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**Confederate Ordnance During the War.
THE DIFFICULTY OF OBTAINING IT.**

Plan Proposed to Increase Accuracy and Range of Smooth-Bore Muskets by Firing and Elongated Projectile Made of Lead and Hard Wood.

William Le Roy Broun, President Alabama Polytechnic Institute, Auburn, formerly lieutenant-colonel of ordnance of the Confederate army, commanding the Richmond Arsenal, contributes the following article to the Journal of the United States Artillery of April, 1898:

In complying with your request to write an article for your Journal, giving experiences and difficulties in obtaining ordnance during the war, I will endeavor, relying on my memory and some available memoranda preserved, to give you a statement of the collection and manufacture of ordnance stores for the use of the Confederate armies, so far as such manufacture was under my observation and control. After a year's service in the field as an artillery officer, I was ordered to Richmond and made Superintendent of Armories, with the rank of major in the regular army, a new officer in the Confederate States Army, and sent to various points in North Carolina and Georgia to inspect and report on the facilities possessed by different manufactories for making arms, swords, sulphuric acid, etc.

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As a general rule the facilities for manufacturing were meagre and crude, giving little prospect for an early serviceable product.

Early in the spring of 1862 I was ordered to report at Holly Springs, Miss., and take charge of a factory just purchased by the Confederacy, and designed for the manufacture of small arms. It was not many months before the defeat of the Confederate army under General Albert Sydney Johnston, at Shiloh, Tenn., cause a hurried removal of all the machinery to Meridian, Miss. Having reported to the chief of ordnance at Richmond, Va., I was assigned to duty connected with the Ordnance Department.

The Confederate Congress had authorized the appointment of fifty new ordnance officers, and the applications to the War Department became so numerous and persistent for these appointments that the Secretary of War, Colonel Randolph, ordered that all applicants should submit to an examination, and that appointments would be made in order of merit, as reported by the Board of Examiners. Thus, what we are now familiar with as

civil-service examinations, were introduced by the Confederate War Department in 1862, in the appointment of ordnance officers.

I was made Lieutenant-Colonel of Ordnance, and as President of the Board, with two other officers, constituted the Board of Examiners. By direction of General J. Gorgas, the Chief of Ordnance, I prepared a Field Ordnance Manual by abridging the old United States Manual and adapting it to our service when necessary. This was published and distributed in the army.

The examination embraced the Field Ordnance Manual, as contained in this abridged edition, the elements of algebra, chemistry and physics, with some knowledge of trigonometry. The first examinations were held in Richmond. Of course, the fact of the examinations greatly diminished the number of applicants. Of those recommended by the Board, so many were from Virginia that the President declined to appoint them until an equal opportunity was given to the young men of the different armies of the Confederacy in other States.

Hence, I was directed to report to and conduct examinations in the armies of Generals Lee and Jackson in Virginia, General Bragg in Tennessee, and General Pemberton in Mississippi. Under other officers, examinations were conducted in Alabama and Florida.

The result of this sifting process was that the army was supplied with capable and efficient ordnance officers.

Early in 1863 I was appointed commandant of the Richmond Arse-

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nal. Here the greater part of the ordnance and ordnance stores were prepared for the use of the Confederate armies.

The arsenal occupies a number of tobacco-factories at the foot of Seventh street, near the Tredegar Iron Works, between Cary street and James river. It included all the machine-shops for working wood and iron, organized into different departments, each under subordinated officers, arranged to manufacture ordnance stores for the use of the Confederate army.

Cannon were made at the Tredegar Iron Works, including siege and field guns. Napoleons, howitzers and banded cast-iron guns. Steel guns were not made. We had no facilities for making steel, and no time to experiment.

The steel guns used by the Confederates were highly valued, and with the

exception of a few purchases abroad, were all captured from the Federals.

At the beginning of the war the machinery belonging to the armory at Harper's Ferry was removed to Richmond, and there established. This armory manufactured Enfield rifles, and the product was very small, not exceeding 500 per month.

With the exception of a few thousand rifles, the soldiers, at the beginning of the war, were armed with the old smooth-bore muskets, and with old Austrian and Belgian rifles imported. These they exchanged for Enfield rifles, as they were favored by the fortunes of war.

In the summer of 1862, after the Seven Days' battles around Richmond, between General Lee and General McClellan, men were detailed to collect arms from the field, which were carried to the Richmond Arsenal, and then, as quickly as possible, repaired and reissued to the army. Subsequently, through the blockaded runners, a large importation of excellent rifles was received and distributed.

