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The Whitworth Rifle

THE ENGINEER, 11 MAY 1860

The Whitworth Rifle has now afforded such ample proof of its superiority to the Enfield arm that the single adverse considerations of its cost cannot be allowed to operate much longer against its introduction. The costliness of the Armstrong gun, extreme as it was and is, proved no insuperable obstacle to its adoption; nor can that of the new rifle be allowed to prevail against it. When Colonel Eardley-Wilmot recently reminded Sir William Armstrong (at the Institution of Civil Engineers) that it was unfair to compare the cost of the new rifled cannon, with the cost of a brass gun, because after the latter became unserviceable as a gun it was almost as valuable as ever to sell as old brass, Sir William replied that he trusted his guns would prove "almost everlasting." Mr. Whitworth may surely employ the same argument, and with even greater reason. It is fallacious to compare the cost of one of his rifles with that of an ordinary Enfield. Mr. Whitworth uses the best material that can be obtained - material that costs no less than £60 per ton, and which is very hard and tough, and difficult to work, but which is also correspondingly strong and durable. That it is so there can be no doubt. In illustration of its great strength, the following may be taken. Mr. Whitworth put into a rifle-barrel, 1in. in diameter at the breech, with a bore of .49 in., a leaden plug 18 in. long, as tightly as it could be driven home upon the charge. It was fired with an ordinary charge of powder, and the leaden plug, being expanded by the explosion remained in the barrel, the gases generated by the gunpowder all passing out through the touch-hole. The same experiment was repeated four times with the same result. It is evident therefore that gunpowder cannot burst the Whitworth rifle. With such strength great durability must of necessity co-exist, unless the quick turn of the rifling should tend to its rapid deterioration. But this is not the case, Mr. Longridge's elaborate investigations having proved that the amount of the force expended on the rifling of the Whitworth rifle scarcely exceeds two per cent. of the total force of the powder. Perhaps the most remarkable testimony which has been borne to the merits of this rifle is that of General Hay, the director of musketry instruction at Hythe. After admitting the superiority of the Whitworth to the Enfield in point of accuracy, General Hay said (at the meeting already mentioned) there was a peculiarity about the Whitworth small bore rifles which no other similar arms had yet produced - they not only gave greater accuracy of firing, but treble power of penetration. For special purposes, any description of bullet could be used from lead to steel. The Whitworth rifle, with a bullet one tenth of tin, penetrated 35 planks, whereas the Enfield rifle, with which a soft bullet was necessary, only penetrated 12 planks. He had found that at a range 800 yards the velocity added to the hardened bullet gave a power of penetration in the proportion of 17 to 4 in favour of the Whitworth rifle. This enormous penetration is of the highest importance in a military weapon in firing through gabions, sandbags, and other artificial defences. General Hay thought the merits of the small-bore had never been sufficiently understood. It has been recently stated that the small-bore Enfield beat the small-bore Whitworth (1), but nothing of the kind has, General Hay states, taken place. It was also proper to state, he said, that the exact bore of the Whitworth has been adopted at Enfield without acknowledgement; even the same twist has been given to the rifling, one turn in 20 in., still the penetration of the Whitworth was two-thirds more than that of the Enfield. "Mr Whitworth has solved," said General Hay, in conclusion, "the problem he undertook, viz. how to project, to the best advantage, a given quantity of lead


with a given quantity of gunpowder, and there is no gun in England at this moment which will fulfil that condition to the same extent as the Whitworth rifle." In reply to a question from the president, Mr. Bidder said, the Whitworth small-bore rifle, fired with common sporting powder, would never foul so as to render loading difficult. He had himself fired 100 rounds one day, 60 rounds the next, then 40 rounds, and so on, and left the gun without being cleaned for ten days, when it fired as well as it did on the first day. With these facts before us, proceeding from the very highest authority, it will be impossible, we submit, for the War Department to continue the manufacture of the Enfield arm to the exclusion of the Whitworth. Every soldier in the service costs the country from £50 to £100 for his education, and £50 a year for his maintenance, and to hesitate upon a question of 5s. or 10s., or even £10, in the cost of the weapon to arm the soldier, certainly appears, as Mr. Bidder remarked, to be carrying economy in the wrong direction. The Enfield establishment is in the hands of very good and able men at present, and we hope they will have sagacity enough to prevent them resisting a change which has now unquestioningly become inevitable.

-Mechanics Magazine

Note 1. Information on these trials and experimental Whitworth rifles can be found in 'The British Soldier's Firearm' by Dr. C.H.Roads.(R&R Books, ISBN 1-884849-13-X)

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Pioneers of the
Machine Tools Industry



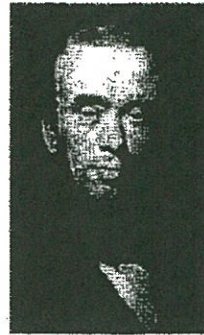
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Pioneers

The Beginning
Leonardo da Vinci
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Joseph Whitworth
John Wilkinson



Joseph Whitworth

General

George Stephenson
Robert Stephenson
Isambard K. Brunel
Thomas Telford
James Watt
Maudslay's Influence

Joseph Whitworth was born at Stockport on December 21st 1803

His father was a minister and schoolmaster.

At the age of fourteen he started work in an office in his uncle's cotton mill but soon found that he was far more interested in machinery than clerical work. As a result, after four years he ran away to Manchester and found work in a factory as a mechanic.

The Humble Drilling Machine

He married in 1825 and shortly afterwards went to London where he found employment with Maudslay and Field. After a period there, he worked for Holtzapffel, a well-known London engineer, and later for Joseph Clement, eventually returning to Manchester in 1833 to set up in business on his own.

Wilkinson's Bore Mill (graphic)
Maudslay Engine (graphic)
Maudslay Lathe (graphic)

He commenced by building improved lathes, planers, slotters, shapers and drill machines which soon became pre-eminent in their field, such was their excellence. This pre-eminence was attained not by any novelty of design nor yet in any radical departure from existing machine tools, but rather in the standard of accuracy and the quality of workmanship they embodied.

With unerring judgment Whitworth spoke of "the vast importance of attending to the two great elements in constructive mechanics, namely, a true plane and precision of measurement. The latter cannot be attained without the former which is, therefore of primary importance".

Coventry

SIR ALFRED HERBERT of Alfred Herbert Ltd. (list)

Until Whitworth's time plane surfaces had been made by roughing on a planer, sem-finishing by filing and then finishing by rubbing together two surfaces with a mixture of oil and emery in between.

MR. AXEL WICKMAN of A.C. Wickman Ltd. (list)

In 1840 he introduced the method of producing plane surfaces by hand scraping by which means he obtained plane surfaces of wonderful accuracy. Having now realised his first objective, a true plane, he next concentrated on the second, improved methods of measurement.

