A Long-Term Survival Guide - 101 Ways To Start A Fire:

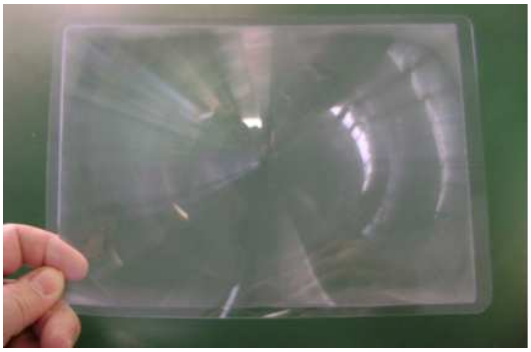
Fire is a useful survival tool, but how many ways are there for getting a fire started?

Here is a modest list of various types of firestarting methods, grouped into rough general categories:

Sunlight Based:

Concentrating sunlight to create enough heat for ignition is one of the easiest ways to start a fire, but it also has several limitations. These methods only work on sunny days, so they are useless at night, and in fog, rain, snow, or overcast conditions. All sunlight-based methods work better when the sun is hot and intense (noon is best) and not as well (or not at all) if sunlight is weak, at morning, evening, or in winter.

1: Magnifying glass: Almost any magnifying glass can be used to focus sunlight into a hot spot that will ignite tinder, if the sun is reasonably strong. Works with both glass lenses, and plastic lenses.



2: Fresnel lens: A Fresnel lens is just a regular lens that has been flattened, by having the curve of the lens divided into little steps, or segments. Fresnel lenses are available as large plastic magnifiers (usually the size of a sheet of paper), and smaller wallet-sized magnifiers. Both work, but larger is better.

3: Bullseye (clear glass or acrylic balls): Clear glass or plastic spheres of various sizes can be used as lenses, for concentrating sunlight. The acrylic balls actually transmit more sunlight than glass spheres.

4: Improvised lens (glasses): It is possible to use glasses to start a fire, but not as easy as you might think. Reading glasses are often simple magnifying lenses, and work ok if the magnification is high enough, but most prescription glasses nowadays have specific shapes that do not work as well. Even so, you can often get success if you carefully bead a blob of clear water onto the top of the lens, to make a more effective lens shape (hold the glasses still, to avoid spilling the water, and move the tinder bundle, not the glasses, to find the best focal spot).

5: Improvised lens (binoculars): Many optical devices contain lenses, which can be removed for use as sunlight-based firestarters. Some work just fine as is, without needing to take them apart. Binoculars can be used to start fires, by pointing the large end at the sun, and then finding the focal spot at the small end (this is why it is a very bad idea to look at the sun through binoculars!). Items 6, 7, 8, & 9 work the same way. With variable-power optics, higher magnification settings usually work better than lower settings.

6: Improvised lens (monocular)

7: Improvised lens (telescope or spotting scope)

8: Improvised lens (rifle scope)

9: Improvised lens (camera lens)

10: Improvised lens (clear ice): It is possible to make a serviceable lens from clear ice, and use it to start a fire, under good conditions. The ice must be clear, and clear ice is usually only found alongside running streams. You can also boil water to remove the air, then freeze it to get clear ice to practice with. An ice lens must be fairly large to work, as big as your hand or larger, and the edges must have a fairly severe bevel, so it must also be three or four inches thick.

11: Improvised lens (clear bottle and clear water): A clear plastic bottle can work as a lens, but only if the top is curved like the example shown, and only if it is filled with clear water.

12: Improvised lens (clear balloon): A clear balloon can be filled with enough clear water to make a spherical lens, and it will work, but clear balloons are not a very common item.

13: Improvised lens (clear plastic bag): A clear plastic bag can be used as an improvised lens by adding clear water and twisting part of the bag into a sphere shape. It needs to be three or four inches across, to work well. Items 14 and 15 can be used in the same way.

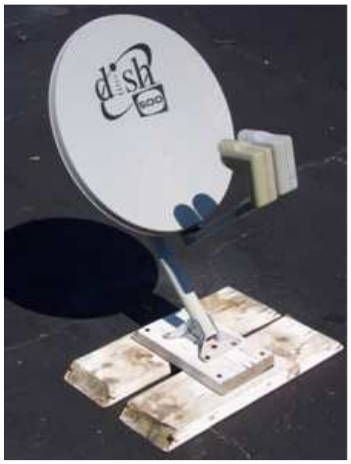
14: Improvised lens (clear condom)

15: Improvised lens (clear plastic wrap, Cling wrap or Saran wrap, or clear plastic from a garment bag)

16: Improvised lens (clear light bulbs and water): Clear light bulbs will also work as improvised lenses, for sunlight-based fire starting, if the elements are removed and the glass bulb is filled with clear water.