When the men detailed for this purpose were collecting the thousands of Enfield rifles left by the Federals on the battle-fields around Richmond, I remembered seeing a few steel breast-plates that had been worn by the Federal soldiers who were killed in battle. They were solid steel, in two parts, shaped to fit the chest, and were worn under the coat. These were brought as curiosities to the Arsenal, and had been pierced by bullets. I remember this as a fact of my own knowledge. Some years ago the charge that some of the Federal soldiers wore breast-plates was denied and decried as a gross slander, and in reply thereto I published in the Nation the statement here made. These, no doubt, represented a few sporadic cases, worn without the

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knowledge of others. The Confederate soldiers had to rely for improved arms on captures on the battle-field, and no importation, when the blockade could be avoided, having available no large armory.

The Tredegar Iron-Works at Richmond, Va., was the chief manufactory of siege and field-guns, all cast iron and smooth bore. The large Columbiads were made there, also the howitzers, 12-inch bronze Napoleons, etc. But the highly-valued banded Parrot 3-inch rifles, with which the army was well supplied, were, as a rule, captured on the battle-field.

As the war continued great difficulties were experienced in obtaining the needful ordnance supplies, and many devices were resorted to. After the

battles about Chattanooga, Tenn., when the Confederacy lost possession of the copper mines, no more bronze Napoleons could be made; but, instead thereof, a light cast-iron 12-pounder, well banded after the manner of the Parrot guns, was made, and found to be equally as effective as the Napoleon.

At the beginning of the war it must be remembered the Confederacy had no improved arms, no powder-mills, no arsenals, no armories, no cap machines, and no improved cannon. All supplies at first, were obtained by importation, though the blockade subsequently cut off this foreign supply. All arms were percussion-cap lock, and issued to the troops.

To keep a supply of percussion-caps was a difficult and very serious problem, as the demand for caps was about twice as great as it was for cartridges.

The machines made after the United States pattern did not yield a large supply, and simpler and much more efficient machines for making, fitting, pressing, and varnishing caps were invented and made by Southern mechanics.

After the Federals obtained possession of the copper-mines of Tennessee great anxiety was excited as to the future store of copper, from which to manufacture percussion-caps.

The casting of bronze field-guns was immediately suspended, and all available copper was carefully hoarded for the manufacture of caps. It soon became apparent that the supply would be exhausted, and the armies rendered useless unless other sources of supply could be obtained. No reliance could be placed on the supply from abroad, though large orders were forwarded, so stringent was the blockade; of course, the knowledge of this scarcity of copper was not made public.

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In this emergency, it was concluded to render available, if possible, some of the copper, turpentine and apple-brandy stills which still existed in North Carolina in large numbers.

Secretly, with the approval of the Chief of Ordnance, an officer was dispatched with the necessary authority to purchase or impress all copper stills found available, and ship the same, cut into strips, to the Richmond Arsenal. By extraordinary energy, he was enabled to forward the amount necessary for our use. The strips of copper of these old stills were rerolled

and handed over to the cap manufacturer. And thus were all the caps issued from the arsenal and used by the armies of the Confederate States, during the last twelve months of the war, manufactured from the copper stills of North Carolina.

After the completion of the cap-machines, which were an improvements on the old United States machine, eight hands only, two being men, the others boys and girls, frequently manufactured from the strip copper over 300,000 caps, within eight hours, stamping, filling, preparing and varnishing them.

These cap machines thus had a capacity of producing a million a day.

These caps made at the arsenal were frequently tested, and pronounced to be superior in resisting of moisture and in general efficiency.

For the completion of these machines, the Confederate Government awarded the inventor-an employee of the arsenal-the sum of \$125,000, being an equal to \$2,00 in gold.

To manufactures the fulminate of mercury, we needed nitric acid and mercury.

A quantity of mercury was obtained early in the war from Mexico. To make nitric acid we required nitre and sulphuric acid. The sulphuric acid we manufactured in North Carolina, after many failures and difficulties, especially in obtaining the lead to line the chambers.

Nitre was made by the Nitre and Mining Bureau, especially organized for that purpose. Everywhere about the environs of Richmond could be seen large earthen ricks and heaps which contained dead horses and others animals, designed for use in the manufacture of nitre. The available earth from caves was also made to yield its quota of nitre. With this sulphuric acid and nitre, on the banks of the James river, we manufactured the nitric acid required in the manufacture of fulminate.

