WASC 1874

Correspondence with
Royal Armouries
on Pallisers Shells

WASC

Correspondence with Royal Armouries on

Palliser armour piercing shells

'Woolwich Infants'

Muzzle Loading Rifled Guns

As the reader may be aware, we have a Rifled 12.5 inch shell mounted on a railway wagon on our 2'-6" gauge railway. What you may not appreciate is that this shell weights approximately 800 lbs & required a charge of 43 lbs of gunpowder to fire it to a maximum range of 6000 yards.

Note the driving studs which engaged the riffling to impart spin to the shell.

By the 1870s these studs were found to be un-necessary and a copper or lead driving band took their place, to engage the rifling.

All though William Armstrong designed & built breach loading rifled guns from the 1850,s, the breach mechanisms proved unreliable and until the 1880,s (when a more reliable breach mechanism was invented) muzzle loading rifled guns were the norm for both land and sea.

The two photos show the type of gun for which this shell was intended.

It is a rifled muzzle loading gun and weighed 38 tons. A crew of twelve men were required to fire this monster and this type of gun was sited at forts on the coast such as Hurst Castle in Hampshire (where these photos were taken), to guard the western entrance to the Solent.

9", 10" & even 13" guns were built and used both on land and at sea in the new Iron warships which were replacing the traditional wooden ship of Nelsons time.

The Hurst Castle site had ten 12.5 inch and five 10 inch, 18 ton rifled muzzle loading guns.

Muzzle Loading Rifled Guns

The Hurst Castle guns were installed in the 1860s and (all though, by the 1880s were obsolete) were kept in service (as a reserve) until the end of the 1914/18 war, when they were finally scrapped. The gun in the photos was salvaged from the Isle of Wight and mounted on a simplified replica carriage.

I have been asked on a number of occasions, "how were these guns loaded?". Well there were a number of methods, the most sophisticated of which was to turn the gun from it's firing position, through 180 degrees so that it faced a shell hoist and mechanical rammer.

The bag of powder (don't forget, this is before the days of cordite) was hoisted from the magazine below, level with the muzzle and the rammer operated to drive it home. While this was happening a shell was loaded onto the hoist which had returned to the magazine and once the rammer was withdrawn, raised level with the muzzle and the shell rammed. The gun was then swung back to its firing position.

At Hurst Castle the loading method was much more physical, with the gunpowder charge being loaded and rammed by the gun crew. The shell was then lifted level with the muzzle by crane and again rammed by the gun crew.

It must have been a hell of a job ramming 800 lbs of shell down the barrel of a rifled gun.

In the photos of the gun at Hurst Castle, you can see the ram and other implements needed to load the gun, in a rack directly above the gun position.

Photos & Text by J. Wilson

10th August 2004

John Wilson,
173 The Hornbeams,
Harlow,
Essex CM20 1PL.
Tel. 01279 426690
8/1/06

Dear Les,

Thanks for your letter of the 4th and glad to hear you are feeling better.
I hadn't thought of a Touchpaper article, but once I have sorted out all the history I can, of the shells, I will look into that.
As regards the original garden display, I have never seen a photo of it; any chance you can get me a copy or the original to copy, to add to the display, when finished?

Reference your question about chilled cast iron, Capt. Palliser was a very inventive man. In the 1860's he invented a means of boring smooth bore canon and inserting a rifled liner into the barrel. The cannon was then fired with an over sized charge, to expand the liner tightly into the bore. this not only increased the useful life of the canon, it also made it stronger.
The next job was to make an armour piercing shell, which he achieved by casting the shell, nose down in a special mould, the lower end of which was steel with a water cooling jacket. The top 3/4 of the mould was a conventional sand mould.
When the cast iron is pored into the mould the nose cools very quickly and becomes extremely hard while the iron in the sand part of the mould cools slowly and remains malleable allowing the machining & fitting of the bronze lands, which engage the rifling. This allows the nose of the shell to cut through the armour, which if it were soft, it could never do.
As I say, Palliser must have been a very clever man, because chilling cast iron not only makes in very hard, it also can cause it to crack in the mould, so foundries avoid chilling like the plague, how he got round the problem of cracking or even persuaded Woolwich to try his idea, I have no idea.