17: Improvised lens (clear wine glass and water): The right size and shape of wine glass can be used with clear water, to form a lens. Hold the glass tilted at an angle as shown, to get a useable lens shape.

18: Parabolic reflector (solar cigarette lighter): You can buy a small parabolic reflector, called a solar cigarette lighter, which will concentrate enough sunlight onto its focal spot to ignite any good tinder.



19: Improvised parabolic reflector (satellite dish and foil): Any satellite dish can be used as a larger parabolic reflector, by covering the inner curved surface with foil, and then aiming it towards the sun. But be careful when finding the focal spot, as larger reflectors can create enough heat to be dangerous.

20: Improvised parabolic reflector (stainless kitchen bowl, or bowl and foil): Some bowls are the right shape to use as improvised parabolic reflectors. Stainless steel bowls may be reflective enough to work, but any bowl can be lined with foil, and then tested. Small reflectors don’t work if your fingers block the sunlight, so the best way to use them is to impale (or wind) your tinder on a thin stick, or a piece of wire.



21: Improvised parabolic reflector (aluminum beverage can bottom and polish): The bottom of an aluminum beverage can is just large enough to work as an improvised parabolic reflector under ideal circumstances, if the surface is made more reflective by using an improvised metal polish. (Chocolate and toothpaste have both been successfully used to polish can bottoms.) Use with “tinder on a stick”. Note that it may take a long time to get the can bottom polished enough to work, so don’t expect to be able to try this after just a few minutes of effort.


22: Improvised Parabolic Reflector (soup ladle): Some large stainless steel soup ladles can work as parabolic reflectors under good conditions, if they are polished enough, and the shape is correct.

23: Improvised Parabolic Reflector (flashlight reflector): If you have a large flashlight, it might be possible to remove the reflector and use it as a parabolic fire starter. One advantage to these is that the tinder can be inserted through the hole in the center that was originally used for the flashlight bulb.

Spark Based:

Creating a spark (which is captured in tinder and nursed into a flame) is an old fire-starting technique that has a number of modern variations, but all of them require specific materials to be successful.



24: Flint and Steel (with char-cloth): Traditional flint and steel fire-starting requires a hardened piece of high-carbon steel (an old file works well), a piece of flint with a sharp broken edge, and a very good tinder for catching the spark (char-cloth, or charred cotton cloth, was the traditional tinder of choice).

When the fire steel is swept past the flint, striking the edge on the way past, the extremely hard flint tears bits of the very hard steel off, and these tiny bits are heated to a molten state in the process. Sparks from a good fire steel actually make a small crackling, hissing noise as they are produced.
(Other stones, such as granite, quartz, and chert, can also make a good spark with a high-carbon steel.)



Char-cloth is made by putting pieces of cotton cloth (t-shirt material works very well) in a small metal can with a lid, making a small hole in the lid, and cooking the can on campfire coals until the cloth is charred. (Flammable gasses will escape from the hole.) The charred cloth is kept as dry as possible.

When a fire is needed, a small piece of the cloth is placed on the edge of the flint, as shown above, to catch the sparks from the strike. The lit cloth is then folded around the spark, and blown on gently to make the spark spread.

The cloth is placed into a tinder bundle, and blown into a flame, but good char-cloth often bursts into flame by itself, without needing to use the tinder bundle.

There are other ways to make char-cloth, such as putting the cloth into a pair of clamshells that are then coated with clay and baked on coals (leaving a tiny hole for the volatile gasses to escape).

And if you don’t have any cloth, you can char other materials, such as cattail fluff, and tinder fungus.

25: Flint Stick Fire-Starters: Flint sticks are just oversized versions of the little flints found in every cigarette lighter. They are scraped with a knife blade, or other sharp object, and create very hot sparks that will light most good tinder materials. There are several brands of flint stick, but they all work the same way.