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Near the close of the war the supply of mercury became exhausted. Here was a most serious difficulty. We had not, and could not obtain, the mercury, and essential material with which to manufacture fulminate of mercury, and without caps the army could not fight, and must be disbanded. This was an extremely serious situation, as no mercury could be obtained in the limits of the Confederacy. We began to experiment on substitutes, and fortunately found in Richmond two substitutes-chloride of potash and sulphuret of antimony-which, when properly combined, answered the

purpose satisfactorily. And the battles around Petersburg during the last few months of the war, were fought with caps filled with this novel substitute. Our lead was obtained chiefly, and in the last years of the war, entirely, from the lead-mine near Wytheville, Va.

The mines were worked night and day, and the lead converted into bullets as fast as received.

The old regulation shrapnel shells were filled with leaden balls and sulphur. The Confederacy had neither lead nor sulphur to spare, and used instead small iron balls, and filled with asphalt.

We had no private manufactories established, which could furnish the appliances needed, and frequently everything had to be done from the very beginning by the ordnance department, and the army in the field. For instance, to run the forges to make the irons for the artillery carriages, we needed charcoal. To obtain this, I purchased the timber of a number of acres of woodland of the south side of the James river, and secured a detail of men to burn the charcoal for the use of our forge department.

During the winter men from General Lee's army cut the timber and shipped it to Richmond, with which artillery carriages were made on which to mount the guns to fight the battles in the spring. Men appointed for that purpose followed the army and collected the hides of the slaughtered animals that were used to cover the saddle-trees made of timber, cut by temporary details of men from the army in the field.

As the war continued, efforts were made to build permanent and well appointed arsenals, as at Macon and Augusta, Ga.

The large arsenal at Augusta, under the management of Colonel Rains, was especially devoted to the manufacture of powder. Toward the close of the war it was making an abundant supply of very superior character, equal and in some respects superior to that imported from foreign countries.

Under the demands of necessity, in many instances, cotton con-

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verted into rubber cloth was used in the manufacture of infantry accoutrements, and was found especially useful in making belts for machinery. Models of inventions were frequently sent to the arsenal, of which large numbers were valueless, and those good in theory could not be tried for want of skilled machinists and ordnance supplies. I remember on

one occasion-the last year of the war-that a large number of Spencer breech-loading rifles, the result of a capture, were turned over to the arsenal, and though greatly desired by the troops, could not be issued for want of ammunition. In the effort to make the cartridges for the Spencer rifles, in the first place tools had to be devised, with which to make the tools used for making the cartridges. Hence the surrender of Richmond came before the cartridges were made.

A plan was proposed at the arsenal to increase the accuracy and range and thus render available and more efficient the smooth-bore muskets in possession of the Confederacy.

The plan proposed was theoretically correct, and is worth mentioning, inasmuch as very late in the war the identical plan was sent to President Davis from Canada, as a scientific gift of great value.

This was sent by him to the War Department, and hence found its way to the arsenal, where the drawings were regarded with interest, since they corresponded exactly with those made at the arsenal years previously.

The idea was to fire an elongated compound projectile, made of lead and hard wood, or papier mache, with spear-point shaped head and shaft of lead-the shaft portion to be enclosed in a hollow sabot of wood or hard papier mache.

On firing, the lighter material, moving first, would press outwards the arrow head, and thus destroy windage, and the flight of the trajectory would be as an arrow, without rotating on the shorter axis, inasmuch as the centre of inertia of the projectile would be in advance of the centre of resistance of the air. At least that was the theory of the compound projectile, devised for the old smooth-bore musket.

An attempt was made to use on the field round concussion shell from the howitzers as mortars. In this concussion shell a friction primer, properly wrapped, acted as a fuse, its head terminated in a bullet, which rested on the shoulder of the brass fuse that screwed into the shell, leaving an unfilled hollow space about the bullet. When the round shell struck any point, except that exactly in rear of the prolongation of the wire, put in the axis of the bore by using a sabot, the momentum of the bullet would draw the friction primer

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and explode the shell, regardless of the point on which a round shell struck.

A gun-carriage was made for howitzers with a jointed trail, as thus they could be used a mortars, and fired at a high angle.

These were rather experiments than instances of success, and are only mentioned now to show that the ordnance officers did something more than simply attempt to imitate the Federals.

They were prevented from accomplishing what they planned by reason of the want of machinery to do the necessary work.