With reference to the Beam Engine display, I purchased a cheap video camera in the latter part of last year and then visited Kew Bridge Steam Museum, to film their Easton & Amos Compound Engine. If you have seen one beam engine, you have basically seen them all, so Kew was the ideal starting point, as the Easton & Amos is near enough the same size as used in the Mills and was built in 1863, so is of the right period too.
I then visited Bredgar & Wormshill narrow gauge railway in Kent, who also have a compound engine, though much smaller than the mills.
The final visit was to Strumpshaw steam museum, where they have a huge compound engine, which is as big as the entire boiler house and engine room put together.
The problem with Kew was that you could not film the engine in it's entirety, as there isn't the space to stand back from it, secondly, the lighting is poor, so that caused no end of problems. Strumpshaw gave the same problem, but worse, as the lighting is even worse than Kew, so I was not able to film anything.
Bredgar was the best location, but here people were a problem, but I did manage some reasonable film.
However all the visits proved one thing, (1) if we want a film of a beam engine, it needs to be done by someone with the skill to edit the film to give some degree of

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professionalism and I'm afraid that's not me.

(2) we need a private visit to a suitable site, Bredgar being the most obvious, so that the film can be made without people getting in the way.
The third option, we purchase a ready made film (if one is available), asking the supplier/maker for permission to give public showings.

As regards the use of the video, I have heard a number of ideas from the Friends. (1) was a large TV screen. (2) a video projector onto the white wall of the engine room. I don't think this practical myself, as the room is too bright for a projection system, and finally a video wall made up of a number of TV screens. I would have thought a large TV the best and most practical option.

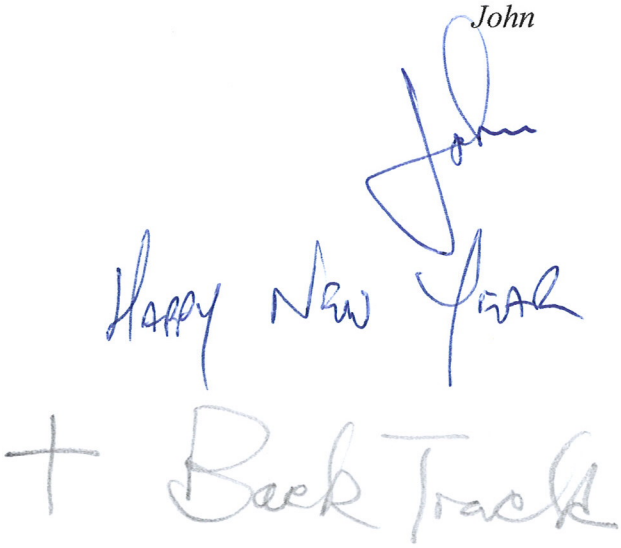
As regards signage, I can produce these, if we get something to show.

One question at this point, does Bolton have any photos of Hicks Hargeave engines, that they would let us have copies of? Perhaps we could then get a professional blow up, to hang on a wall in the engine house.
There is a small A4 photo of the Easton engine in the engine room, but it isn't of good enough quality to blow up any bigger.

Let me know beforehand, when you intend to be in next, and I will bring in the Video CDs of the film I took, for you to borrow.
Some will play on a DVD player, others you will need a computer with a media player.

Regards,

John



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30.11.05

John Wilson Esq,
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Dear Mr. Wilson,

Thank you for your recent letter and very nice image. Having looked at the details again I would like to revise my identification of your shell. They are, of course, Palliser shell for the 12-inch Rifled Muzzle Loading gun of 35 tons and not common shell. Palliser shell were armour piercing. The bursting charge was issued through the one and three quarters inch filling hole in the base into what was almost a teardrop shaped chamber lined with composition that was 4.2 inches at its base and 9.8 inches in length. The bursting charge was 9lb 14oz either of large grain shell powder or dry guncotton. The filling hole was then plugged with a base plug. No fuze was necessary because the concussion against armour was sufficient to ignite the bursting charge.