26: Plastic Match Safes: Even if you have used all of the matches that were in your plastic match safe, you may still be able to start a fire with the safe itself, because some of them have a small flint stick on the bottom. The orange match safe currently sold at WalMart (for about one dollar) has the flint stick.

27: Magnesium Firestarters: This is just a flint stick glued to a small block of magnesium, which can be scraped to create a pile of hot-burning magnesium shavings, and then the shavings are lit with the flint.

28: Blast Match: A Blast Match is a flint stick with a built-in scraper, so it can be used with one hand. The flint is held above some tinder, then you press on the scraper and push down, to make the sparks.

29: Permanent Match: A permanent match has a flint stick on the side of a small container that holds some lighter fluid, and a scraper with a wick on the end, which normally stores in the container. To use, the scraper is removed from the container and used to make sparks on the flint stick, to light the wick. Like a zippo lighter, the permanent match must be refilled with lighter fluid every so often to work.

30: Spark Lite (zippo emergency firestarter): This firestarter uses a flint and striker wheel, very similar to a regular cigarette lighter. There are several firestarter sticks stored inside this unit, and you remove one of the firestarter sticks, and use the flint-wheel to make sparks to light the stick. Firestarter sticks must be replaced as they are used up, but this fire-starting device does not require any lighter fluid.

Friction Based:

You actually can start a fire by “rubbing two sticks together” (well technically, you create a coal that can be placed into tinder, and nursed into a flame). There are several different friction fire-starting methods, with variations for each, but most use a spinning stick on a stationary stick, creating tiny bits of hot wood dust, that build up until they form a small glowing ember.

31: Hand Drill: A straight spindle stick is spun between the palms, while resting in a prepared depression (the spindle hole) on a stationary hearthboard, until a coal is produced. A notch is usually cut into the side of the hearthboard, deep enough to reach the spindle hole, so that the hot wood dust can fall into this notch and build up in one spot. This technique requires practice, and good materials, to work. Experienced people use a spindle that is about the thickness of a pencil – thicker ones are harder to spin.

32: Team Hand Drill: Two people can work together to keep a hand drill spinning, to reduce fatigue.

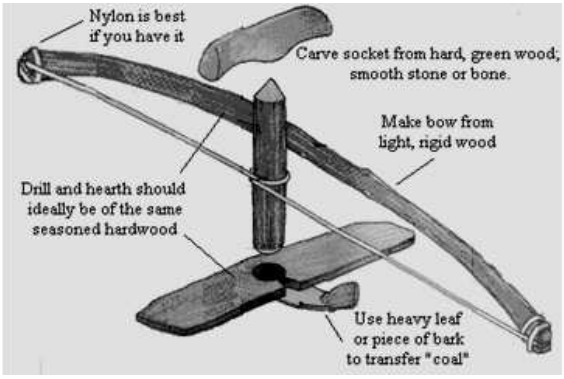
33: Thong Hand Drill: Tying a cord (with thumb loops) to the top of the spindle of a hand drill allows you to increase downward pressure as you spin the spindle, and your hands don’t travel down as you spin, making this a much easier technique to use.

34: Shoe Hand Drill: Spinning the hand drill can cause your palms to ache. One way to avoid this is to hold a pair of shoes against the spindle, so that the soles absorb all the punishment. Use a cord with thumb loops as well (try the shoelaces). Other objects could also be used, if you don’t have shoes, such as short lengths of 2x4 lumber (roughen the contact surfaces), or pads cut from an automobile tire.

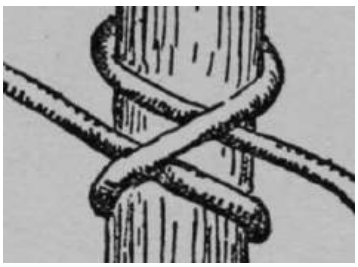
35: Collapsible Hand Drills: The spindle of your hand drill can be made from two or more pieces, with a socket made from bamboo (or metal tubing). This design lets you carry the spindle as a shorter package, and it is easier to find short straight pieces and combine them, than it is to find one long straight piece. (You can straighten curved sticks to make straight spindles, but you need a fire first, to heat them with.)

36: Miniature Hand Drill: Another variation on hand drills is the miniature hand drill. With practice (and good materials), you can make a coal using a surprisingly small spindle and hearthboard. (The example shown here is pictured next to a cigarette, for size comparison.) I would suggest getting very familiar with easier variations of the hand drill, before trying this one.

