

The Fire Piston



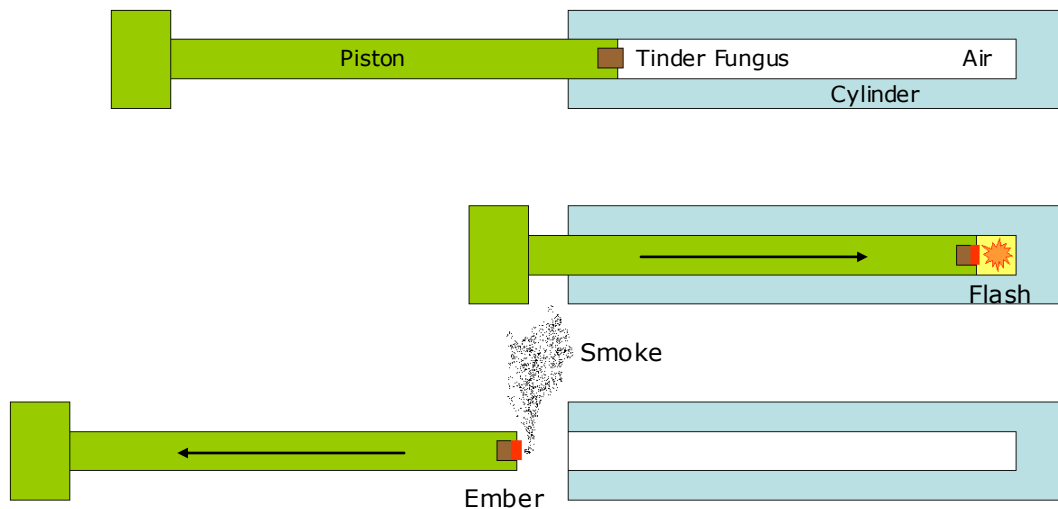
History of the fire piston:

It's amazing that centuries before scientists such as Boyle established the ideal gas law, or the idea of a diesel engine was conceived, the fire piston was being used in Southeast Asia, Indonesia and the Philippines to start fires. The principle of heating air by compression and igniting tinder was accidentally "re-discovered" much later during the early 1800 in Europe by a French airgun manufacturer, who, when firing an airgun in the dark observed light being emitted from the barrel. This led to the development of the "fire syringe", which was then widely used in Europe until the first wooden matches become popular.

Basic theory how a fire piston works:

The basic working of the fire piston can be explained by using Boyle's ideal gas law formula and the diagram shown below.

Boyle's ideal gas law: $P \cdot V = n \cdot R \cdot T$



When a fixed volume of air is quickly compressed by a piston in a cylinder the volume (V) is reduced and the pressure (P) increases significantly. The number of moles of air (n) and the universal gas constant (R) is unchanged, thus most of the work done by quickly compressing the fire piston is converted into heat which increases the temperature (T) by at least an order class. This high air temperature results in the tinder fungus reaching flash point, causing a small local explosion in the cylinder. If the piston is quickly removed, and the tinder fungus exposed to oxygen, ignition point and thermal runaway is reached leading to the formation of an ember, ready for you to start a fire with.

Yes, air gets very hot when compressed under high pressure. A good example is the heat generated when using a bicycle pump.

Making a fire using the fire piston:

Step 1:

Ensure that the piston fits snugly into the cylinder, is well lubricated (use Vaseline) and that air does not escape past the sealing ring. To check this, push in the piston - it should feel like freely pushing against an air bubble. When you pull the piston out, it should make a popping sound when leaving the cylinder.

Step 2:

We need to prepare the tinder nest. Take a piece of hemp and pull and divide it into small tufted pieces like cotton wool, as per photo (a). Now, shape the plucked out hemp into the form of a birds nest, as per photo (b), and place a piece of charred cloth, shown in photo (c), in the centre. You are now ready to make the red hot ember with the fire piston that will be used along with the charred cloth, in the tinder nest, to finally start the fire. You could also light your pipe with the ember.



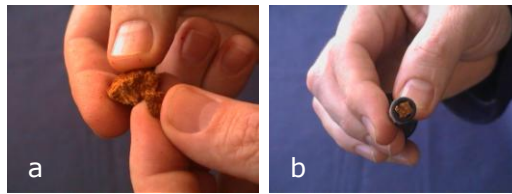
Note: Charred cloth is a piece of cotton cloth that has been, heated, starved of oxygen and thus changed into a form of "cotton charcoal". Charred cloth can be ignited with the smallest of embers even a small spark will do the job.