The nature of this subject is quite complex and involves the work of Sir William Palliser who in 1863 proposed a projectile of cast iron in a metal chill to render it harder for armour penetration.

I hope this will clarify the situation and apologies for my earlier error. I hope it has not inconvenienced you in any way.

Yours sincerely,

PA Magrath

Philip A. Magrath
Curator of Artillery

John Wilson
173 The Hornbeams,
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01279 426690
26/2/04

The Royal Armouries,
Fort Nelson,
Dear Curator,

Having written to the Imperial War Museum, they suggested that I drop Fort Nelson a line, as my questions were out side there expertise, so taking them at there word, I wonder if you can give any information?
I am a volunteer for the Waltham Abbey Royal Gunpowder Mills and wonder if you could give me any history on the type of 12" shell shown in the accompanying photos and Drawing.
We have 6 in total, which, I am told came from Woolwich Arsenal and were used as garden ornaments, placed around a sundial in front of Walton House, which was the offices block on the Northern site of the Gunpowder Mills.
With the close of the Mills as a working site the shells were dumped in a metal skip (see photos) where they have remained for at least three years (probably a lot longer).
It is my intention to clean them up, give them a coat of paint and put them on display. But I would like to know more about them before doing so.
Their dimensions are 12" dia by 32" long (base to point). With 8 or 9 rows of three studs to engage riffling. It is difficult to be sure of the number of rows, as its so hard to move the shell to count them.
There are two ¾" dia by ¾" deep lifting holes in the nose. There is a hole cast in the base of the shell 1 ¾" dia and approximately 20" deep. The shells appear to be solid cast iron and since we don't have lifting equipment, is proving very difficult to move.
From my own examination and from the little information I could find on shell technology in two books I have on Big Guns, I assume these are a very early design for a muzzle loading riffled cannon and that the two holes in the nose are for lifting the shell.
We have no lifting equipment at the Mills and no way of weighting the shells but I would estimate their weight at 4 to 5 Cwt. I consider myself to be reasonably strong and the only way I found of moving them, is with a very big crowbar and a 2 ton pallet truck.
A very rough sketch is enclosed with the dimensions on it.
I would be grateful for any information you can give as to their age, use, and since we intend to give them a coat of paint, what colour (if any) would be appropriate. I hope you will be able to help with this enquiry, as I am sure these are a very important artefact (I have never see anything like them before) and it would be a pity to leave them hidden from our visitors.

Yours Sincerely,

John Wilson

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22/11/05

J. Wilson Esq.
173 The Hornbeams
HARLOW
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Dear Mr. Wilson,

Thank you very much for your enquiry dated 26/2/04. Perhaps you will forgive me for the great delay in responding occasioned by a huge backlog.
Your letter is very interesting and thank you for the images. It looks very much as if you have common shell for the 12-inch Rifled Muzzle Loading gun of 35 tons. This was introduced into the service in 1871 and only fifteen guns were made. I am very sorry to hear that they were dumped but it was pleasing that you had the presence of mind to rescue them. By now I expect you have restored them to their former glory. You are correct in your belief that the two holes were to do with moving the items – these were called unloading holes. The studs on the round were used of course to engage within channels grooved in the gun barrel in order to enable rifling or to impart spin to the projectile. This type of rifling was known as the 'Woolwich groove'. Studless shell could also be used but required a device called a gas check fitted to the base of the round. I can provide much more information on this item if you would still like.

As far as conservation is concerned, I suggest ideally that you would have had them grit-cleaned and then treated with a rust inhibitor like Jenolite or red oxide. When unfilled with explosive these rounds were painted black, then when filled a red band of about an inch diameter was added just below the top of the round.

Once again I am extremely sorry for the great delay in getting back to you. If you do wish to contact me again about this I shall reply immediately.