37: Thong Fire Drill: This technique is the “missing link” between the hand drill and the bow drill. A pivot block (a piece of wood or bone with a shallow hole in the bottom, for the top of the spindle to rotate in) is used by one person to provide downward pressure on the spindle stick, while a second person uses a length of cordage wrapped around the spindle to spin it back and forth, as shown. If you are alone, tie one end of the cord to a springy tree limb, and use one hand to hold the pivot block, and the other hand to pull the cord. (The tree limb acts as a spring, to pull the cord in the other direction.)



38: Fire Bow Drill (traditional hearthboard): This design uses a curved bow to hold the cordage that spins a short spindle stick, allowing one person to hold the pivot block, and spin the spindle. The easy way to use a bow drill is to secure the cordage to the spindle stick. I like to use a clove hitch (see below), but some people drill a hole in their spindle sticks for the cord. Next, wrap the cord (on one side of the clove hitch) around the spindle stick several times, and tie the ends to the bow, so that there is just a tiny bit of slack. Pushing the bow will now cause the spindle to spin, unwrapping the cord on one side of the clove hitch, while wrapping cord from the other side around the spindle stick. Without the clove hitch and wrappings, the spindle tends to slip (or even escape) during use. Use a strong cord, such as paracord.



Clove Hitch

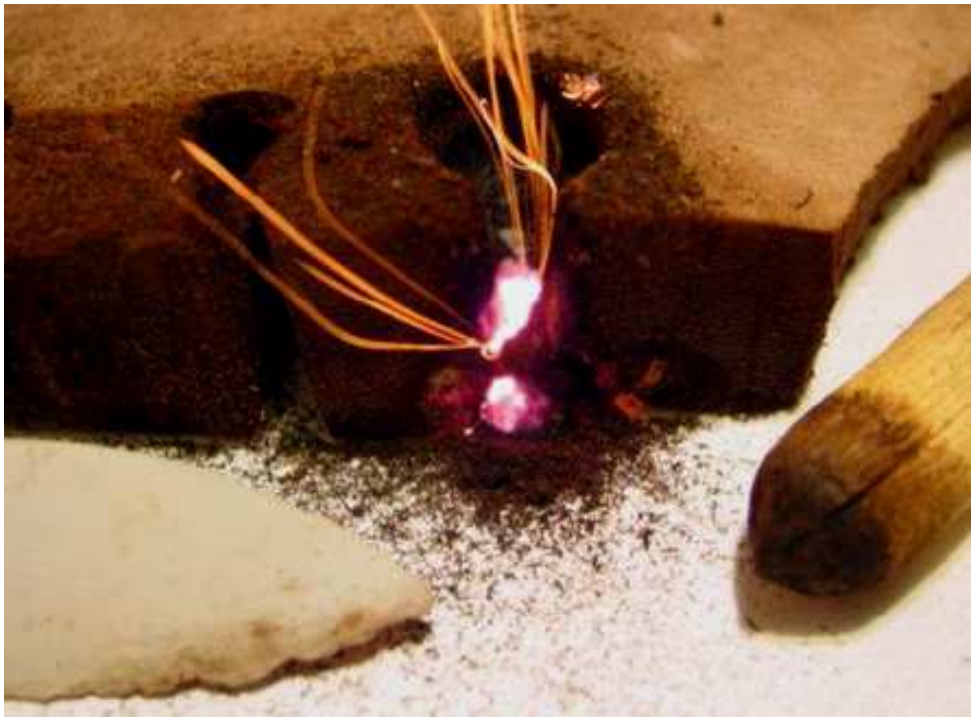


39: Fire Bow Drill (two-stick hearthboard): Another way to make a hearthboard for friction fire drills is to tie two round sticks together. The gap between the sticks collects hot wood dust, just like the notch of a traditional hearthboard, until enough has accumulated to create a coal. This is my favorite hearthboard.


40: Fire Bow Drill (natural hearthboards): A stick which has a naturally-formed crack or crevice can be used as a natural hearthboard, if it is a suitable fire-making wood. The crack can also be enlarged using a knife, if it is too narrow.

Some of the woods in North America that are easiest to use as spindle materials are: Coastal Redwood, Yarrow, Horseweed, Box Elder, California Buckeye, Mule Fat, Blue Elderberry, Cattail Stalks, Big-leaf Maple, Mugwort, Bull Thistle, Scotch Broom, Douglas Fir, California Figwort, and Sow Thistle, and most of these make good hearthboards as well.

