

Period Fire Making

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Fire may no longer be the everyday necessity it once was, but studying and practicing period fire making methods can be an immersive (and fun!) way to learn more about those whose lives depended on it. Some documentable methods for making fire prior to 1600 CE include friction, solar, and percussive ignition.

Friction fire making

An ember can be generated by rapidly grinding pieces of combustible material against each other, or, to over-simplify the process, by “rubbing two sticks together”. Some methods for starting a fire by friction include fire saw, fire plow, hand drill, bow drill, thong drill, and pump drill [1] [2]; of these, bow drill seems to be the one most commonly taught in modern bushcraft and survival classes. Making fire by friction requires semisoft, dry wood, and material selection is considered by some experts to be the most important step in the process [3].

Well-preserved fire drill components were found in tombs of the Yanghai cemetery (c.1000 BCE – 100 CE) in Xinjiang, China, including boards made from *Picea* sp. (spruces), *Populus* sp. (poplars and cottonwoods), and *Salix* sp. (willows) and drills made from *Picea* sp., *Salix* sp., and woody vines in the *Clematis* genus [2]. The finds were determined to have been used for hand drilling, specifically; the tops of the drills were not rounded and no surface abrasion was detected, indicating that they had not been used with a bearing block or bow (Figure 1). A (very roughly) contemporary Roman account of friction fire making can be found in Pliny the Elder’s *Natural History* (c. 77 CE) [4]. He recommends a combination of ivy wood and laurel, as well as another unnamed vine, for fire by friction, but does not specify what method should be used¹.

In many places, friction fire making appears to have been replaced by other ignition methods over time, but some later references to fire drills in western Europe can be found. The Old Icelandic terms *bragð-almr* and *bragðals-eldr* are translated as “twirling awl” and “the fire produced using a *bragð-almr*”, respectively [5], suggesting the knowledge of some sort of fire drill. A fire drill on a massive scale was used in medieval and early modern Europe to kindle the needfire [6]. A hole was bored through a log to create a hearth board, and a spindle made from another log was fit into the hole and turned by use of ropes or a windlass [6]. This apparatus created a “virgin flame” from which all the fires in the village were ceremonially relit [7].

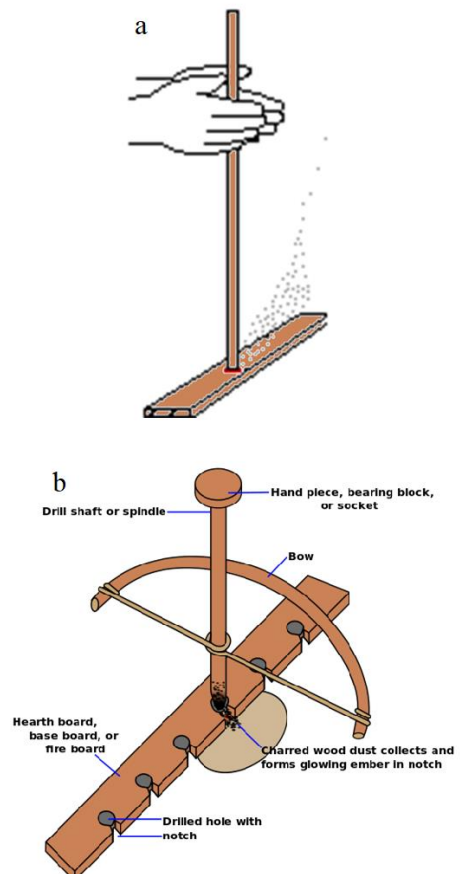


Figure 1. A comparison of a) hand drilling [33] and b) bow drilling [34]

¹ “This has been discovered by experience in the camps of military scouting parties and of shepherds, because there is not always a stone at hand to strike fire with; consequently two pieces of wood are rubbed together and catch fire owing to the friction, and the fire is caught in a lump of dry tinder, fungus or dead leaves catching most readily. But there is nothing better than ivy wood for rubbing against and laurel wood for rubbing with; one of the wild vines (not the claret-vine), which climbs up a tree like ivy, is also spoken well of.”

The Church in western Europe opposed this practice; the 8th century *Indiculus superstitionum et paganiarum* (“Small index of superstitions and paganism”) condemns the practice of *nofyr*² [8], and the capitulary of Charlemagne in 942 forbids *niedfyr*³ [9]. Despite this, a needfire was lit in 1268 in England (as reported with pious horror in the Chronicle of Lanercost⁴) to combat an outbreak of disease among the village cattle [10]. While the practice of the needfire preserved a method of fire making by friction into the early modern era in western Europe, and is therefore worth mentioning, it should not be considered evidence for the common use of friction fire making in everyday life.