Yours sincerely,
PAMagrath

Philip A. Magrath
Curator of Artillery

John Wilson,
173 The Hornbeams,
Harlow,
Essex CM20 1PL.
Tel. 01279 426690
24/11/05

Mr. P. A. Magrath,
Royal Armouries,
Fort Nelson,
Dear Philip,

Thanks for your letter of the 22nd, it was most interesting and answered a number of questions for me.
One further question though, you mention filled & unfilled shells, do I take it that a explosive charge was inserted in the 1-3/4" Dia. hole that runs down the centre of the shell?
Presumably there would have been a time fuse in the base of the shell to set the charge off? as the nose of the shell is solid, precluding some form of impact fuse in the nose, or was there some other means of detonating the charge.

Due to limited volunteer numbers, we have only cleaned & mounted one shell at present & I enclose a photo of our 2'-6" gauge loco, with shell mounted on a wagon. The Hunslet loco & wagons that you see in the photo are from the cordite factory at Bishopton, Scotland.

I look forward to hearing from you & will be passing this information onto our archivist, so that we can use your information in future projects.

Thanks Again

Yours Sincerely,

John Wilson

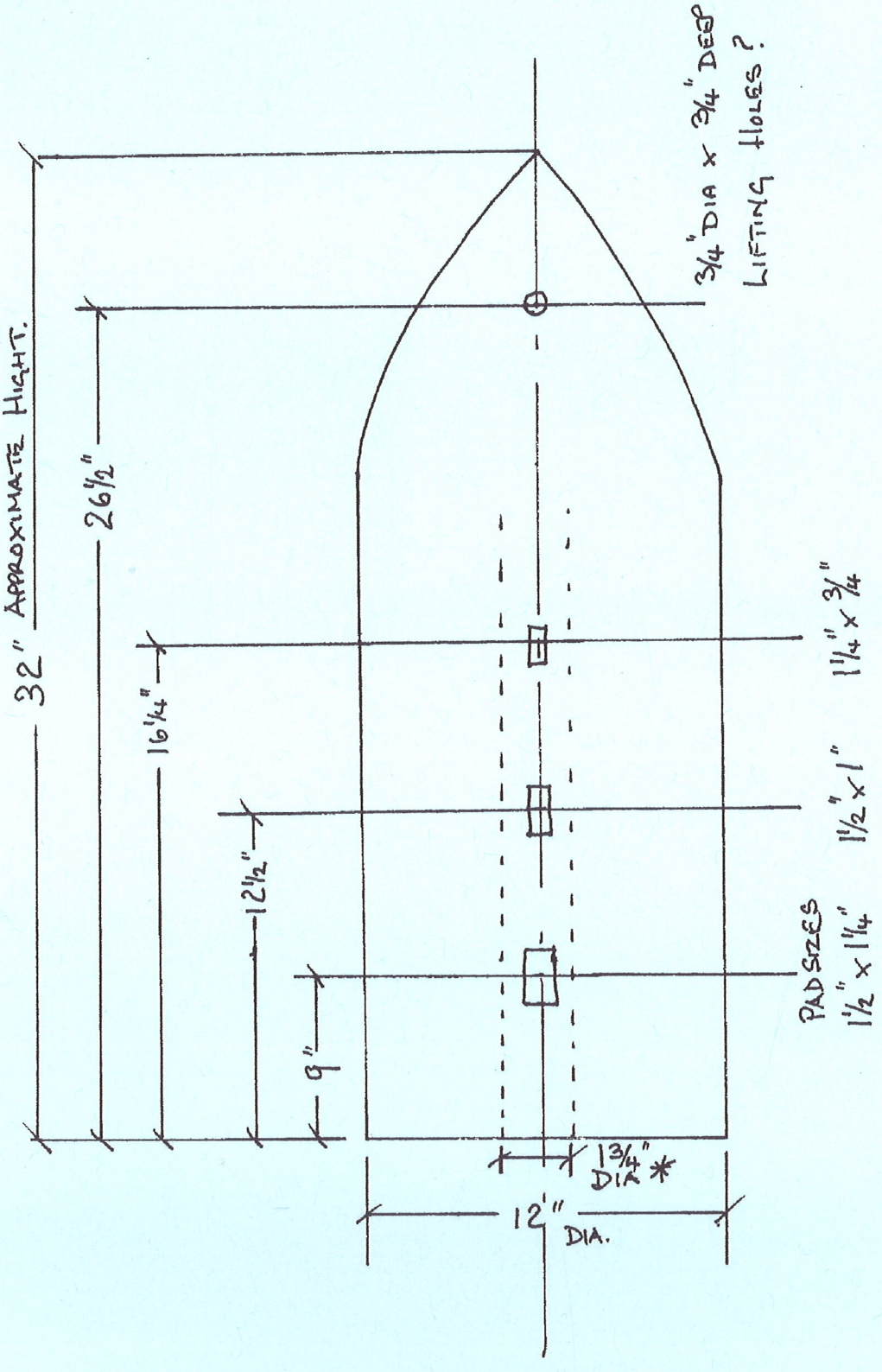
Copy to Lynne Lennard
Brian Harvey
Richard Thomas
Les Tucker