SIR FRANK WHITTLE the jet engine pioneer of

He introduced the system of "end measurements" and in 1856 exhibited a measuring instrument controlled by a screw which detected differences in length.

Power Jets Ltd.

SIR HARRY FERGUSON
founder of the tractor
empire.

as small as one millionth of an inch.

It was Whitworth also who brought about the standardization of screw threads England.

Using Clement's previous work on thread standards as a basis, he laid down the formula for the thread system which now bears his name.

COMMENTS

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It was after he had visited America in 1853 that the British Government asked to design a complete plant for the manufacture of rifles. Whitworth was not satisfied with the Enfield rifle that was then being used so he made a series of tests, as a result of which he designed a new rifle. Although it excelled all others in accuracy, range and penetration, the War Office nevertheless rejected it. In 1862 he made a high power rifle-cannon having a range of six miles and developed a stronger steel for ordnance use.

He made many other contributions to the manufacture of heavy ordnance but all met with the same reception from the War Office.

Many years before this, however, as early as 1850, Whitworth was the foremost machine-tool builder in the world.

While it is true to say that most of the general machine tools had been invented before his day he nevertheless raised the whole art of machine-tool building to a level previously unknown.

It was he who introduced the box design for machines, and also introduced such accuracy in the working of the machines that he undoubtedly dominated English tool practice for many years.

During his lifetime he made a great fortune and as a result he was able to establish the famous Whitworth Scholarships for which he was created a baron

He died in 1887 after being universally recognized as one of the greatest engineering authorities in the world.

In 1856, Sir Joseph Whitworth was elected President of the Institution of Mechanical Engineers in recognition of his outstanding contribution to the development of industrialisation and mechanical engineering. This was then followed by a long list of awards and achievements:-

- 1857, elected as a Fellow of the Royal Society
- 1863, created an honorary LL.D by Trinity College, Dublin.
- 1866, re-elected President of the Institution of Mechanical Engineering
- 1868, conferred an honorary D.C.L by Oxford University
- 1868, awarded the Legion of honour by Napoleon III of France
- 1868, received the Albert Medal from the Society of Arts
- 1872, made a commander of the Brazilian Imperial Order of the Rose
- 1874, awarded a Royal Medal by Carlos VII, King of Spain

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[From a photograph taken in 1882]

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This document was published in London by Longmans, Green Reader, & Dyer in 1873. The text reproduced is from Chapter II and concerns Whitworth's involvement in rifle design. The remainder of the work concerns artillery and Whitworth's 'fluid-compressed steel.'

Text provided by David Minshall.

Guns and Steel

by

Sir Joseph Whitworth, BART.,

C.E., F.R.S., LL.D., D.C.L.

Preface

It is probable that few are aware of the manner in which I approached the subject of rifling guns, or know that the Whitworth rifle was produced as the result of many months of experimental research in the rifle gallery, five hundred yards long, erected in my grounds at Manchester. I cannot mention this fact without saying how much personal interest the then Commander-in-Chief, Lord Hardinge, took in the experiments, every stage of which he communicated to the Prince Consort. At that time I demonstrated every conclusion by the most carefully conducted trials, and I proved that the Enfield service rifle of that day was wrong in every particular. The diameter of the bullet was too large for the size of the gun, the bullet itself was too short, and the twist of rifling was not one-third of what it should have been. Accordingly, in the year 1857, the public trials of my rifle against the Enfield rifle, made by the direction of Lord Panmure, established the superiority of my weapon, as well as the soundness of the conclusions at which I had arrived.

In 1859 a Committee of officers reported that the bore of my muzzle-loading rifle was too small for use as a military weapon.

In 1869 another Committee recommended that the bore of the service breech-loading rifle should be exactly that rejected ten years previously.

IN the year 1854, when Lord Hardinge was endeavouring to obtain the best possible rifle with which to arm the British troops, he requested me to aid him by investigating the mechanical principles applicable in the construction of an efficient weapon. I willingly agreed to do so, subject, however, to the condition that I should have a suitable gallery, protected from changes in the wind and from

fluctuations in the atmosphere, wherein to carry on the experiments which were necessary for enabling me to arrive at any sound conclusion.

It was absolutely essential to track the path of a rifle bullet throughout its entire course, to determine whether its point preserved a true forward direction, and to record its trajectory. This could be done most readily in a closed gallery provided with screens of very light tissue paper.

Accordingly a gallery, 500 yards in length, was erected in my grounds at Rusholme, in the year 1855. Its height was 20 feet and width 16 feet; it was slated, and had openings on the south side only for the admission of light and for getting rid of the smoke.

The first result of the work done in this gallery was the construction of my small-bore rifle.

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Whitworth Sharpshooter Rifle

by Bertil Häggman, LL.M.

(The original text of this article appeared in issue 66 (September 2001) of Crossfire, the magazine of the ACWRT (UK) as 'Confederate Imports of Whitworth Sharpshooter Rifles from England 1861-1865')

CIVIL WAR RE-ENACTOR BERTIL HÄGGMAN, A MEMBER OF THE SWEDISH AUTHORS ASSOCIATION, IS RESEARCHING ONE OF THE LESSER KNOWN IMPORTS OF ARMS FROM BRITAIN TO THE CONFEDERACY, THE WHITWORTH RIFLE. IN HIS RESEARCH HE HAS FOUND THAT THE MANCHESTER-MADE WEAPON IS SAID BY SOME TO BE ONE OF THE MOST ACCURATE RIFLES USED IN THE CIVIL WAR.



Little is public about Confederate imports of Whitworth sharpshooter rifles from England during the War Between the States.

During the course of the War Between the States, both the Confederate States Government and the individual Southern States sought to import necessary supplies and material from Britain. These vital stores were delivered by blockade runners. Running the blockade was extremely dangerous, but also extremely profitable. Many blockade runners came in off the coast of Cape Fear, North Carolina, under the protection of Fort Fisher.

The great lack of arms of the CSA was overcome by importation of arms from abroad, mainly England. Around 400,000 arms of various types came from that powerhouse of industrialism of the era.

Britain was officially neutral but there was strong sympathy among segments of the English aristocracy for the Southern cause. The private English small arms makers had no problems with neutrality. They naturally wanted to sell as many arms as possible including to the South.

The Confederate authorities tried to purchase arms in an organized fashion, but communication was so slow that often instructions were obsolete before an agent reached England by ship. Confederate authorities thus tried to do the best they could under circumstances forced upon them.

Two Confederate-financed companies were established in Britain: Sinclair, Hamilton & Co. and Isaac Campbell & Co. The initials "SH over C" and the name "Isaac Campbell & Co". will be found on some arms. The South also established five primary English suppliers.

Among British companies established in the arms trade who acted as purchasers for the Confederate Agents were Bond, Freed & Co. and James, Kerr and Scott & Son. Arms acquired by each of these suppliers can be determined by a capital letter stamped in the corner of

the stock in the front of the butt tang.