During the siege around Petersburg it was discovered that the shells used for the large Parrot guns were very defective-that is, had but very short range. The shells would start off and fly well and straight, revolving on the longer axis during the first half of the trajectory, and then suddenly whirl on the shorter axis and drop almost vertically. One can tell by the ear the instant the axis of revolution changes, if one gun is fired. The action of the shell being observed, the cause was obvious and a remedy suggested itself. The center of the resistance of the air at the summit of the trajectory was in advance of the centre of inertia, and produced a couple that caused the rotation on the shorter axis. The obvious remedy was to make the front of the shell hemispherical instead of conoidal, and diminish its length, and thus put the centre of gravity forward of the centre of resistance. With this change made, the maximum range was attained; and the complaints of the artillerist ceased.

When we consider the absence of manufactories and machinery and of skilled mechanics in the South at the beginning of the war, its successfully furnishing ordnance supplies for so large an army, during the four eventful years, is a striking evidence of the energy and resources and ability of its people.

The success of the Ordnance Department was due to its able chief, General J. Gorgas, and in large measure to the intelligence and devotion of its officers, selected by the sifting process of special examination.

I must add this, that never was an order received from General Lee's army for ammunition that it was not immediately supplied, even to the last order to sent a train-load of ammunition to Petersburg, after the order was received for the evacuation of Richmond.

As continuous work was necessary to keep a supply of ammunition at times serious difficulties threatened the arsenal, not only from scarcity of supplies of material, but also from depreciation of our currency.

Food supplies were very scarce in Richmond, and became enormously high in Confederate currency, and during the very severe last winter of the war all the female operatives who filled cartridges with powder, left the arsenal and struck for higher wages. These were trained operatives, and the demand for ammunition was too great to afford time to train others even if they could have been secured.

An increase in money wages would not relieve the difficulty.

I remember once being, early in the morning, on the island in James river, with the ice and frost everywhere, surrounded by a number of thinly-clad, shivering women, and, mounting a flour barrel, I attempted to persuade them by appeals to their loyalty and patriotism to continue at their work until better arrangements could be made.

But patriotic appeals had no effect on shivering, starving women. Very fortunately at this juncture a vessel with a cargo for the Ordnance Department ran the blockade at Wilmington, N. C., laden, not with rifles and powder, but with bacon and syrup and articles for food and clothing, these being of extreme value. An ordinance store was immediately established, and food and clothing sold to the employees of the arsenal at one-fourth the market price. This fortunate cargo made all happy and relieved the impending difficulty.

I submit herewith a statement of the principal issues from the arsenal made up to January 1, 1865.

This can be relied on as accurate, having been copied from the official reports preserved at the arsenal, consolidating all issues.

The report was prepared by my order, furnished the Richmond Enquirer, and published the day of the evacuation of Richmond.

A copy was published in the New Eclectic Magazine, April, 1869, from which this extract is taken.

STATEMENT OF PRINCIPAL ISSUES FROM THE ARSENAL.

Statement of principal issues from the Richmond Arsenal, from July 1, 1861, to January 1, 1865:

Artillery Equipments, etc.-341 Columbiads and seige-guns; 1,306 field pieces of all descriptions; 1,375 field-gun carriages; 875 caissons; 152 forges; 6,825 sets artillery harness; 921,441 rounds field, seige and sea-coast ammunition; 1,456,190 friction primers; 1,110,966 fuses; 17,423

port-fires; 3,985 rockets.

Infantry and Cavalry Arms, Accoutrements, etc.-323,231 infantry arms; 34,067 cavalry arms; 6,074 pistols; 44,877 swords and sabres;

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375,510 sets of infantry and cavalry accoutrements; 188,181 knapsacks; 478,498 haversacks; 328,977 canteens and straps; 115,087 gun and carbine slings; 72,413,854 small arm cartridges; 146,901,250 percussion caps; 69,418 cavalry saddles; 85,139 cavalry bridles; 73,611 cavalry halters; 35,464 saddled-blankets; 59,624 pairs spurs; 42,285 horse-brushes; 56,903 curry-combs.

The enormous amount of "thirteen hundred field pieces of all descriptions," classed among the issues, does not signify that that number was manufactured at the arsenal, but that number includes all those obtained by manufacture, by purchase, or by capture, and afterwards issued therefrom. The writer in the *Enguiner* further says: "Assuming that the issues from the Richmond Arsenal have been half of all the issues to the Confederate armies, which may be approximately true, and that 100,000 of the enemy were killed, not regarding the wounded and those who died of disease, it will appear from the statement of issues that about 150 pounds of lead and 350 pounds of iron were fired for every man killed, and if the proportion of killed and wounded be as one to six, it would further appear that one man was disabled for every 200 rounds expended. In former wars, with the old smooth-bore musket, it was generally said, 'his weight in lead is required for every man who was killed.'"