Friction fire making can be achieved with materials can be gathered from a woodland environment, and produces an ember without the use of prepared tinder. However, it can be somewhat physically demanding, and careful material selection and technique are critical for success. Those seeking to practice period fire making may find one of the other two methods simpler to start with.

Solar ignition

As many who have played with a magnifying glass on a bright summer day have found out, ignition can be achieved by concentrating the sun’s rays on a small area. Historically, this was accomplished through the use of burning lenses and mirrors.

Burning lenses were initially ground out of naturally occurring crystals [11]. One such crystal is explicitly described as being used to kindle a fire⁵ in “The Clouds” by Aristophanes, written in 419 BCE [12], demonstrating that the ancient Greeks utilized solar ignition methods. A few centuries later, Pliny commented on the light-focusing effect of water-filled glass globes⁶ [13]. A “sacred glass” being used to start a fire⁷ appears in L.L.C. Hamilton’s *Ishtar and Izdubar, the epic of Babylon*, now known as the *Epic of Gilgamesh* (c. 2100-1200 BCE) [14]. However, Hamilton’s work has been described as “an extremely free adaptation” of the source material, expanding three thousand fragmentary verses into “some six thousand lines of often clumsy rhymed couplets” [15], so some skepticism of this scene is warranted.

An oval piece of ground and polished quartz capable of magnification was found in Iraq in the 19th century and attributed to the Neo-Assyrians (c. 750 – 710 BCE) [16]. It has been suggested that the so-called “Nimrud lens”, with one planar and one slightly convex face, could have been used as a magnifying glass or burning lens. These optical properties are likely accidental, however; it is more likely that the crystal is a piece of inlay. The aspheric Visby Lenses (c. 11th – 12th century CE) have also been found to have magnifying properties, but again, it is not known if these ground and polished crystals were used for magnification or fire making, or if they were simply decorative [17].

² “15 . De igne fricato de ligno id est nodfyr.” (The fire rubbed from wood that is needfire)

³ “illos sacrilegos ignes quos niedfyr vocant” (those sacrilegious fires which are called needfire) [9]

⁴ “quidam bestiales, habitu claustrales non animo, docebant idiotas patriae ignem confrictione de lignis educere” [7] (certain bestial persons, monks in garb but not in mind, taught the country people to extract fire from wood by friction [10])

⁵ “*Strepsiades* - Have you ever seen this stone in the chemist’s shops, the beautiful and transparent one, from which they kindle fire? *Socrates* - Do you mean the burning-glass?”

⁶ “...and yet glass globes containing water become so hot when they face the sun that they can set clothes on fire.”

⁷ “The King then rises, takes the sacred glass,/And holds it in the sun before the mass/Of waiting fuel on the altar piled./The centring rays--the fuel glowing gild/With a round spot of fire and quickly spring/Above the altar curling, while they sing”

In addition to lenses, concave mirrors can be used in fire making, as Pliny also noted⁸ [18]. Burning mirrors were also used in China; Gāo Yòu provides clear instructions for lighting tinder with one⁹ in “Notes on the Huainanzi” (c. 212 CE) [19].

The properties of burning lenses and mirrors were carefully studied and mathematically expressed in the Persian mathematician and physicist Abū Sa’d al-‘Alā’ ibn Sahl’s treatise *On the Burning Instruments* (c. 984 CE) [20] and various treatises by Basran mathematician, astronomer, and physicist Abū ‘Alī al-Ḥasan ibn al-Ḥasan ibn al-Haytham (died after 1040 CE) [21]. These works appear to have greatly influenced the 13th century English friar Roger Bacon, who wrote on burning lenses in the 1260s or 1270s CE [11].

Solar fire making is less physically demanding than fire by friction, requiring patience and a steady hand, and ignition can be achieved without specially prepared tinder. Success is greatly affected by weather, season, and latitude, however, which may be why it does not appear to have been as widely used as the final method discussed here.

Percussion fire making

The practice of generating sparks by striking a ferrous material (be it naturally-occurring iron pyrite or a forged fire steel) with a hard stone is called percussion fire making. This method dates back to at least the Copper Age in Europe. Ötzi the Iceman, who lived between 3400 and 3100 BCE, died in the Ötztal Alps carrying what is thought to be a fire making kit – flints and tinder containing traces of pyrite, all tucked securely in a leather pouch worn close to his body [22]. Fire kits consisting of pyrite nodules and purpose-shaped flint pieces have also been found in Bronze Age burials in Britain, France, and Denmark [23], and Pliny described pyrite as “indispensable to reconnaissance parties preparing a camp-site” for its ability to produce sparks¹⁰ [13].