LES,
THOUGHT THIS ENCLOSED MAY BE OF INTEREST FOR YOUR ARCHIVES.

John

THIS DRAWING IS NOT TO SCALE

18/2/04



* DEPTH OF HOLE IN BASE 20" BUT MOST OF THE SHELLS WERE FILLED WITH DIRT AS WAS THE ONE MEASURED, SO IT IS PROBABLY A LOT DEEPER.

Article by John Wilson for Touchpaper March 2006.

The Woolwich ~~Orphans.~~ Infants

6 off 12inch shells were used as part of a garden display, outside Walton House and were (indeed still are) referred to as the Woolwich ~~Orphans~~ Infants (anybody know why?). One is now part of our 2 foot 6 inch gauge railway display at 83B, where it is mounted on a railway wagon. 3 are laying in a metal pallet besides 83B and two are now on display in the large exhibits area.

They are 12 inch muzzle loading, rifled, armour piercing shells (M. L. R.), made at Woolwich Arsenal to the design of Major Sir William Palliser1830-1882 and were made in 1871, with only fifteen guns being built to this calibre.

What makes these shells unusual is their method of manufacture.

Sir William realised that to penetrate the new armoured war ships which were appearing in the 1860's, a hard point was required, to punch a hole through the wrought iron armour. He came up with the idea of a water cooled mould for the head of the shell, with a conventional sand mould for the other two thirds. The reasoning being, that when cast iron is cooled suddenly, it becomes very hard. The shell was cast nose down with the steel part of the mould at the bottom. The sand part of the mould cools slowly, so the main body of the shell remains ductile and can be machined to take the driving studs for the rifling.

Each shell weights approximately 800 lbs & required a charge of
43lbs of gunpowder to fire it to a maximum range of 6000 yards.

The shell could be used in two ways, (a) as a plain shell without explosive charge, or (b) with 9lbs 14oz of large grain gunpowder, or guncotton, inserted through the base into the shell cavity, the base then being sealed.

A red band around the nose denoted that the shell had a charge of powder.

When filled, no fuse was needed, as the impact of the shell against the target is enough to set off the charge.
Note the driving studs which engaged the rifling to impart spin to the shell.
By the 1870s these studs were found to be un-necessary and a copper or lead gas check was fitted to the base of the shell to engage the rifling.
All though William Armstrong designed & built breach loading rifled guns from the 1850s, the breach mechanisms proved unreliable for large calibre guns, and until the 1880,s (when a more reliable breach mechanism came into service) muzzle loading rifled guns were the norm for large calibres above 7" both on land and at sea.
The two photos show the type of gun for which this shell was intended.
It is a rifled muzzle loading gun and weighed 38 tons.
A crew of twelve men were required to fire this monster and this type of gun was sited at forts on the coast such as Hurst Castle in Hampshire (where these photos were taken), to guard the western entrance to the Solent and on the larger battleships such as H.M.S. Inflexible of 1881, which had two twin mount 81 ton, 16inch calibre M. L. R guns mounted in turrets amid-ship.
7, 9, 10, 12 & even 16inch M. L. R. guns were built and used both on land and at sea in the new Iron warships which had replaced the traditional wooden ship of Nelsons time by the 1860's.
The Hurst Castle site had ten 12.5 inch and five 10 inch, 18 ton rifled muzzle loading guns which were installed in the 1860s and (all though, by the 1880s were obsolete) were kept in service (as a reserve) until the end of the 1914/18 war, when they were finally scrapped. The gun in the photos was salvaged from the Isle of Wight and mounted on a simplified replica carriage.