And from the issues of the arsenal it does not appear that the improved rifle requires a pound less.

It will appear to one fond of statistics, who may reduce the moving force of the projectile to horse-power, that the force required to kill one man in battle will be represented by about one thousand horse-power.

Some general remarks in reference to the conclusion of the war and the destruction of the arsenal may not be out of place.

There was a large number of Federal prisoners in and about the city. Libby prison was filled with officers, and Bell Isle with many privates.

To release these was the object of cavalry raids against the city, when the main army was absent.

All the operators of the arsenal, and the Tredegar Works, and employees of the departments were organized in regiments, and were called to the field when a raid was expected.

So they literally, worked with their muskets by their sides-and so valuable were the lives of the skilled artisans, that is was said if three iron-workers in the regiment of the arsenal were killed, the manufacture of cannon would stop.

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But the end was approaching. In the Confederate Senate I remember listening to an animated discussion in regard to enlisting negro troops in the army.

It was urged by some of the senators that we should enlist and arm fifty thousand negroes, of course with a pledge of freedom.

I knew we could not possibly arm five thousand. The Ordnance Department was exhausted. One company of negroes was formed, and I witnessed the drill in the Capitol Square, but I understood as soon as they got their uniforms they vanished in one night.

As the spring of 1865 approached, the officers often discussed the situation. We knew that Lee's lines were stretched to breaking, we knew the exhausted condition of every department, and we knew the end was near.

Sunday, April 2d, was abright, beautiful spring day, and Richmond was assembled at church. I was at St. Paul's church, about four pews in front of me sat President Davis, and in a pew behind him General Gorgas, Chief of the Ordnance Department, and my chief. During service and before the sermon, the sexton of the church, a well-known individual in the city, stepped lightly forward, and touching Mr. Davis on the shoulder, whispered something to him.

Mr. Davis immediately arose and walked out of the church with to calm expression, yet causing some little excitement. In a moment the sexton came back and called out General Gorgas, I confess I was made extremely uneasy, and was reflecting on the probable cause, when, being touched on the shoulder, and looking around, the sexton whispered to me that a messenger from the War Department awaited me at the door.

I instantly felt the end had come.

I was ordered to report to the War Department, where I soon learned General Lee had telegraphed that his line was broken and could not be repaired, and that the city must be evacuated at 12 o'clock that night.

I was ordered to remove the stores of the arsenal, as far as could be done, to Lynchburg, and was informed that the President and chief officials would proceed to Danville, and the line be re-established between Danville and Lynchburg.

I immediately had the canal-boats of the city taken possession of, and began to load them as rapidly as possible with machinery, tools, stores, etc., to be carried to Lynchburg.

As a large supply of prepared ammunition could not be taken, I

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had a large force employed in destroying it by throwing it in the river.

Supplies of value to families were given away to those who applied. By midnight the boats laden with stores were placed under charge of officers and started for their destination, which they never reached. What became of them, I never knew.

About 2 o'clock in the morning General Gorgas, the Chief of Ordnance, came to the arsenal to tell me that he was about to leave with the President for Danville, and to report to him there. I never reported to him till fifteen years later, when I met him at Sewanee, Tenn., the Vice-Chancellor of the University of the South.

Every possible effort was made to prevent the destruction of the arsenal.

I, as commanding officer, visited every building between 3 and 4 o'clock in the morning of the 3rd of April, had the gas extinguished, and the guards instructed to shoot any man who attempted to fire the buildings.

One hour afterwards (I was then four miles from the city) the rapid and terrible explosion of shells heard in the distance proved that that part of the city occupied by the arsenal was being made desolate by the torch applied by the frantic mob. Shortly after the President left the city the gunboats were blown up.

After witnessing the explosion from the steps of the arsenal, I sent for the keeper of the magazine, and satisfying myself that life would not be

endangered by its destruction, wrote an order for him to explode the magazine at 5 in the morning, the last order of the Ordnance Department, and among the last orders of the Confederate Government, given in the city of Richmond.

As I rode out of the city in the early dawn I saw a dense cloud of smoke suddenly ascend with a deafening report, that shook the city to its centre.

Thus ended the surrender of the city of Richmond.

The mob immediately took possession, looted the stores, and fired the city.

A large part of beautiful Richmond was burned to the ground.

The Federal troops marched into the burning city in splendid order, took possession, dispersed the mob, and saved, by their energy and discipline, the city from total destruction.