The Confederate Government also set up a marking system. Each arm had a number from 1 to 10,000 engraved on the butt tang and shank of the ramrod, the hilt on the socket of the bayonet and the bayonet scabbard stud. Upon reaching 10,000 the numbering began again from 1 to 10,000 over the letter "A". To date, on the first 20,000 arms imported by the Confederate Central Government have been so identified. At the same time a Confederate government agent applied his inspection/acceptance mark to the belly of the stock but also occasionally to the comb of the stock.

"JS over Anchor" mark is seen on many of the guns. Georgia State purchases had their own series of numbers and the obverse stock was struck with a large "G". The same was true for South Carolina. Their stocks have a prominent "SC" on the obverse butt.

Louisiana arms were usually marked with a diamond with an inset "L" or had the numbers stamped on the stock behind the trigger guard. By comparison of known arms, it has been determined that rifles and rifle-muskets each had their own series of numbers, and some arms bought by private speculators only have initials on the comb or belly of the stock such as "SH over C" as discussed above.

In conclusion, one can identify at least 20,000 Confederate Central Government guns: numbers 1-10,000 over A, 10,000 G (Georgia) arms, and 10,000 SC (South Carolina) arms. Also readily identifiable are private purchases by the use of "SH over C" (Sinclair-Hamilton), "CH over I" (Caleb Huse Inspected) and IC (Isaac Campbell). The "JS over Anchor" is an inspection mark readily identifiable for Southern import.

At best one can positively identify less than 25% of the 400,000 or so arms imported from England by the Confederate Central Government and individual Southern States.

Whitworth Background

Sir Joseph Whitworth of England created a rifle with a twisted hexagonal bore and then shaped bullets to match this bore. (1) He patented his hexagonal bore in 1854. (2) A Confederate weapon in the Civil War, when outfitted with a telescopic sight this firearm had an effective range of 1,500 yards. The twisted hexagonal bore imparted a steadiness of flight to its .45 caliber bullet, and made this rifle the favorite of Confederate sharpshooters.

The Confederacy imported a small number of the rifles from the Whitworth Rifle Company of Manchester, England, beginning in 1862. (3) A total of 13,400 Whitworth muzzleloading rifles, including 5,400 for the military, were produced from 1857 to 1865. Generally the early Whitworth rifles were marked on the lock "Whitworth Rifle Co. Manchester." After about 1860 the locks were marked "Whitworth." In the spring of 1862 the lock markings were changed to "Manchester Ordnance & Rifle Co." In the latter part of 1863 the lock markings were changed indiscriminately and will be found marked "The Whitworth Company Limited" and "Manchester Ordnance & Rifle Co."

The military rifles were made in groups of 1000. When the next batch of 1000 was begun, numbering started with 1 and a prefix of A, B, C, D, E, or F. By 1864 (the beginning of the demise of the muzzleloader), the lock markings on the high "E" numbers and the rest of the "F" numbers were worded "The Whitworth Company Limited" and "J. Whitworth & Co. Manchester". Often the inside of the lock is marked "Joseph Brazier, Ashes" indicating the name of the lock maker who is still in business. There are examples where Joseph Brazier is simply noted by the initials "J.B."

A very limited but unknown quantity of Whitworth rifles was marked "2nd Quality" on the rearstrap of the triggerguard. These rifles were purchased by the Confederate service during the Civil War.

The balance of the production of the 13,400 pieces were commercially produced by Bissel, Beasley Brothers, McCririck, the British Small Arms Company and others.

Cased rifles that were presented through military or civilian channels for certain events are known. The varnished oak case is unlined and finished in natural color. In 1860, Whitworth rifles sold for about US \$96 for the rifle alone, or US \$120 with cased accessories. But I have seen prices ranging up to US \$ 500.

The Imports

It has not been possible to find any concrete evidence or material on the actual purchase by Confederate agents of Whitworths in England.

I have seen a quote on a first visit made by Confederate agents at the factory in Manchester but no record of purchases. Some sources indicate that the Whitworth Rifle Co. of Manchester went bankrupt after the war and that the records of the company are not preserved.

Based on information in Anderson Morrow (4), 'The Confederate Whitworth Sharpshooters' in the United States (privately printed book - 1989), I believe that arms importing companies in New Orleans, LA, Memphis, TN, Charleston, SC, Lynchburg, VA and elsewhere in the South imported the rifles on blockade runners (very often via Mexico) and sold them or even presented them free of charge as gifts to the Confederate army.

One way to continue the research is of course to try to find the records of these companies in the United States in archives of respective cities. But there is of course a great risk that such records are not preserved. They were private and may not be preserved in public archives.

Anybody with information on importers and the way of purchase and import of Whitworth sharpshooter rifles in the Confederate States of America is most welcome to contact me.

The Inventor

Sir Joseph Whitworth was born 1803 in Stockport (the son of a

schoolmaster) and as a young boy went to Derbyshire and learnt about textile machinery. At the age of 22 he went to London working for Maudsley & Co., a leading engineering firm in Britain. In 1833 he returned to Manchester, where he had worked before going to London. He founded a company named after himself producing machine tools but gradually shifted to arms.

Possibly his greatest invention was the Sharpshooter Rifle, which was hexagon-bored but Confederate Sharpshooters seem mainly to have used cylindrical bullets.

At the first meeting of the British NRA at Wimbledon in 1860 Queen Victoria opened the meeting by firing a specially prepared Whitworth from a mechanical rest at a target 400 yards away. It was a bull's eye, the bullet striking very close to the centre.

Whitworth Rifle Company, 51 Sackville Street, Manchester, was the outlet from 1860-1862. The rifles were almost certainly constructed by J W Edge of Manchester, using Brazier locks and metal components from Preston and Palmer.

Manchester Ordnance & Rifle Co., the follow up, seems to have been in business from 1862-64 at Sackville Street in Manchester.

Confederate purchasers thus certainly visited Sackville Street in Manchester many times during the war.

The Whitworths surpassed modern sniper rifles. The sniper with most "kill-confirmations" seems to be Matthias Hetzenauer, WWII German soldier on the Russian front, with 345 certified "kill-confirmations" (that is with probables or unconfirmed excluded). His longest kill was 1,000 meters. There are numerous verified reports of "kills" at far longer distances by Confederates with Whitworths. But the CSA had no system of "kill-confirmation", so we do not know the actual figures.

I am now looking toward further information on the actual sales and how the rifles were received in the Confederate States of America. Any information would be greatly appreciated.

Bertil Häggman
SCV Europe Camp # 1612
E-mail: mvk575b@tninet.se

Notes

- (1) Pageant of the Gun, by Harold L. Peterson.
- (2) The Gun and its Development, by W.W. Greener.
- (3) Information about Whitworth rifles can be found in the Dixie Gun Works Catalog, USA.
- (4) Morrow is a Georgia-born great-grand nephew of Confederate Partisan Ranger Col. John S. Mosby. He is a teacher and has served with the 101st Airborne Division and with Special Forces.