How were these guns loaded?

Well there were a number of methods, the most sophisticated of which was to turn the gun from it's firing position, through 180 degrees so that it faced a shell hoist and mechanical rammer this method being used on battleships for the larger calibres, such as the 16inch guns mentioned earlier.

The bag of gunpowder (don't forget, this is before the days of cordite) was hoisted from the magazine below, level with the muzzle and the rammer operated to drive it home.

The hoist returned to the magazine where the shell was collected and raised level with the muzzle again. The shell was then rammed. The gun was then swung back to its firing position, ready for use.

At Hurst Castle the loading method was much more physical, with the gunpowder charge being loaded and rammed by the gun crew. The shell was then lifted level with the muzzle by crane and again rammed by the gun crew.

It must have been a hell of a job ramming 800 lbs of shell down the barrel of a rifled gun.

In the photos of the gun at Hurst Castle, you can see the ram and other implements needed to load the gun, in a rack directly above the gun position.

The last firing of a similar gun was on Malta, during the defence of the island from German attack in the 1940's.

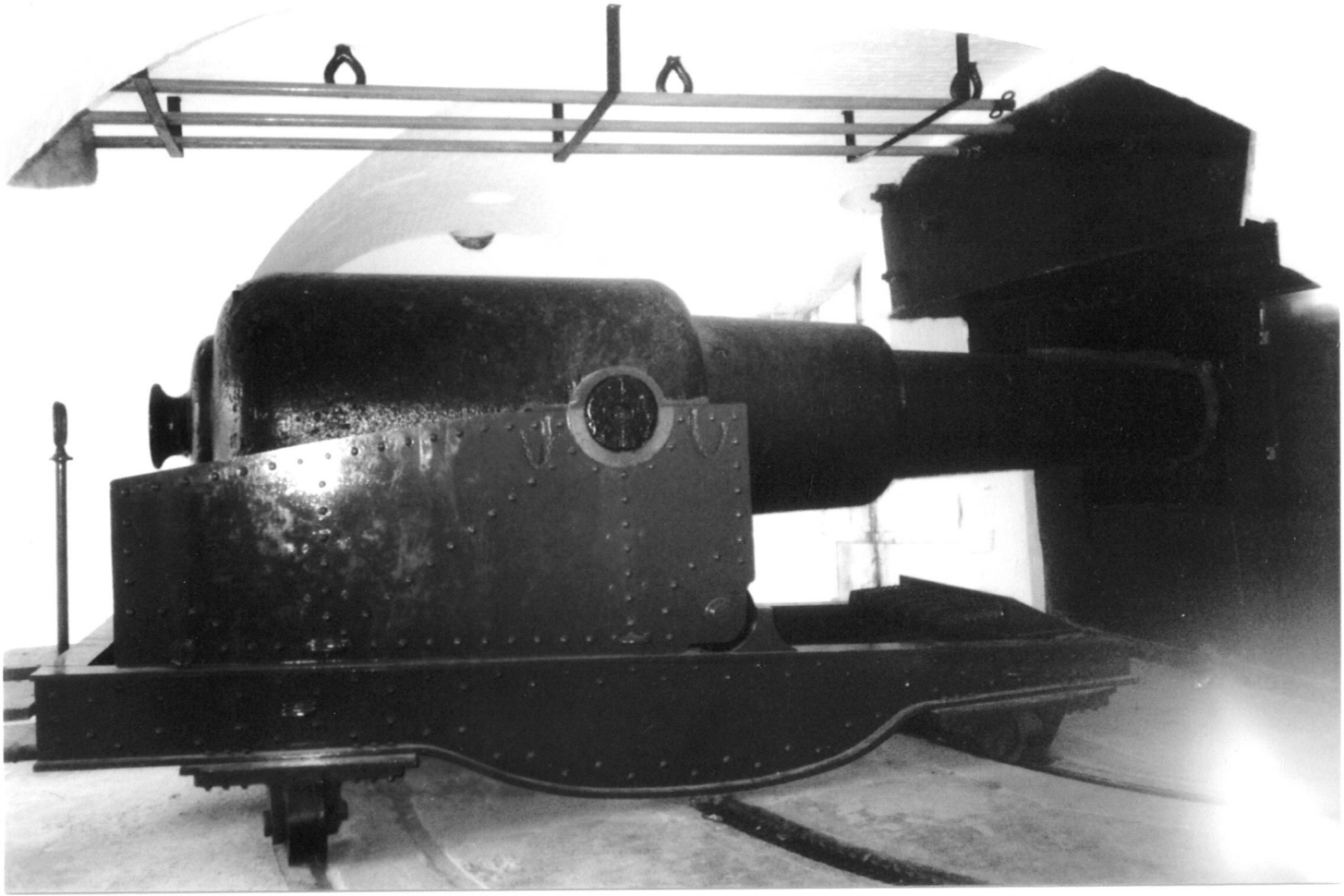
There is no record of whether it hit it's target.