Another “natural” hearthboard technique is to simply use the spindle stick to wear a pit into the hearthboard, then shift the spindle over just enough so as to have an overlap. The first pit will then collect the hot wood dust from the second pit, acting as a notch.



41: Friction Fire Drill (fungus hearthboard): Tinder Fungus and Artist's Conk are two types of fungus that can be used as friction fire hearthboards, instead of wood. (Of course they must be dried first.)

42: Friction Fire Drill (stone hearthboard): Don't laugh, but a rock can also be used as a hearthboard. You need a stone with a shallow hole in it, about half an inch deep, and roughly the width of your spindle stick. Grind up or crush up some dry wood into small bits, and sprinkle into the hole, then use the spindle stick to create a coal, adding more wood dust to the hole as needed.

43: Fire Bow Drill (Bamboo): Dry Bamboo is a good friction fire material, and can be used as both the spindle stick and hearthboard for hand drills and bow drills. You can also use a hollow bamboo cane as a spindle stick, with a replaceable tip made from some other wood.

Dry bamboo can also be scraped with a knife to produce little curly shavings that are excellent tinder material, for nursing your coal into a flame. You can even make bamboo fuzz sticks, that are easy to ignite, and which burn nice and hot. Fuzz sticks are used to get a fire established in damp conditions.

Because it burns so well, bamboo is often used with the fire saw technique (See number 51).


44: Fire Bow Drill (collapsible): Since the bow of a bow drill doesn't flex like an archery bow (it just holds both ends of the cord), you can make a collapsible bow that can be stored in a small space. Like a collapsible spindle stick for a hand drill, the collapsible bow can have a socket made from bamboo, or metal tubing.


45: Fire Bow Drill (miniature): An experienced user can start a fire with a very small bow drill set. Miniature bow drill sets must be made from good materials, and require practice to work well.


46: Fire Bow Drill (Team): Two or more people can act as a team to share the work of using a bow drill.

47: Mouth Fire Drill (hand): In yet another variation of friction fire drills, both 47 and 48 use a pivot block held in the mouth, to provide downward pressure on the spindle stick. It works, but this is not my favorite technique, since the spindle stick can get loose and poke you in the face, or put your eye out.

48: Mouth Fire Drill (bow)



49: Pump Fire Drill: Pump drills are made with a crossbar that has a hole in the center, so it can fit over the spindle stick, and ride up and down on it. A cord is tied to the top of the spindle, and runs to both ends of the crossbar. Turning the spindle by hand will wind the cord around the spindle stick, and pull the crossbar up, getting it ready for use.

To use, the crossbar is pressed down, causing the spindle stick to spin. This drill uses an improvised flywheel, usually made from wood or stone, to keep the spinning motion going, so the momentum will wind the cord around the spindle, raising the bar, so it is ready for another spin. The drill is named after the cyclic up and down pumping motion of the crossbar.

Flywheels can also be improvised from items such as small wheels or pulleys, if they are available.



50: Other Rotating Drill Methods: There are other ways to spin a spindle stick, to make a friction fire. For example, an electric drill or hand drill (with a spindle stick in the chuck) will produce a coal.

You can also improvise mechanical methods of spinning the spindle that use counterweights, or springs, to reposition the cord for another pull (like the pull-starters, on small engines). Use your imagination. Natural materials such as wood and bamboo were used as springs long before metal ones were invented.

51: Fire Saw (Bamboo): Although you can make a fire saw from other materials, it is a technique most often used with dry bamboo. Split a dry bamboo stalk, and cut a small slot (crossways) in one of the halves. It should go all the way through the bamboo. Scrape the bamboo to produce some fine shavings, which will be the tinder. Put the tinder in the hollow of the half with the slit, and place a couple of thin bamboo slivers on top of the tinder, to help hold the tinder in place.

The most common method for using the bamboo fire saw is to take the other half, and brace it between your stomach and the ground, with one edge up. Hold the slotted half in both hands, grasping the slivers in the hollow so that they keep the tinder trapped behind the slot. The slot is placed on the edge of the braced bamboo, and the slotted half is pushed and pulled back and forth along the braced half.