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INSTRUCTIONS FOR LOADING AND CLEANING

THE

WHITWORTH PATENT MILITARY RIFLE

CHARGE

The charge is $2\frac{1}{2}$ drachms, or 70 grains, of No. 6 size powder of the best quality. It should be accurately weighed.

WAD

The lubricating wad should always be used for continuous firing. It is put between the powder and the projectile.

PROJECTILE

The cylindrical form of projectile is the best for general use. It is 530 grains in weight and is wrapped with paper. In loading, the projectile should be pressed gently home, and should not be so forced down as to crush the lubricating wad or the grains of powder. Projectiles cast from the mould are not to be relied upon for accurate shooting, unless they are passed through a die-press.

CARTRIDGE

To save the trouble of weighing the charges, and pressing the projectiles, it is recommended to use the WHITWORTH PATENT CARTRIDGE, in which the powder is carefully weighed, and the projectiles are uniform in weight, size, and figure. This Cartridge consists of a tube, containing the projectile, patent lubricating wad, and powder, placed in their proper order, ready for use. The powder is kept in the tube by a valve, or trap. When the cartridge is used, the end containing the powder is inserted in the muzzle of the rifle (which is chamfered to receive it,) and is held there with the left hand. The ramrod, which should be previously withdrawn from the stock, is held in the right hand. The trap is withdrawn by the finger and thumb of the right hand, and the powder falls into the barrel. The ramrod is then pushed through the tube, taking down with it the projectile and lubricating wad, which should be gradually and gently pressed. The emptied tube is thrown away, and the loading is

complete.

The cartridges should be kept dry, but should not be subjected to a heat higher than 90° Fahrenheit.

CLEANING

The rifle is cleaned in the usual way with sponge, woollen cleaner, or a little tow wrapped round the brass jag, which fits on the end of the ramrod. When the loose dirt is washed out, the wire brush will readily remove any hard dirt that may remain. It is advisable to use hot water in cleaning the rifle to ensure the perfect dryness of the barrel afterwards, as any damp remaining in the barrel, after cleaning, would be very injurious.

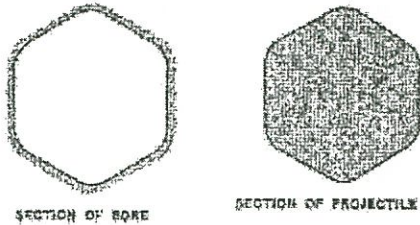
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Sir Joseph Whitworth, 'Guns and Steel'

Hexagonal Rifling



I have stated that the form of the bore of the Whitworth rifle is polygonal, being a hexagon with rounded edges; it is therefore a combination of a straight line and a circle, and its surfaces are those most easily produced in the workshop.

There is a geometrical simplicity pertaining to the polygonal form which is unattainable by any other form.

The amount of bearing surface for giving rotation, and which also conduces to the centring of the shot, depends upon the difference between the maximum and minimum diameters of the bore, this difference, in fact, represents the hold which the barrel has upon the projectile. In any grooved system of rifling you pass more rapidly from the maximum to the minimum diameter, and the extent of bearing surface is diminished accordingly, whereas in the hexagonal system, there is a long inclined bearing surface, the section of which is a straight line starting from the minimum diameter and running into a circle at the end of the maximum diameter.

A polygonal rifled projectile is applicable to the largest cannon as well as to small arms, and I have adopted the hexagonal form, because it gives me the best working difference between the maximum and minimum diameters.

It will be observed that the hexagonal form of the projectile is analogous to that of the hexagonal nut universally used.

It may be said that this record of my experiments, showing how the modern rifle has become what it is in range, in penetration, and in accuracy, has ceased to be of interest or importance since the new element of rapid firing has been brought to bear with such important results by the introduction of breech loading. I would state in reply that breech loading and rapid fire give increased importance and value to range, penetration, and accuracy, as the primary and essential qualities of the rifle. However necessary these qualities may have been for the muzzle-loader, they are still more requisite with an arm which must otherwise waste its ammunition. Rapid firing must rest on the very best system of rifling, as its only safe basis.

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Sir Joseph Whitworth, 'Guns and Steel'

First Comparative Trials Of The Whitworth And Enfield Rifles

In the year 1855 I commenced a series of experiments in the new rifle gallery, and was at that time requested to adhere to the service charge of powder, viz., 70 grains, as well as to the service weight of bullet, viz., 530 grains, but I was unrestricted in every other particular.

The barrel of the Enfield rifle, as then used in the service, was 39 inches in length, its bore being .577 of an inch in diameter. The rifling was effected by three spiral grooves, making 1 turn in 78 inches, and the bullet rotated half a turn during its passage along the barrel. The length of the bullet was 1.81 diameters of the bore.

The bullet was cylindro-conoidal; it was wrapped in paper, and was made of such a size as to pass easily down the barrel, and had a conical wood plug in its hollow base. At the instant of firing, the explosive force of the powder caused the bullet to become expanded or upset, and thus moulded it to fit the grooves in the bore. It was essential that the lead should be very pure and soft in order to allow of its being properly expanded into the grooves.

The bullet is shown in the diagram.



The cross section of the barrel is given at D, the circular portions, which do no work in rotating the bullet, are called land's, and the grooves run in a screw thread of uniform pitch between the lands.

The barrel of the Whitworth rifle is 39 inches in length, the interior is hexagonal in section, and, instead of consisting partly of non-effective lands and partly of grooves, has rifling surfaces which are wholly effective. The rifling turn is much quicker than that of the Enfield rifle, being 1 turn in 20 inches, and the angular corners of the hexagon are rounded in the manner shown. The maximum diameter of the bore is .490 of an inch, and the minimum diameter is .451 of an inch.



The bullet may be either hexagonal or cylindrical; in the latter case, it will expand and be driven into the recesses of the hexagon, and will adapt itself to the curves of the spiral rifling; in the former case the inclined sides of the hexagon offer no direct resistance to this expansion, which is easily effected. The length of the bullet is 3 diameters of the bore.

With all expanding bullets, a quick burning powder must be employed. The expansion depends on the sudden action of the powder upon a bullet possessing inertia, it therefore fails with a slow burning powder.

If there be a mechanical fit between the bullet and the bore of a muzzle-loading rifle, this expansion is no longer necessary, and the bullet may then be made of alloys of tin and lead of any degree of hardness, or a hardened steel bullet may be used. It is perfectly easy to form a mechanically-fitting bullet adapted to the hexagonal rifling, on account of the simplicity of the form, but quite impracticable to obtain an accurate fit between the bullet and the bore of the rifle where any system of grooves is adopted.