Forged fire steels eventually replaced pyrite as the material from which sparks were driven. These fire steels could be of relatively simple forms, as shown in Figure 2, or they could be works for art, fantastically-shaped and inlaid with gold and jewels [24]. Regardless of its form, the sparks generated by striking a fire steel with flint or quartz are too cold (about 800°F) to ignite kindling, so they must be caught on some highly flammable material, or

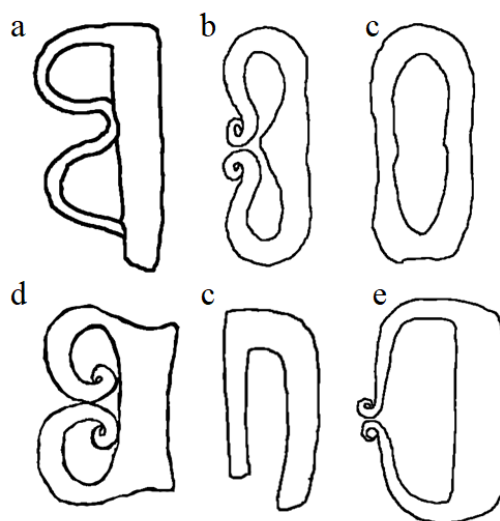


Figure 2. Drawn examples of fire steel forms. a) One-armed fire-steel from France, c. 400 CE [31]. b) Viking Age fire-steel with rolled back ends from Estonia [35]. c) 11th century oval fire-steel from Estonia [35]. d) Fire-steel in the Zurich armorial, c. 1340 [36]. e) One-armed fire-steel in *Les cris de Paris*, c. 1500 [37]. f) Post-medieval C-shaped fire-steel [38].

⁸ “...when also hollow mirrors facing the sun's rays set things alight more easily than any other fire.”

⁹ “The burning mirror is of metal. One takes a metal cup untarnished with verdigris and polishes it strongly, then it is heated by being made to face the sun at noon time; in this position cause it to play upon mugwort tinder and this will take fire.”

¹⁰ “Some writers class as 'pyrites' yet another kind of stone that contains a great quantity of fire. Stones known as 'live stones' are extremely heavy and are indispensable to reconnaissance parties preparing a camp-site. When struck with a nail or another stone they give off a spark, and if this is caught on sulphur or else on dry fungi or leaves it produces a flame instantaneously.”

tinder, to create an ember [25]. Ötzi carried a “shredded feltlike wad” of processed *Fomes fomentarius*, or tinder fungus [22]. *F. fomentarius* treated with saltpeter was found at Hedeby [26], and recipes for preparing similar tinder can be found in *Le Menagier de Paris*¹¹, published in 1396 [27], and Cyprian Lucar’s *Three Bookes of Colloquies Concerning the Arte of Shooting*¹², published in 1588 [28]. Lucar also describes a method for charring cloth for “a Gunners tinder boxe”¹³, but it differs from the current preparation of charcloth, which involves placing a closed tin containing cotton cloth into a fire and burning the cloth without oxygen [25]. Lucar’s method much more closely resembles that described by Dan Beard in 1920 [1], suggesting that charring cloth in by burning it a fireproof container may be a more modern method.

One technique for generating a spark by striking flint with steel and catching it on tinder to create an ember can be seen in one of the late Gothic paintings composing the altarpiece of Saint George’s Church in Hagenau, France [29]. In the background of the piece, Joseph can be seen working to light a candle lantern with flint and steel (Figure 3a). He holds the fire steel in his right hand and the flint in his left, with a piece of tinder (likely processed *F. fomentarius*) held on top of the flint with his thumb. This corresponds with the technique described in *Le Menagier de Paris*¹¹, and suggests that the fire steel would be struck down across a sharp edge of the flint (Figure 3b). This technique results in sparks being sheared from the steel and igniting the tinder held on top of the stone, resulting in an ember.

This ember may be placed in a tinder bundle or “bird’s nest” and blown into flame [25], or it may be used to light a sulfur match. Pliny mentions the Roman use of sulfur in fire making¹⁰ [13], and the Latin word “sulpharata” (especially “ramenta sulpharata”) is sometimes translated to mean a sulfur (or brimstone) match [30]. Other sources claim that the sulfur match was invented in China, citing Thao Ku’s description¹⁴ in *Chhing I Lu* (c. 950 CE) [19]. Regardless of their origin, *Le Menagier de Paris*¹¹

¹¹ “If you want to make good tinder to light a fire with (flint and) steel, take walnut [escume] past its prime, and put in a pot of very strong lye, either whole or in pieces the size of two fingers, whichever you wish, and boil continually for at least two days and a night. And if you have no lye, take good ashes and mix with the water and make it like “charree” (the thick mixture of ashes and water left at the bottom of the washtub after you pour off the lye), then put your [escume] on to boil in it for the time mentioned above and add liquid as needed while it boils. If you boil it in lye, add lye; if you boil it in charree, add water; and all the time it is boiling, if you can provide clean animal urine to add to it, so much the better. And when it is boiled enough, press it, and then wash in good clean water to soak it, then dry in the sun or in the hearth, away from the fire, so it does not burn, for it should dry gradually and gently; and when it is dry, if someone will help you, beat it with a mallet or a stick, until it gets spongy. And when someone wants to light a fire, let him take a piece about the size of a pea and put it on his flintstone, and he will soon have a fire ; he only needs a sulphured spill, and he can light the candle.” Hinson translates the Middle French “escume” as “bark” [27], but according to another translation by Greco and Rose [32], it literally translates to “foam” or “scum”, which could possibly refer to a walnut fungus.