Hot dust will pass through the slot and build up in the tinder, until enough is present for ignition. The smoking tinder is usually coaxed into flame by gently blowing on it while it is still in the slotted half.

This technique, like anything else, gets easier with practice. The type of bamboo, and how dry it is, will also cause it to be easier or harder to get ignition (your bamboo may vary!).

52: Fire Thong: The fire thong is one of the harder techniques for making friction fires, and it also requires a material only found in the tropics – rattan. A thin, flexible strip of rattan is used with a hearthboard, pulled back and forth to create the hot wood dust needed to produce a coal.

Trying to substitute other materials for the rattan strip usually ends up with the substitute breaking, just as smoke is starting to form. But if you have some rattan, make a hearthboard as shown, with a pair of notches near one end, and a shallow pit between the notches. The pit should have a small hole in the center, that goes all the way through the hearthboard.

To use the fire thong, stand on the hearthboard with the pit facing up, and the rattan under the board. Pull the ends of the rattan back and forth, and the two notches should keep the rattan in position under the pit. Hot wood dust will come up through the hole and build up in the pit, until a coal is formed.

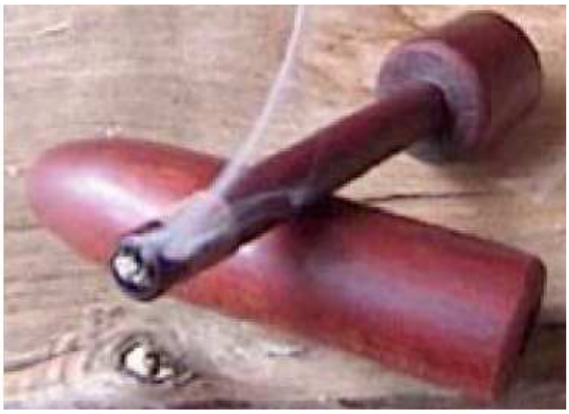


53: Fire Plow: The fire plow is another difficult technique, unless you have access to another tropical material – hibiscus. Seasoned hibiscus wood is one of the easiest woods to get fire from, so even the normally difficult fire plow technique is not that hard to do, if you have some.

A fire plow is just two sticks, a hearthboard with a shallow groove on top, and the plow, a stick with one end carved into a chisel shape, as shown. Holding the plow stick with both hands, place the plow in the groove, and push and pull it back and forth quickly, pressing down hard on the push stroke. Hot wood dust will build up at the end of the groove, until a coal is formed. Be careful not to run over the forming coal with the plow, or you will put it out. Practice is a big help with this technique. (You can also carve a little pit into the hearthboard at the end of the groove, to make a place for the hot dust to build up in.)

Compression Based:

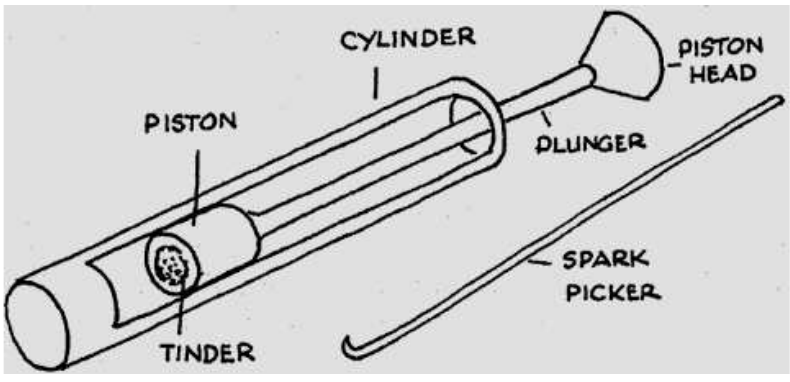
Compression-based fire starting is a primitive form of the diesel principle. Air is forcefully rammed into a tiny space, creating enough heat to cause ignition. Compression fire starters are called fire pistons.



54: Fire Pistons (commercial): You can buy fire pistons already made, usually from a dense hardwood. There are two parts; the piston, a rod with a striking knob on one end, and a hollow to hold tinder on the other, and the chamber, a piece of wood with a hole in it that is exactly as deep as the piston rod is long. To keep air from escaping, there must be a seal on the piston, by the tinder hollow, which can be made from waxed thread, or an O-ring, or a rubber plumbing washer.