Sir William Palliser, Soldier, Inventor, MP.

Sir William Palliser was a prolific inventor, born in Dublin on the 18th. June 1830 and was educated at Rugby, Trinity College, Dublin and then Trinity College, Cambridge where he studied rifled ordnance and projectiles. He then went to Sandhurst and obtained a commission as an Ensign in the Rifle Brigade on 22nd. April 1844. He later served in the Crimea as a Lieutenant and in 1858 transferred into the 18th. Hussars where he was promoted to Captain.
In July 1860 he went to Dublin as Brigade-Major of Cavalry, where he remained until 1864, retiring from the army in December 1871 as a full major.

His inventing skills are first seen in 1853 at Shoeburyness, when projectiles to his design are tested and again in 1855 when a rifled mortar is tested.
He took out a patent in 1854 for projectiles, and in 1860 for improvements to breech loading rifles.
In 1862 he designed a method of boring out smoothbore canon and inserting a rifled sleeve so making an obsolete 32 pounder smoothbore into a useful 64 pounder M. L. R.
Some 60 guns of various calibres were converted in this way.
Also in 1862 he took out a patent for screw bolts for fixing armour plate.
On the 27th. May 1863 he took out the patent for chill-casting projectiles, which is where our orphans were born.
Between 1867 and 1881 he took out a further fourteen patents dealing with guns, projectiles & bolts.
Sir William was Knighted on 21 January 1873.
In 1880 he became MP for Taunton.
He passed away on 4th. February 1882 & was buried in Brompton cemetery

Photos & Text by J. Wilson
10th. January 2006
Many thanks to Philip A. Magrath, Fort Nelson, for his help in compiling these notes and also to my friend Cyril Martin, who did the research into Sir Williams Life.



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11/1/06

Mr. P. A. Magrath,
Royal Armouries,
Fort Nelson,
Dear Philip,

Please find enclosed an article that I hope to get published in the Gunpowder Mills house magazine call the Touchpaper. I hope you find it of interest.
I also enclose copies of the two photos referred to in the text.

Now for another question. When cleaning the two shells, I notice numbers stamped on the bottom row of rifling pads (see photos). Not every pad is numbered, but I wondered if you knew if they had any significance?
As you will see from the photos, the first shell has the number 1 X then what could be a date 11/77 on the first pad and then reading around the shell in an anti-clockwise direction, 1,3,Blank,Blank,3,Blank,Blank,3.
The second shell also has a 1 X, then Blank,1,Blank,Blank,1,Blank,Blank,1.

Any thoughts on what they may mean?

Yours Sincerely,

John Wilson

Typical markings found on first shell when cleaning

Typical markings found on second shell

Two views of 12" shells after cleaning and first coat of red oxide.
7th. January 2006