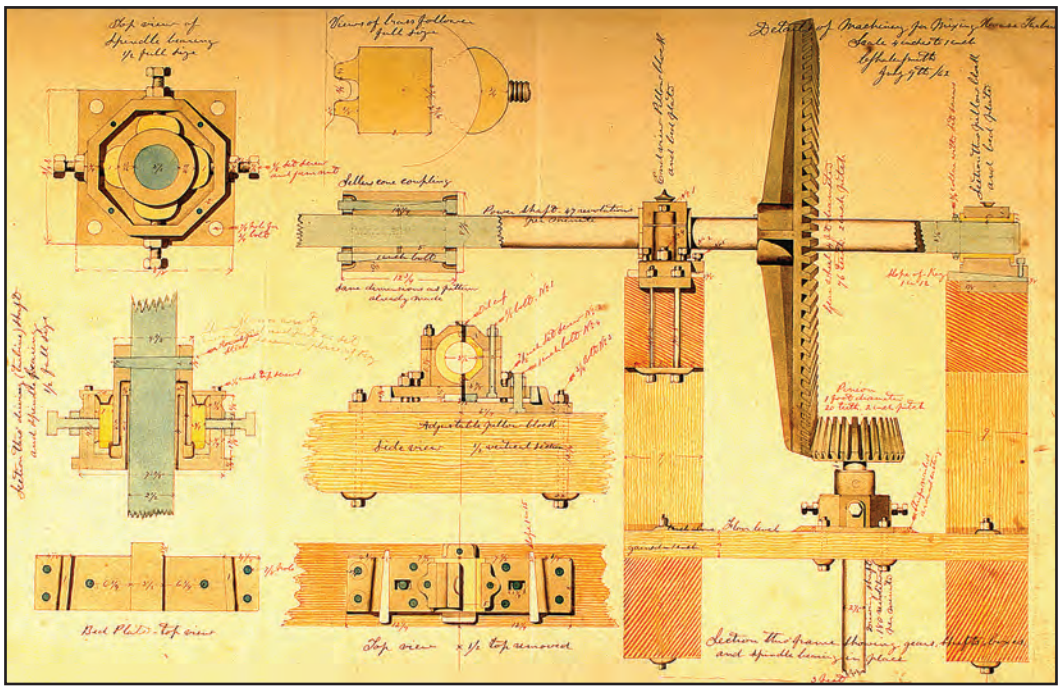

Figure 14. Machinery drawing for mixing house. (Blanchard Family Collection)

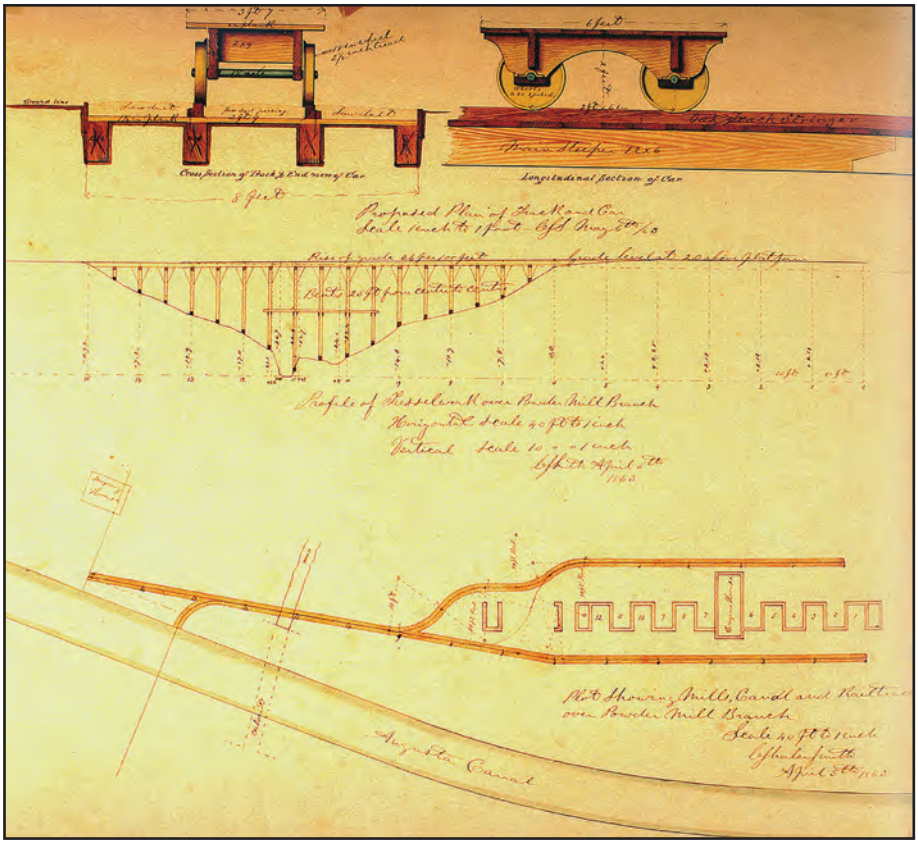

Figure 15. Plan of the rail system linking the incorporating mills, mixing house and cooling magazines. (Blanchard Family Collection)

