

Armament

HMS Warrior was the most powerful ship of her day. Her impressive armament was a mixture of old and new technology.

The twenty six 68-pounder, muzzle loading guns on the gun deck represented the old technology. Muzzle loading guns have their powder and shot rammed in down the muzzle. This means that after every firing the gun has to be pulled back so that the gun crew can clean out the barrel and load the next shot before pushing the gun back up to it's firing position. This takes time but a really good gun crew could do it in less than a minute.



The new technology was represented by eight Armstrong 110-pounder, breech loading guns. These were state of the art weapons and the decision to fit them was taken only while the *Warrior* was still being built. Instead of loading powder and shot through the muzzle, the back end, or breech, of these guns was able to unscrew and the powder and shot could be loaded this way. This meant that there was less man handling of the guns and in theory they could be reloaded more quickly than the muzzle loaders.

The muzzle loaders fired a range of different projectiles, mainly solid iron shot or explosive shells filled with gunpowder. The 68-pounders could fire a shot weighing 68 pounds (31 kg) some 2300 metres. The 4.75 ton (4826 kg) gun and carriage needed 18 men to handle it.



Firing one of *Warrior's* Armstrong breech loaders
Image courtesy of HMS Warrior 1860

The Armstrong breech loaders weighed in at 4.1 tons (4160 kg) and fired a 110 pound (50 kg) shot some 4100 metres.

Instead of cannon balls these guns fired cone headed shells. The shells were coated with lead because these guns were 'rifled'. This meant that the inside of the barrel was lined with spiral grooves. The lead coating of the shell bit into the spiral grooves and as the shell travelled up the barrel it spun. These spinning shells were much more accurate than the balls fired out of the smooth bore muzzle loaders.

Continued on next page



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How does a cannon work?

The working principle of a cannon is really quite simple.

A cannon consists of a sturdy tube (the barrel) which is closed at one end (the breech) and open at the other (the muzzle). You pack the breech end with explosive and then push a projectile (cannon ball) down on top of it. A wad of rope or material is pushed in on top of the ball to stop it rolling back out the barrel if you need to fire at a low elevation.

The explosive is then ignited through a narrow hole in the breech called the vent or touch hole. The explosive undergoes a chemical reaction which generates lots of gas very quickly. These reactions generally also give out a lot of heat. The expanding gas pushes against its surroundings. As long as your barrel is sturdy enough, the only thing that will move is the projectile and this is propelled up and out of the barrel with great force.

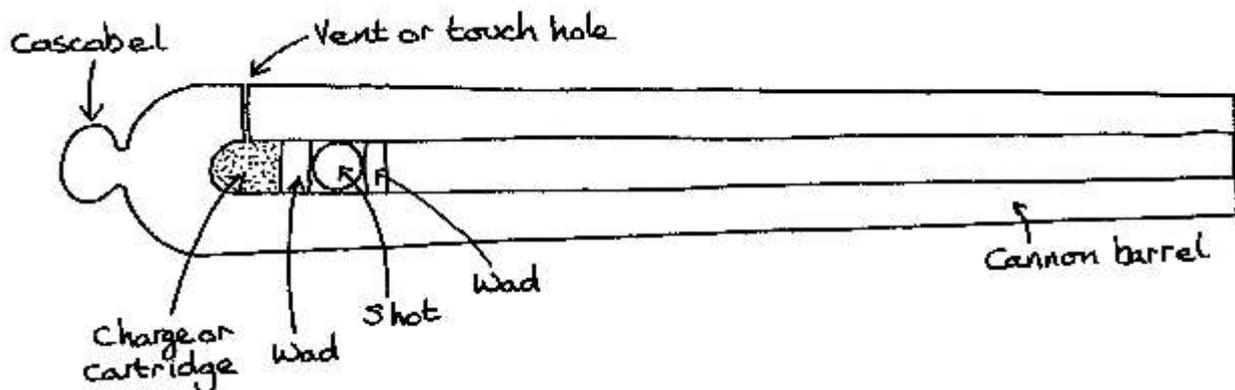


The breech of one of *Warrior's* 110 - pound Armstrong guns

Due to Newton's Third Law of motion, which states that every action has an equal and opposite reaction, the cannon ball is pushed in one direction and the cannon itself is pushed in the other.

This pushing of the cannon backwards is called recoil. If the muzzle loaders on the *Warrior* were left to their own devices, on firing they would recoil over 15 metres. As the ship is 18 metres across at its widest point it would not be a good idea to let this happen. Instead the guns are tied down and allowed to recoil about 2 metres.

Considering that they weigh over 6000 kg a piece, this gives an idea of the considerable force with which the cannon ball is fired.



Build your own muzzle loader

Building a cannon is simple. All you need is a tube and a source of fast expanding gas. The instructions below show you how to build your very own cannon. It won't quite be able to hurl a 30 kg iron ball over 2 km but it's pretty impressive none the less.

Here's what you will need to make it:

- A small (33 cl) fizzy pop bottle
- An old biro (preferably with a round outer surface)
- Some cling film
- Some electrical tape
- Some paper
- A round headed pin
- A wooden kebab skewer
- Some fizzy antacid tablets
- An electric drill
- A hot glue gun
- A junior hacksaw
- Some fine grade sand paper
- A pair of needle nosed pliers
- A pair of safety goggles

Adult assistance may be required when using the drill, saw or hot glue gun.

Please note: The antacid tablets should not be given to young children to use without adult supervision.

Here's what you do:

Step 1

Pull the refill out of your old biro and pull the plug out of the top. Use the hacksaw to carefully cut the tapered end off of the biro tube. Sand any rough edges down.