When in the veld, the hemp and charred cloth can be replaced with fine dry tinder that is available.

Step 3:

Let's get going, as per photo (a) break off a small piece of tinder fungus, just large enough to fill the hole at the front of the piston. Push the piece of tinder fungus into the hole, and break it up into small pieces with your

nail. Ensure that the tinder fungus is well seated, but not too tight, as shown in photo (b).



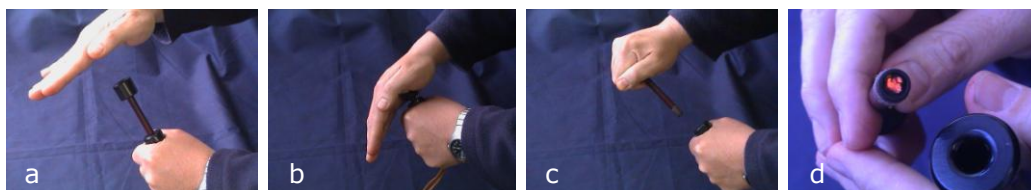
Ok, so you don't know what tinder fungus is. Tinder fungus is shown in photo (a) below. It is also known as Amadou, Hoof fungus or scientifically as *Formes fomentarius*. It has been used for centuries to help start fires. The fungus is prepared by slowly boiling it in urine for a view days. Yes believe it or not, the urine boiling results in the saturation of the fungus with saltpetre (you can also boil the fungus in potassium nitrate). The fungus is then dried, cut into thin slices, and hammered flat with a piece of wood and is now ready for use.



True tinder fungus is shown in photo (b) above. It is also known as Clinker fungus, in Russia as Chaga or scientifically as *Inonotus obliquus*. This fungus normally grows on live birch trees, has a hard black exterior, and a softer red-brown corky interior, which is used as true tinder fungus. When smouldering, the true tinder fungus gives off a lovely aroma. The flash point of true tinder fungus is typically 280 °C which makes it ideal for use as tinder in the fire piston.

Step 4:

Place the piston into the cylinder with the sealing ring just inside. Hold the cylinder firmly with your left hand and hit down fast and hard with the palm of your right hand onto the piston, as shown in photos (a) and (b). Grip the piston handle and quickly pull the piston out from the cylinder as shown in photo (c). Turn the piston towards you and gently blow oxygen onto the tinder fungus. If all is well a red hot glowing and smoking ember should be forming as shown in photo (d). If no ember has formed, repeat Step 4 until successful.



Ok, you have tried and the palm of your right hand is blue and sore. Obviously there is something wrong. Make sure of Step 1, then redo Step 3, and try Step 4 again. Well if you are still unsuccessful eat mielie pap,

hit down faster and harder. Note: There is another emergency option, use a piece of charred cloth in the piston instead of the tinder fungus it will also work but will pollute your cylinder in the long run.

Now we are ready to start the fire.

Step 5:

Place the glowing ember onto the charred cloth in the tinder nest and lightly blow oxygen over it igniting the charred cloth as per photo (a). Fold the tinder nest over the glowing charred cloth and continue blowing air into the nest as per photo (b). The tinder nest will start smoking. Blow harder and harder. Don't stop until the tinder nest suddenly bursts into flames as per photo (c). Yes, you've done it ! Flames to start a big fire. All you have to do now is to put this burning tinder nest into your pre-prepared fire pile and that's it, a fire started with a fire piston.



The fire piston is an elegant age-old way of making a traditional fire, which will give you years of good service. Kids young and old are fascinated by its working. The fire piston is a practical and efficient way to start a fire in the veld.

Note: You can purchase a complete fire piston set, as used in the article above from Gavin "Slow Match" Margrate at e-mail address plumcrazy@absamail.co.za or phone him on +27 (0)82 469 3236.

Thanks to Dr Riana Geschke for the photos taken. My side kick, Wessel Croukamp who assisted with the fire making. Dr Igor Gutman "Wild African Man" who supplied the true tinder fungus (Chaga) from Russia and Dr Peter Mallon for determining the flashpoint.

Dr Wallace Vosloo