The operation at the Powder Works was interrupted twice, both times by the threat posed by General William T. Sherman's army. On November 15, 1864 Sherman's army left Atlanta, headed east and south into the interior of Georgia. The left wing was composed of two corps of veteran troops headed east towards Augusta. Realizing the impossibility of defending Augusta against such a force and what the loss of the Confederacy's powder factory would mean, Rains began dismantling the machinery on November 21. In the next several days, key machinery was dismantled, loaded aboard rail cars and moved towards Columbia, South Carolina. The trains returned on December 6 when it became apparent that Augusta was not the target. Production resumed on Christmas Eve.[23]

Sherman again threatened Augusta in February 1865 as his army moved out of Charleston and marched into the interior of South Carolina. On February 10 the dismantling began again. This time, the threat was brief and production resumed on February 15. Production did not cease until the end of April when Rains received word of General Johnston's surrender on April 26, 1865.

Aftermath

Following the end of the war, the Powder Works buildings were used for housing former employees, freed slaves and U.S. Colored Troops. The buildings deteriorated until 1871 when the last pieces of the property were sold at auction. The city of Augusta was planning an enlargement

Powder Shipped by Type

Type of Powder	Weight	Percentage
Columbiad	1,207,425	35.72%
Cannon	1,036,446	30.70%
Rifled Musket	720,465	21.34%
Musket	129,473	3.83%
Rifle	110,399	3.27%
Mortar	87,372	3.27%
Pistol	43,761	1.30%
Blakely/Great Gun	34,213	1.01%
Sporting	6,568	0.19%
Total	3,376,123	

Destinations of powder shipped

Destination	Weight received
Richmond, VA	836,100
Charleston, SC	665,851
Augusta Arsenal	343,502
Mobile, AL	254,074
Selma, AL	230,016
Wilmington, NC	148,500
Macon, GA	145,200
Savannah, GA	141,175
Jackson, MS	131,857
Columbus, GA	93,916
Atlanta, GA	92,550

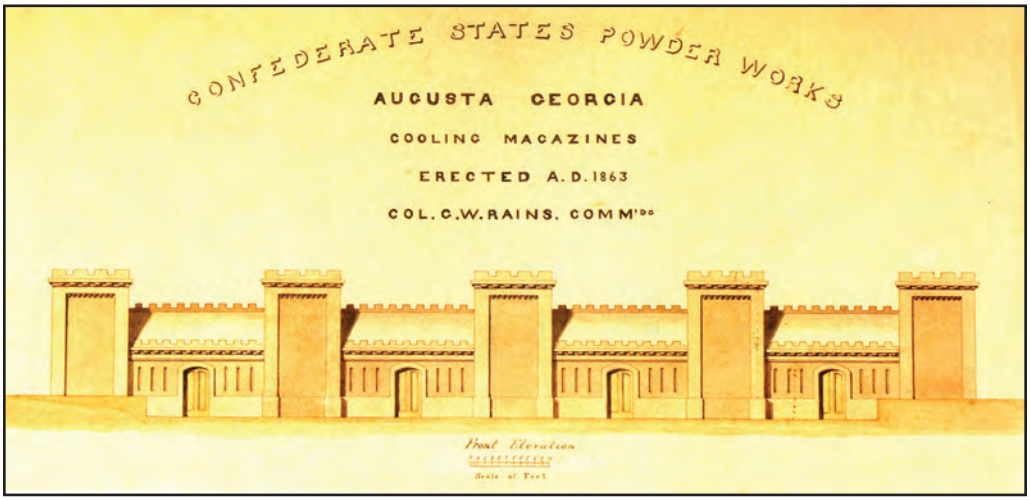

Figure 16. The cooling magazines. (Blanchard Family Collection)