The expansion principle may be combined with an easy mechanical fit, so that a projectile made of metal harder than lead, such as an alloy of lead and tin, may be used, and the bullet will then expand sufficiently to fill the bore, giving a penetration more than double that of lead.

In my earlier experiments I tried the effect of lengthening the bullet of the Enfield rifle, and I showed, by means of a piece of tissue paper placed three yards from the gun, that an increase of only a quarter of an inch in length caused the bullet to strike obliquely. This fact was clearly ascertained by the mark left upon the paper. I then made a barrel of the same bore with a twist of 1 turn in 30 inches, instead of 1 turn in 78 inches, and I kept the weight of the lengthened bullet at 530 grains by making a portion of the interior hollow. The result was that with the same charge the bullet hit the target at the same height.

Having thus proved that there was no loss of range on account of the increased rotation of the bullet, and that the trajectory was as good as before, I made another barrel, reducing the minimum diameter to .5 inch, and lengthening the projectile, and finally I reduced the bore to .45 inch.

In order to satisfy myself as to the effect of increased twist in the rifling I tried barrels with 1 turn in 20 inches, 1 turn in 10 inches, 1 turn in 5 inches and lastly with 1 turn in 1 inch. I fired from these barrels mechanically fitting bullets of lead and tin, and with the barrel rifled to 1 turn in 1 inch (using 35 grains of powder) I penetrated through 7 inches of elm-tree planks.

In this way I exhausted the subject, and arrived at the result that the best twist for a rifled musket bullet would be 1 turn in 20 inches, the minimum diameter of the barrel being .45 inches.

This construction gave the best shooting with the charge of powder and weight of bullet to which I was limited.

If the ordinary strength of a man was greater than it is, the Enfield bore would be right but it would be necessary to increase the length of bullet and the twist of rifling, the rifle itself being also made heavier in proportion.

I experienced great opposition to the change of rifle turn from 1 turn in 78 inches to 1 turn in 20 inches, or I should have made the twist somewhat more rapid in order to fire a steel bullet when necessary for penetration. It should be understood that the amount of rotation must be increased when the specific gravity of the bullet is made less, otherwise the projectile will fall over in its flight, - that is to say, an iron projectile requires more rotation than one made of lead.

The same principles apply in determining the rotation for the heaviest guns. A long projectile turns over unless it has sufficient rotation, and the twist for field guns should not be less than 1 turn in 15 diameters. The gun will then fire projectiles 6 diameters in length.

I have always contended that the primary element of success in long range shooting, is length of bullet, and generally that great range, with a low trajectory, accuracy and penetration are obtained by employing a long bullet, high rotation, and a large powder charge.

The superiority of the Whitworth, as compared with the Enfield rifle, was first proved in a series of trials made at Hythe, in the year 1857, under the direction of Lord Panmure, then Minister of War.

These trials led to no satisfactory conclusion, and after a lapse of eighteen months a Committee of Officers reported to the Government in 1859 that the bore of my rifle was too small for use as a military weapon.

Compare with this the report of another Committee of Officers made in 1862, "that the makers of every small-bore rifle, having any pretensions to special accuracy, have copied to the letter the three main elements of success adopted by Mr. Whitworth, viz., diameter of bore, degree of spiral, and large proportion of rifling surface."

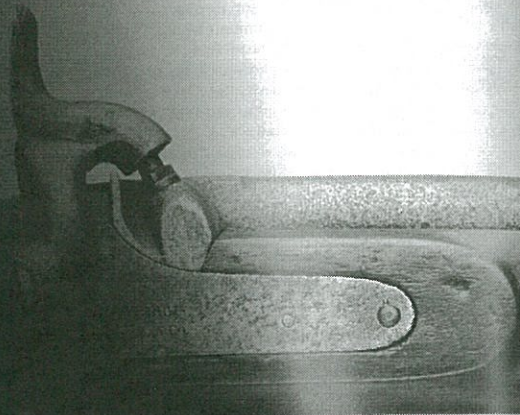
In 1869 a Special Committee reported to the War Office that the calibre of a breech-loading rifle, should be .45 inches, as appearing to be the most suitable for a military arm. This conclusion is directly contrary to that arrived at in 1859, but is the exact bore which I recommended in 1857.

The mechanical question is the same whether we deal with a rifled musket or the heaviest gun. I have from the commencement advocated one uniform system, the value of which I have established by direct experiment.

As regards heavy artillery, it will probably require some long interval before the professional advisers will be enabled to see that sound ductile steel is the best material for a gun, that the bore for a given weight of gun should be made smaller than that used in the service, that the projectile should be lengthened, that its rotation should be increased, and that the stud system should be abolished.

In this direction they have made one step. They have taken the weight I proposed for a gun of 12 inches bore, and have increased the weight of the service 12 inch gun from 25 to 35 tons. In all other respects the Woolwich system is in direct opposition to my own. Following past precedent it must be expected that when the truths I have endeavoured to press upon official attention are fully understood, and action is taken upon them, my part in first developing them will probably be forgotten.

An iron mounted Kerr rifle with a plain unchecked stock.



An unusual back sight on this Kerr rifle with

showing the Birmingham

were chosen from each of the five regiments of the brigade, the 2nd, 4th, 5th, 6th and 9th Kentucky Infantry and Second Lieutenant George Hector Burton was placed in command.⁴³

Several months later Oladowski submitted an Armament and Ammunition Report of the Army of Tennessee for the week ending on 25 June 1864. In that report he listed a total of 29 rifles of .44 calibre, all in Hardee's Corps. Whitworth rifles are specifically listed separately so it is quite probable that these rifles were Kerr rifles.⁴⁴ At some point during the intervening months, two rifles were lost or transferred to units outside Hardee's Corps.

In a cover letter some six weeks later for a Consolidated Armament and Ammunition Report sent to Colonel Gorgas dated 4 August 1864, Captain W. D. Humphries, Depot Ordnance Officer of East Point, Georgia, Army of Tennessee states:

*We have in this army 38 Whitworth and Kerr's Rifles which are the same cal. and the Whitworth Cartridge is much preferred of which we have no supply in reserve.*⁴⁵

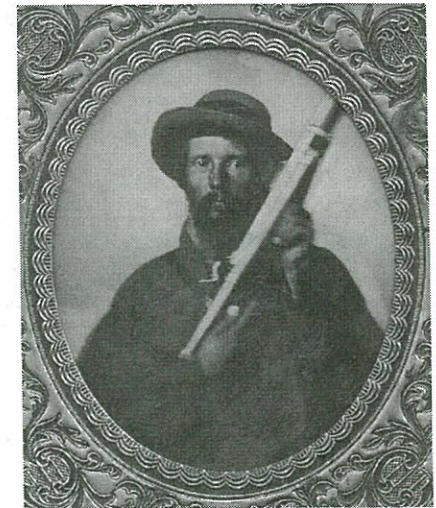
One unusual Kerr rifle has survived. This rifle, part of a late 19th century institutional arms collection since dispersed, was presented by the Confederate veteran who stated he used the rifle during the war. It is iron mounted with standard LAC dome head screws and has a plain stock with no checkering. The lock has the typical crown over "V.R." behind the hammer and "1861"/"L.A.Co." in front of the hammer. The 37-inch barrel, 56 bore (.436 calibre), has definite Birmingham proofs, a distinctive long range backsight with a platinum centre-line on the slider and simple fixed blade front sight, evidently a special order barrel. There is no visible number engraved behind the backsight, probably due to pitting on the barrel, and the bore is too deteriorated to determine if special rifling was present. This was possibly one of the "special target rifles" associated with General Breckenridge.

