

# Spark (fire)

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A **spark** is an incandescent particle.<sup>[1]</sup> Such sparks may be produced by pyrotechnics, by metalworking or as a by-product of fires, especially when burning wood.

## Contents

- 1 Pyrotechnics
- 2 Flint and steel
- 3 Metal working
- 4 Fires and spark arrestors
- 5 Symbolism
- 6 See also
- 7 References



Sparks from a screw held on a grinder

## Pyrotechnics



Sparks from a pyrotechnic sparkler.

In pyrotechnics, iron filings and metal alloys such as magnalium may be used to create sparks.<sup>[2]</sup> The quantity and style of sparks produced depends on the composition and pyrophoricity of the metal and can be used to identify the type of metal by spark testing. In the case of iron, the presence of carbon is required, as in carbon steel — about 0.7% is best for large sparks. The carbon burns explosively in the hot iron and this produces pretty, branching sparks.<sup>[3]</sup> The color of sparks used in pyrotechnics is determined by the material that the sparks are made from, with the possibility of adding different chemical compounds to certain materials to further influence the color of the sparks. The duration of the existence of a spark is determined by the initial

size of the particle, with a larger size leading to a longer-lasting spark.<sup>[2]</sup>

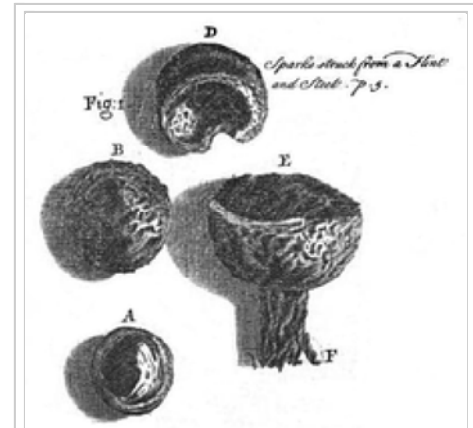
Metals with low thermal conductivity are especially good at producing sparks. Titanium and zirconium are especially good in this respect and so are now used in fireworks. Copper, on the other hand, has a high conductivity and so is poor at producing sparks. For this reason, alloys of copper such as beryllium bronze are used to make safety tools which will not spark so easily.<sup>[4]</sup>

## Flint and steel

Robert Hooke studied the sparks created by striking a piece of flint and steel together. He found that the sparks were usually particles of the steel which had become red hot and so melted into globules.<sup>[5]</sup> These sparks can be used to ignite tinder and so start a fire.<sup>[6]</sup>

In colonial America, flint and steel were used to light fires when easier methods failed. Scorched linen was commonly used as tinder to catch the spark and start the fire but producing a good spark could take much time. A spinning steel wheel provided a good stream of sparks when it engaged the flint and a tinderbox designed to do this was known as a mill.<sup>[7]</sup>

In a modern lighter or firesteel, iron is mixed with cerium and other rare earths to form the alloy ferrocium. This readily produces sparks when scraped and burns hotter than steel would. This higher temperature is needed to ignite the vapour of the lighter fluid.<sup>[8]</sup>



The cold remnants of steel sparks struck by Robert Hooke using a flint. These were collected on paper, studied using his early microscope and drawn by hand.

## Metal working



Spray of sparks from a Bessemer converter as air is blown through the molten metal

Molten metal sparks can be created when metal is heated by processes such as Bessemer conversion of iron to steel or arc welding.

Arc welding uses a low voltage and high current electric arc between an electrode and the base material to melt the metals at the welding point, which often creates sparks. To reduce the risk of burns, welders wear heavy leather gloves and long sleeve jackets to avoid exposure to extreme heat, flames, and sparks. In spot welding, metal surfaces that are held in contact are joined by the heat from resistance to electric current flow. It is common for a spray of



Sparks from spot welding robot

sparks in the form of molten metal droplets to be ejected from the parts being joined.<sup>[9]</sup> or the resistance heating of spot welding.<sup>[10]</sup>

## Fires and spark arrestors

Fires may produce sparks as updrafts carry particles of the burning fuel aloft. This was a great problem with steam locomotives as the sparks might set fire to the adjacent landscape or even to the train itself, especially if the engine burned wood rather than coal.<sup>[11]</sup> To prevent this dangerous nuisance, a variety of spark arrestors were invented and fitted.<sup>[12]</sup>

The chimneys and exhausts of other fuel-burning engines such as steam engines or internal combustion engines might also have spark arrestors fitted if there would be a fire risk from their operation. For example, a trail bike might be fitted with a centrifugal arrestor, which will trap glowing hot pieces of soot.

<sup>[13]</sup>



A spark-arresting chimney on a locomotive

## Symbolism



The Creation of Adam by Michelangelo in which the spark of life is passed

The significance of a spark as a source for a flame or a conflagration shows clearly, for example in the naming and motto of Lenin's newspaper *Iskra* [The Spark]. The spark metaphor has often been used in philosophy, since Stoicism,<sup>[14]</sup> and recently, after Jacques Lacan, the “creative spark” has come to be considered as inherent to metaphor itself.<sup>[15]</sup> Hasidic philosophy contains a doctrine of holy sparks (*nitzotzot*) from the kabbalism of Isaac Luria in which there is a duty to gather the sundered light of creation.<sup>[16]</sup>

In the Book of Job (Job 5:7) it is written "Yet man is born unto trouble, as the sparks fly upward." The use by King James' translators of the word *sparks* here is a poetic one rather than a literal one.<sup>[17]</sup> The sparks of fire are identified by some translators as the sons of Resheph - a Canaanite deity of lightning and pestilence.<sup>[18]</sup>

## See also

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