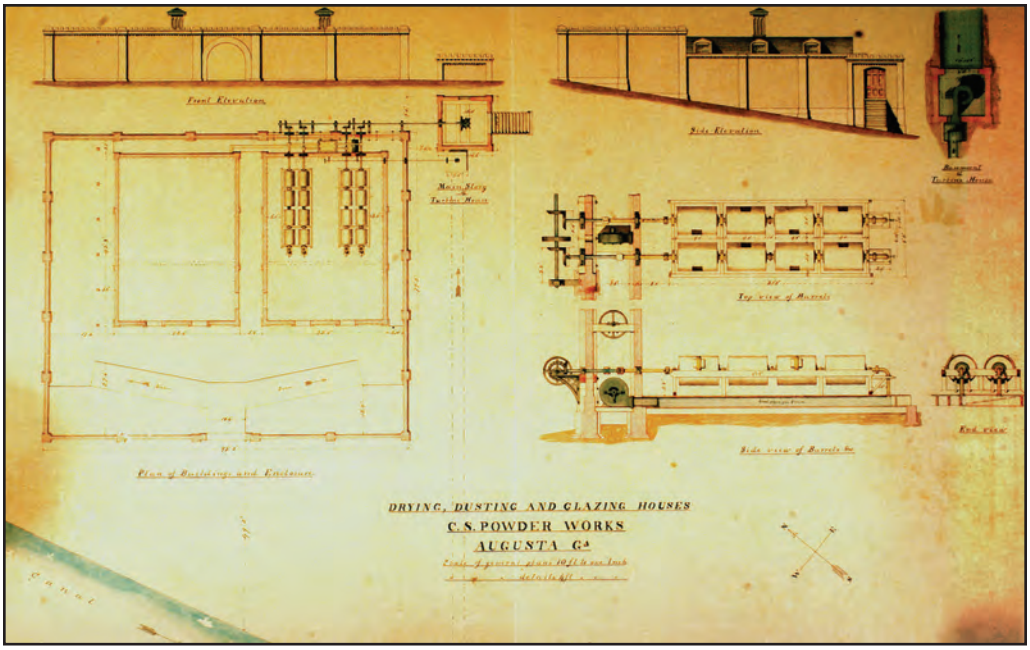

Figure 17. Drawing of the drying, dusting and glazing houses. (Blanchard Family Collection)

of the Augusta Canal and purchased the land. Shortly after that, most of the buildings were torn down. Rains was at the Medical College of Georgia in Augusta at that time. He appeared before the city council to request the chimney, or grand monumental obelisk, be preserved as a memorial to the Confederate war dead. The council agreed and added a marble plaque to honor the dead, and years later one was added in honor of Colonel Rains. The salvaged bricks were used to build the Sibley Mill just behind the chimney. The mill was constructed in a similar style of architecture and now provides a nice backdrop to a view of the chimney from across the canal (Figure 19).

C. Shaler Smith married an Augusta woman just after the war ended and returned to engineering work. Within a few years, he was recognized as one of the foremost bridge engineers in the country. He pioneered the cantilever bridge design, bridging several of the most challenging rivers in the Midwest. He was injured in a fall during construction of the St. Louis Exposition building in 1884 and died on December 19, 1886 as a result of his injuries. He is buried in the Summerville Cemetery in Augusta.

George Washington Rains remained in Augusta after the surrender and accepted a professorship in chemistry at the Medical College of Georgia in 1866. As ignorant of medical matters as he had once been of gunpowder, Rains worked hard and in 1880 was made dean of the college. He served

Figure 18. Label on barrel head for 100 lbs. of large cannon powder. (Augusta Museum of History)

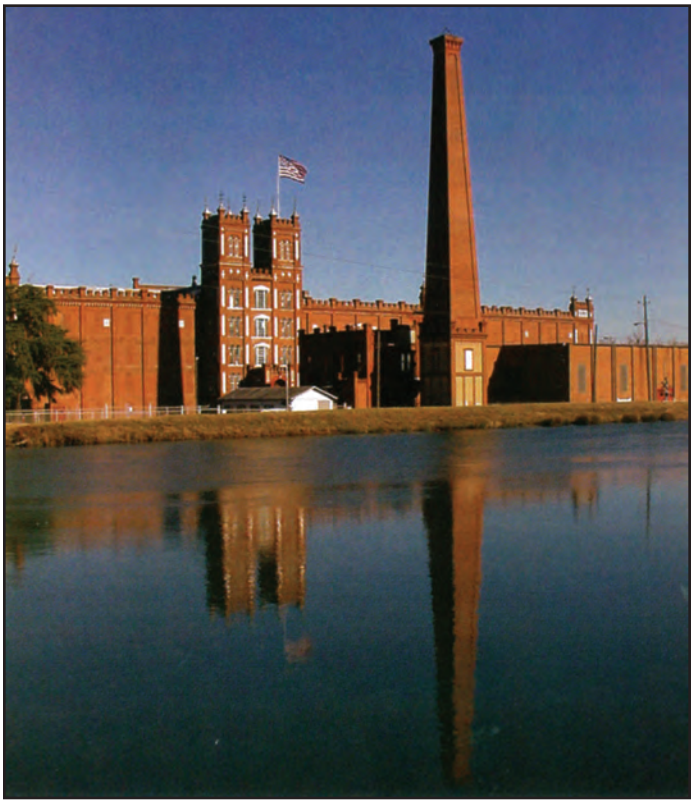

Figure 19. The "grand monumental oblesik" in front of Sibley Mill in 2003.

four years as dean before returning to teaching. He continued teaching until he retired at age 77 in 1894, being honored as professor emeritus. He returned to his wife's home in Newburgh, New York where he died on March 21, 1898. He is buried in Newburgh with his wife and daughter.[24]

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Note: This article is a very small summary of a selected amount of the material found in the books listed below. They are highly recommended for those interested in greater detail of the subjects lightly touched on in this article.

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