There is precious little documentation of Kerr rifles used during the war and much of that is vague and ambiguous. What little information there is indicates their use only in the Western Theatre during the latter stages of the war. There is no mention of the use of the Kerr rifle in the Army of Northern Virginia.

There is no question that twenty Kerr rifles were purchased from Sinclair, Hamilton & Company and an unknown Englishman gave General Breckenridge an additional eleven Kerr rifles. Other Kerr rifles were possibly acquired from private sources after they ran the blockade, probably John Fraser & Company of Charleston, as this was the case with thousands of LAC Kerr revolvers as discussed in Chapter Four. The discovery of additional records may increase this number, but currently based on available evidence, it is doubtful if more than fifty Kerr rifles were imported.

Whitworth Rifles

The Whitworth rifle was the brainchild of Sir Joseph Whitworth, a gifted engineer and metallurgist. His use of a hexagonal bore together with a mechanically fitted bullet made his rifles the most accurate long range small arms the world had ever seen. Whitworth began manufacture in 1857 and in 1860 he established the Whitworth Rifle Company in Manchester. The company was reorganized in May of 1862 and became the Manchester Ordnance & Rifle Company. A significant number of variations of Whitworth rifles were manufactured including experimental, sporting, commercial, target and military models, many with special order features, all showing extraordinary craftsmanship. As fabulous as these rifles are, most have no connection with the American Civil War. Some were cased with extra barrels and accessories and others exist in half and full stock configurations. A number are found that were awarded as shooting prizes and have engraved silver plaques affixed denoting the event and the recipient. Nevertheless, the mere mention of any Whitworth rifle causes some measure of excitement for most Civil War collectors because of their historic association with Confederate sharpshooters. Those very few that can be documented as used by Confederate soldiers are invariably 2nd quality military match rifles, most fitted for the Davidson telescopic sight.



An unknown Confederate soldier wearing a slouch hat and overcoat holding a Whitworth rifle with telescope sight.

Second Quality Military Match Rifles

Whitworth rifles were not consistently built in blocks of a particular configuration but instead were fabricated as the flow of orders dictated so the numbering system used adds little to any methodology in the study of the weapons. Early production, regardless of type, were numbered 1 to 1000, the next one thousand had a "B" prefix, then "C" and so forth. Thus, a fine military match rifle could have a consecutive number to a special order sporting arm. Randomly interspersed among production were less expensive 2nd quality military match rifles that have long been associated with Confederate service, the lowest known number being "B 509" mounting a Davidson telescopic sight with provenance to General A. P. Stewart who donated the rifle to the Tennessee Historical Society in the 19th century. The rifle subsequently became part of the collections of the Tennessee State Museum. The highest known number is "C 619" also mounting a Davidson telescopic sight in the Richard D. Steuart Collection at the Virginia Historical Society in Richmond. Only nineteen 2nd quality rifles are known to survive.

The term "2nd quality" should not be interpreted to mean these particular rifles were of lesser quality. This description applies to the external finish which lacked the fine engraving found on some of the other rifles. Mechanically, these rifles were as finely built as other Whitworth products.

The Whitworth rifle used by Confederate sharpshooters is 49 inches long overall with a 33-inch barrel, .52 bore/.451 calibre, with Whitworth's distinctive hexagonal bore. The barrel, which has no provision for either socket or sabre bayonet, is marked "WHITWORTH PATENT" between the backsight and the breech and has a rifle number or serial number on the left side of the barrel in line and adjacent to the Birmingham proof marks. There is some question about who made Whitworth barrels and it appears Whitworth, while he made some, did not make all of them. Regardless of maker, those barrels seen have Birmingham proofs. These numbers without prefix are also found on the shank of the ramrod and on the interior surfaces of each piece of the Davidson scope mount components. The backsight is a simple folding type mounted reversed with gradations to 1,200 yards on the right side of the ladder and 1 to 5.5 degrees on the left side of the ladder. The barrel is held by two conventional clamping bands, the front band with a swivel attached. The back swivel is attached to a wood screw that is set in the trigger guard tang well behind the trigger guard. The plain lock is engraved in one line "WHITWORTH RIFLE Co. MANCHESTER" in front of the hammer and has a crown over "W" behind the hammer. The walnut stock of most is checkered at the wrist and forearm and in most cases extends to within about one-inch of the muzzle although several have been noted with plain stocks and others with the nose

cap about four inches from the end of the barrel. No specific marks have been observed on the stock. One of the key identifying features is engraved on the trigger guard tang between the two retaining screws, the designation "2nd QUALITY".

There appears to be two variations of the engraving of "2nd QUALITY". One type encountered in the B series uses a Q that first appears to the eye as a fancy numeral 2 while the C series uses a Q that looks like a conventional Q, suggesting a change in engravers during production.



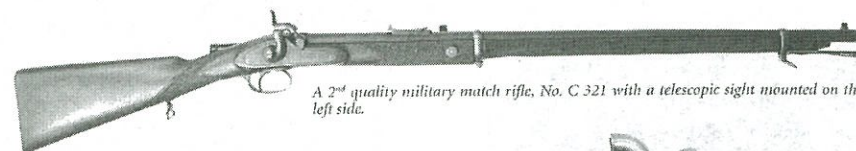
The "2nd QUALITY" mark found on Whitworth rifle, No. B 547. Note the two lines under the "nd" in 2nd and the Q in QUALITY appears to be the numeral 2.



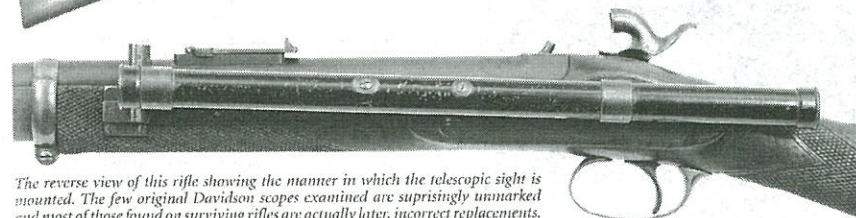
The "2nd QUALITY" mark found on Whitworth rifle, No. C 529. Note the lack of any lines under "nd" in 2nd and Q in QUALITY appears to be of conventional design.