¹² “Take those great things which are called olde Todestooles growing out of the bottomes of nuttrees, beechtrees, oaks, and such like trees, drye them with the smoke of fire, & then cut them into as many peeces as you will, and hauing well beaten them, boyle them in strong lie with waule floure, or saltpeeter, till all the lie shal be consumend. After this laying them in a heape uppon a boorde, drie them in an oven which must not be made verie hotte, and after you haue so done, beate them well with a wooden mallet, and when you shall haue cause to use any parte of those Todestooles (now by the means above declared made touchwood) rubbe well that parte betweene your handes for to make it softe and apte to take fire”

¹³ “But when you will make tinder for a Gunners tinder boxe, take peeces of fustian, or of old and fine linnen clothe, make them to burn and flame in a fire, & suddenly before the flame which is in them doth die, choke the fire, & keepe their tinder so made in a boxe lined within with clothe, to the ende that it may not be moyste at any time”

¹⁴ “But an ingenious man devised the system of impregnating little sticks of pinewood with sulphur and storing them ready for use. At the slightest touch of fire they burst into flame.”

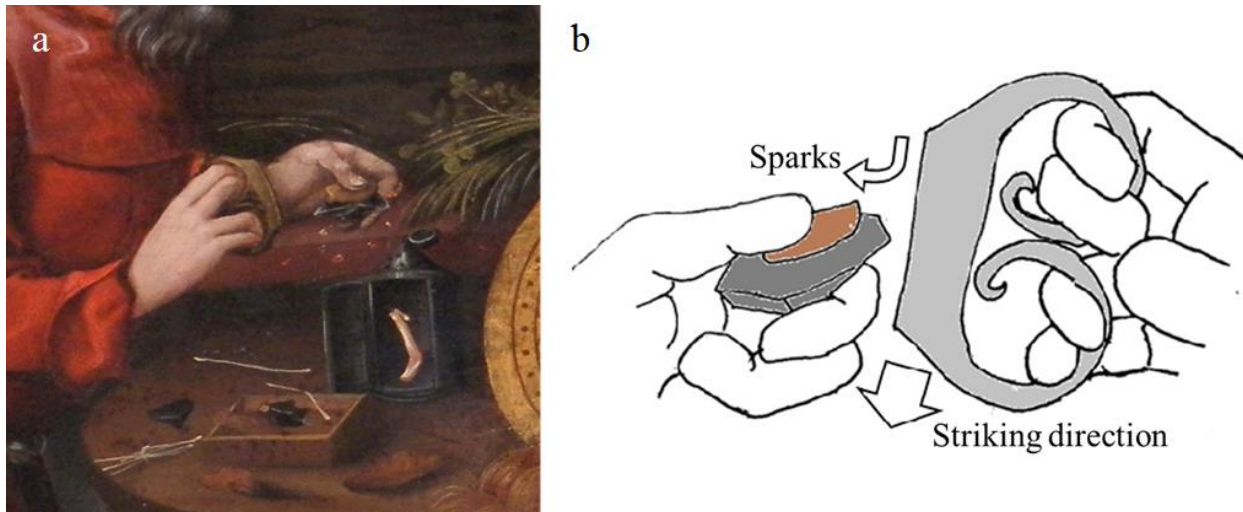


Figure 3. Flint and steel fire making technique. a) Detail from the altarpiece of Saint George's Church [29] showing the use of flint and steel to light a candle. b) Author's interpretation of the technique seen in 3a.

mentions using a "sulphured spill" to light a candle, suggesting that sulfur matches were used in western Europe by the late 14th century, and the sticks laying on the table in the altarpiece of Saint George's Church discussed above (Figure 3a) may be a depiction of sulfur matches.

While percussion fire making uses prepared tinder to catch a spark and create an ember, it is a faster ignition method than friction or solar fire starting. With this in mind, it is perhaps unsurprising that flint and steel remained an important method for firemaking until the invention of the friction match in the 19th century [31].

Conclusion

Fire was once essential for light, heat, and food preparation. Friction, solar, and percussive ignition were practiced prior to 1600 CE, but determining which method is most appropriate for a particular impression will require study of the time, place, and culture in question. Regardless of which practice is most appropriate for any given interpretation, practicing period fire making is a satisfying and immersive way to better understand those who whose lives depended on it.

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