You should now be left with a long, straight tube.



Build your own muzzle loader

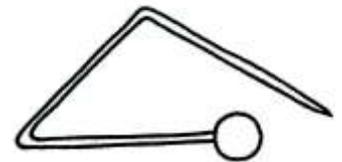
Step 2

Find a drill which is the same diameter as your biro tube. Make a small pilot hole in the centre of the pop bottle lid and then drill through. Push the biro tube through the hole so that about a third of its length will be inside the bottle when the lid is screwed on.

Use the hot glue gun to seal the biro tube in position. Put glue on the inside and outside of the lid as this seal needs to be airtight. When putting glue inside the lid make sure it will not interfere with screwing the lid on and off.

Step 3

Using the needle nosed pliers bend a round headed pin into the shape shown in the diagram. Mind your fingers as you do this. It is also recommended that you wear eye protection whilst doing this as some pins can be brittle and snap when bent.

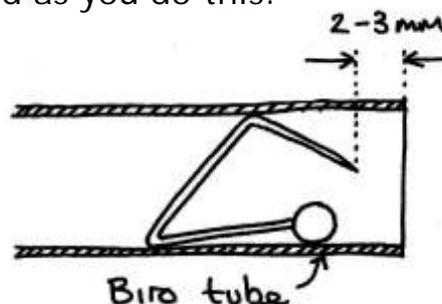


Step 4

This step has to be done quite quickly. Put a dab of hot glue onto the round head of the pin and push the bent pin into the end of your biro which will be inside the bottle. Use the needle nosed pliers to grip the pin as you do this.

The point of the pin needs to end up about 2 or 3 mm from the end of the tube.

Take care not to get pricked as you do this.



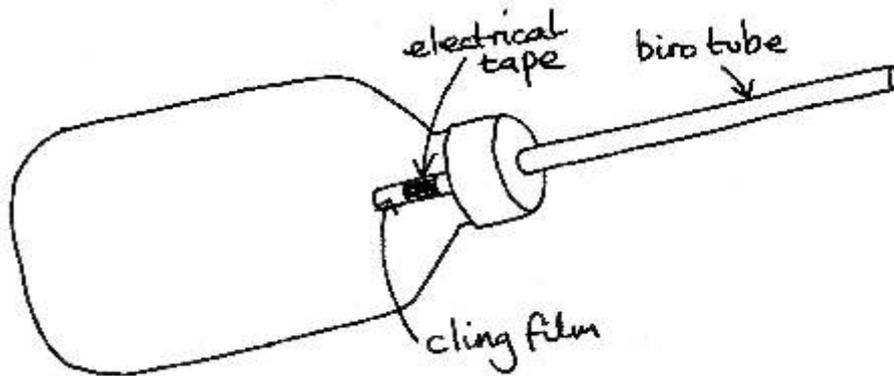
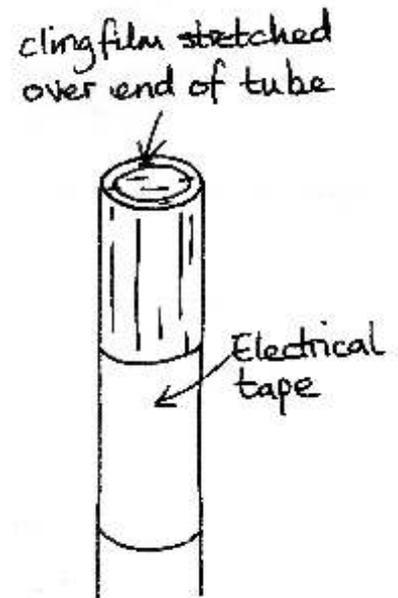
Build your own muzzle loader

Step 5

Cut a piece of cling film about 2 cm by 2 cm and place it over the end of the tube which will be inside the bottle. Carefully wrap the cling film around the tube and fasten it tightly with a piece of electrical tape. Make sure there are no holes in the cling film and that the electrical tape forms an airtight seal. You can check this by blowing lightly down the open end of the tube.

Screw up a small piece of paper and dampen it with some water. This little ball of paper should fit tightly into the outside end of the biro tube. Break the sharp end off of your wooden kebab skewer and use this as your ram rod to push your 'cannon ball' down the barrel.

Be careful not to dislodge your pin as you do this.



Build your own muzzle loader

Step 4 - Firing Your Cannon

Your cannon is loaded and ready to fire!

Before you carry out the next instructions make sure that you have a clear field of fire. Do not aim the cannon at people or animals.

All you need to do now is half fill the pop bottle with water. Then break up two fizzy antacid tablets and place them in the centre of a piece of paper that has been folded in half. Use the paper to slide them into the bottle and very quickly screw the lid of your bottle on. Make sure the barrel is pointing away from you and not at anyone else when you do this.

What happens now is all down to chemistry and physics.

The tablets react with water and give off carbon dioxide gas. The reaction is much slower than the reaction that produces gas when gunpowder burns. Because of this, we need to contain the gas until a decent amount of pressure has built up. That's where the cling film comes in.

As the pressure builds in the bottle it pushes outwards. The cling film covering the end of the biro tube bulges into the barrel and eventually touches the pin and breaks. When this happens the gas in the bottle is released quickly and shoots up the barrel, pushing the paper ball in front of it.

Things You Can Try

What difference does using hot or cold water in the bottle make?

What difference does using more or less tablets make?

Set up a target to practice firing at.

Make up your own gun drill and see how many shots you can fire in one minute.

Can you achieve a higher rate of fire if you have another person to help in your gun crew?