The detachable Davidson telescopic sight is mounted on the left side of the rifle parallel to the barrel and is devoid of any markings. The mounts were patented on 19 December 1862 but they too are unmarked except for the number of the rifle without a prefix on an internal surface. The body of the telescopic sight is 14.5 inches long with a black enameled brass body about .9375-inch in diameter with a cross wire reticule. Most of the Davidson telescopic sights found on Whitworth rifles today are modern reconstructions using 20th century optics. Originally, there was probably some type of protective leather carrying case issued with the sight but none has been identified. A globe sight was reported used on some Whitworth rifles issued to the Army of Northern Virginia.⁶⁰ No such sight has actually been noted on a rifle with credible Confederate provenance.

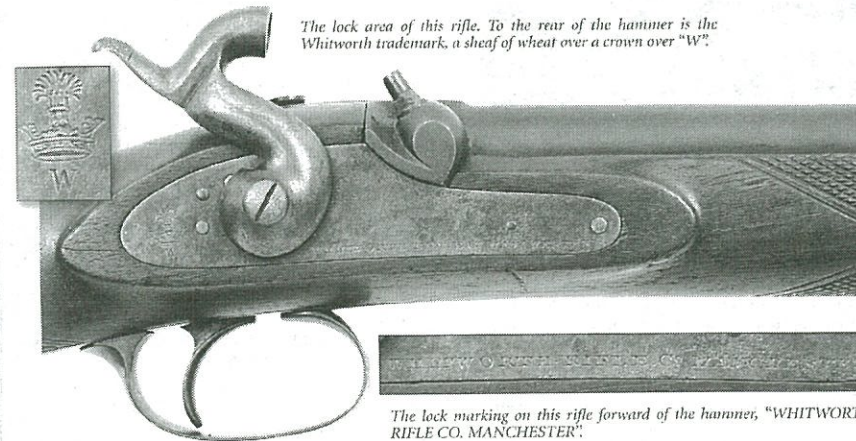
The first mention of the purchase of Whitworth rifles appears in Major Anderson's diary on Tuesday, 2 July 1861. Anderson wrote, "I prevailed on [Joe] Battersby to go with me to the Whitworth Foundry....Before leaving Whitworth's establishment this morning we bought two of his rifles. He asks enormously for them."⁶⁷ No further mention of these rifles has been found and it is not known if Anderson brought them with him when he returned to Georgia in late 1861. A post-war reminiscence



A 2nd quality military match rifle, No. C 321 with a telescopic sight mounted on the left side.



The reverse view of this rifle showing the manner in which the telescopic sight is mounted. The few original Davidson scopes examined are surprisingly unmarked and most of those found on surviving rifles are actually later, incorrect replacements. Note the simple backsight is mounted reversed.



The lock area of this rifle. To the rear of the hammer is the Whitworth trademark, a sheaf of wheat over a crown over "W".



The left side of the barrel this rifle, No. "C 321", showing the number, Birmingham proofs and .52 bore.

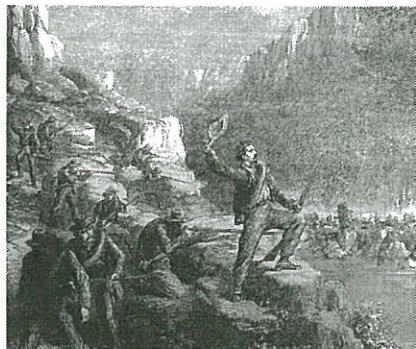
states that the Whitworth rifle, "...was imported by the Ordnance Bureau of the Confederate States at a cost of about \$1,000, in the equivalent of gold, for each rifle and one thousand rounds of ammunition."⁸⁸

The Davidson telescopic sight is not mentioned with the rifle so it is unclear if that cost included the sight. Even allowing for the passage of thirty years and the age of the writer, assuming the figure is reasonably accurate, Anderson's comment is an understatement. Unfortunately, no government purchase documents have been located at this time.

There is no question that the Whitworth rifle was used by the Army of Northern Virginia and the western armies although accounts of its use come predominately from Western Theatre sources. William A. Albaugh notes:

In the spring 1863 Confederate Ordnance imported one dozen long-range Whitworth rifles. Six were sent to the Army of Northern Virginia, and two to each Corps for their best marksmen. The others were sent to the Western Army.⁸⁹

The source of this information is not provided. One of the very few instances of the use of the Whitworth rifles by elements of the Army of Northern Virginia was recorded when General James Longstreet, with the divisions of Hood and McLaws, was detached and sent west to reinforce General Braxton Bragg during the Chickamauga Campaign in September 1863. An illustration that appeared in the *Illustrated London News* and *Harpers Weekly* portrayed Whitworth sharpshooters of Longstreet's Corps firing on a Federal



This wood engraving from the 5 December 1863 issue of the *Illustrated London News* by British correspondent Frank Vizetelly depicts Whitworth armed sharpshooters of Longstreet's Corps on detached duty from the Army of Northern Virginia firing on a Federal wagon train across the Tennessee River from Raccoon Mountain. Unfortunately, there is not enough detail to actually identify these rifles but Vizetelly did so in his comments.

wagon train in the mountains of west Tennessee. 1st Lieutenant Robert T. Cole, 4th Alabama Infantry remembered:

We had brought our Whitworth rifles from Virginia with us....I saw one of the Whitworth rifles, an English gun with Globe sight carrying a large ball, a few of which ran the blockade, in the hands of one of our sharpshooters, kill two mules with one shot—the heavy missile passing through their necks.⁹⁰

As far as use in the Western Theatre is concerned, on 29 May 1863 Colonel Gorgas wrote General Braxton Bragg commanding the Army of Tennessee that he had ordered Captain J. T. Trezevant at Charleston Arsenal to send him:

...for the use of sharpshooters 20 Whitworth (telescopic) Rifles recently imported from England. These arms are reported to be very effective at 1200 yards....they be placed in the hands of careful and reliable men only as they are very costly & so costly indeed that it is not deemed expedient to increase the number already brought in.⁹¹

Gorgas' statement indicates that there was no further government importation of Whitworth rifles by Confederate Ordnance after May of 1863. General Bragg forwarded the letter to his Chief of Ordnance, Lt. Colonel Hypolite Oladowski, at Tullahoma, Tennessee on 3 June 1863 "...who will issue one of these guns to each brigade, to be placed in the hands of one of the most skillful sharpshooters."⁹²

An invoice of Ordnance and Ordnance Stores turned over to Major Jas. M. Kennard in Tullahoma, Tennessee on 15 June 1863 included two Whitworth rifles, two telescopes, two gun slings, two bullet moulds, and four spare cones.⁹³ On 20 June 1863, Colonel Gorgas wrote to Lt. Colonel Oladowski that 20,000 rounds have been sent to General Bragg with the 20 Whitworth (telescopic) rifles.⁹⁴ This Gorgas letter, seen on the next page, appears to confirm the statement made by the writer of the reminiscence previously quoted that 1,000 rounds accompanied each rifle. Records of Augusta Arsenal indicate eighteen Whitworth rifles with telescopes, moulds and slings were forwarded to the Charleston, South Carolina Arsenal on 13 July 1863.⁹⁵

Captain John W. Gillespie, the military store keeper in Mobile, ordered:

...transportation of 6 Whitworth Rifles Complete, (including) 6 Telesc. Sight, 6 Gun Slings, 3 Moulds for Whit. Rifle, 2000 Whitworth Rifle Cartridges (in) 3 packing cases to Brigadier General James Cantey on June 12, 1864.⁹⁶

Lt. Col. Hypolite Oladowski in his Armament and Ammunition Report of the Army of Tennessee dated 19 June 1864, reported three Whitworth rifles in Hood's Corps and twenty-three Whitworth rifles in the Army

Confederate States of America,
WAR DEPARTMENT,
ORDNANCE BUREAU,

Richmond, May 29. 1863.

General

I have directed Capt. J. T. Trezevant Command of Arsenal Charleston to send to you for the use of sharpshooters 20 Whitworth (Telescopic) Rifles recently imported from England.

These arms are reported to be very effective at 1200 yards.

I have the honor to request that they may be placed in the hands of careful and reliable men only as they are very costly, so costly indeed that it is not deemed expedient to increase the number already brought in.

Ammunition and a copy of instructions for their use will accompany the arms.

Very Respectfully,
J. M. Gorgas

Major Colonel

General Braxton Bragg
Commanding
Tullahoma Tenn

A letter from Colonel Gorgas to General Bragg dated 29 May 1863 advising him that "20 Whitworth (Telescopic) Rifles" had been sent to the Army of Tennessee from the Charleston Arsenal and that due to cost, no more would be imported. Courtesy of the National Archives

of the Mississippi, for a total of twenty-six. The same formations had 173 and 3,140 rounds of ammunition respectively for a total of 3,313 Whitworth cartridges.⁹⁷ A week later on 25 June 1864, Oladowski reported three Whitworth rifles in Hood's Corps and twenty-nine Whitworth rifles in the Army of the Mississippi, for a total of thirty-two. This document refers to the largest number of Whitworth rifles in one instance found to date. The same formations had 193 and 3,250 rounds of ammunition respectively for a total of 3,433 Whitworth cartridges.⁹⁸

There is no doubt that marksmen with Whitworth rifles moved about as needed. It must be noted that the transfer of rifles from one facility to another, while seemingly frequent, never enumerated any appreciable amount of rifles indicating that the presence of Whitworth rifles was actually quite limited. Possibly other Whitworth rifles were acquired from private sources in spite of Gorgas' letter in May 1863, after they ran the blockade, possibly from John Fraser & Company of Charleston. No evidence has been found of any Whitworth rifles being surrendered at the end of the war, nor is there any mention of them in post war government sales. The discovery of additional records may increase this number but at present, based on evidence that is available, it seems doubtful if more than fifty Whitworth rifles were imported during the war.

It has become apparent in recent years that existing Whitworth rifles and other British long range rifles have been modified or enhanced to give the impression that they are actually Confederate sharpshooter's rifles. Modifications have included engraved attributions, spurious 2nd quality marks engraved on the trigger guard tang and the fitting of incorrect telescopic sights to some rifles. When considering the purchase of such a rifle, extreme caution should be taken.

Wilson Rifle

The Wilson breech-loading rifle is the rarest and one of the most technologically advanced English arm imported by the Confederacy during the war. Covered by Patents 685 and 1318 in 1859 and 1860 respectively, only seven military pattern short rifles are known at this time, three are in institutions and four are in private collections. Examination of these arms indicates three distinct variations arbitrarily designated the early, transitional and late types.

The rifle is 48.5 inches long overall with a 33-inch barrel with Birmingham proofs. The top of the breech bolt in all variations is engraved in two lines, "T. WILSON'S PATENT". The serial number appears on the barrel beside the cone seat in front of the loading aperture and on the left side of the bolt on two components. Numbers on the early type are "A 12", "A 29", and "A 84". The transitional rifle is "221", no A prefix, and numbers on the late type are "2A 5025", "2A

5048" and "2A 5059". There is no apparent correlation between the serial numbers of the transitional type and the numbers on the early and late type. One early type and one late type have been disassembled and the barrels of each are marked on the bottom by the maker, Henry Clive. The transitional and late pattern rifle barrels have five lands and grooves as found on the Pattern 1858 naval short rifle and Pattern 1860 short rifle.

The early type is .54 calibre and the barrel has standard Birmingham proofs. This rifle has an iron butt plate, trigger guard and stock tip. The breech bolt has a decidedly beaver tail shaped operating latch that is deeply checkered and the lock is dated "1860" which is stamped with a die in front of the hammer. Swivels are located at the rear of the trigger guard tang and on the front barrel band in the manner of the Pattern 1856 iron mounted short rifle. The backsight is the standard sight found on short rifles with gradations to 1,100 yards. One example has a third swivel mounted on the rear barrel band. This early type rifle was likely the pattern shipped on *Bamberg* to Havana and destined for the showrooms of J. Scholefield, Sons & Goodman in New Orleans, according to a sworn statement of Archibald McLaurin, an agent for that company, made 10 July 1862 to Major General Benjamin Butler while in Federal custody.⁹⁹

The transitional example is 28 bore/.55 calibre with five lands and grooves and Birmingham proofs. The rifle has a brass butt plate, trigger guard and stock tip. The butt plate has a trap accessed by a hinged door. Two cavities therein are now empty. Size suggests they contained an oiler and some sort of gun tool. This transitional type retains the beaver tail shaped operating latch of the early type and the same placement of the sling swivels. The lock is dated "1861", but the date is engraved rather than stamped. The barrel bears a small proof, a crown surmounting the initials "TW", meaning Thomas Wilson, in front of the loading aperture, and the number "221". The serial number is repeated in two locations on the left side of the bolt, the bottom of the bolt key and the concave bottom of the beaver tail operating latch. The bayonet bar with extended key and the bottom of the elevating ladder of the backsight are marked with the numeral "1".

The late type is 30 bore/.54 calibre and has a brass butt plate, trigger guard and nose cap. The breech bolt operating latch is the same as that found on the earlier types. The lock is dated "1863" and the numerals are die stamped as was the early type. Swivels are located on the front of the trigger guard and on the front band as in the Pattern 1858 naval rifle. The top of the patent breech bolt is engraved "T. WILSON'S PATENT" in two lines.