To use a fire piston, tinder (usually char-cloth) is placed in the tinder hollow, and the piston is just started into the chamber. The chamber is held against a solid surface, and the piston is driven all the way home with a sudden sharp slap. If done correctly, the heat from the compression will ignite the tinder. The piston is quickly removed, and the smoking tinder is removed from the hollow (a small pick can be used to do this), and placed into a tinder bundle, and nursed into a flame.

It is difficult to make a workable fire piston in a survival situation, because the hole in the chamber must be smooth and polished (or air will escape), and the piston shaft must completely fill the chamber hole (or compression will be inadequate). But fire pistons are a lot of fun to experiment with.



55: Fire Pistons (bamboo): A fire piston can be made from bamboo, like this example. The piston shaft can be made from wood, or carefully sanded bamboo. The inside of the bamboo chamber must be drilled out, so that the hole has straight, even sides, for best results.

56: Fire Pistons (other materials): Fire pistons can also be made from PVC pipe (left), or clear acrylic (center). The clear design allows you to see the ignition spark, in low light conditions. Note the shape of the tinder hollow, which makes it easier to remove the smoking tinder.

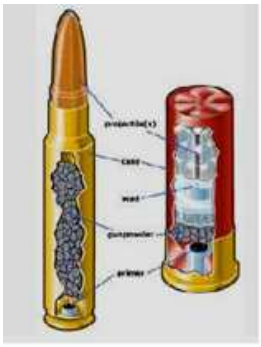
57: Fire Pistons (improvised): One common item that could be used to improvise a fire piston in the field, is a mini-maglight flashlight (right). It is a good size and shape, once the focal head is removed. Making a good seal for a piston shaft whittled from a stick is difficult, unless you have wax and thread.

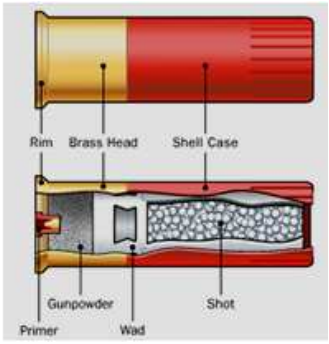
Firearm Based:

There are several ways to use guns as improvised fire starters. Here are a few examples:

58: Flintlocks: If you have a flintlock black powder firearm, you can use the mechanism to start a fire. With the gun unloaded, put a bit of tinder in the flash pan, add some black powder, and pull the trigger. Be ready to transfer the burning tinder to an already prepared tinder bundle, to get the fire established. Sparks from flintlocks will also ignite charcloth, if you run low on black powder.

59: Tinder Pistols: A tinder pistol is half a flintlock. It is the flintlock mechanism, with no gun barrel. This antique was designed to light fires, using the technique from # 58. The two examples shown are a tabletop version, and a walking cane version, and you can buy the tabletop pistol as a kit (left).





60: Gunpowder From Cartridges: If you have ammunition, you can use the gunpowder from a cartridge to start a fire. It is easier to remove powder from shotgun shells, than from rifle or pistol cartridges, but you will have to use what you have available. Once you have the gunpowder, it can be placed in the pit of a hearthboard, then a hand or bow drill spindle stick is spun on the hearthboard, to ignite the powder.

Even the weak sparks made by striking stones against steel can ignite gunpowder, with a bit of luck. The gunpowder pellets can also be ground up with a stone, to create more surface area, for easier ignition.

61: Firing Cloth Wads: If you have a shotgun and shotgun shells, you can start a fire in another way. Cut the end off a shotgun shell, and remove the lead shot, wadding, and gunpowder. Tear a small piece of cloth from a rag or shirt, sprinkle gunpowder on it, then roll it up and stuff it back into the shell casing.

To use, load this shell in the gun and shoot it, and the burning cloth will be shot out by the force of the primer. You have to be able to retrieve the burning cloth while it is still lit, so you have to shoot it towards the base of a tree, or a pile of firewood, or it will be ejected a long ways. You also have to have a tinder bundle prepared in advance, to use as soon as the cloth is fired. (Beware of the muzzle blast when firing, as the hot gasses can injure you as easily as a bullet can.)

62: Exotic Ammo (signal flares): Specialized shotgun shells which fire signal flares can be used to start fires in much the same way as # 61, only easier, because the flare burns very hot, for several seconds. It is useful to have a piece of bark handy, to scoop the burning flare into your tinder.



63: Exotic Ammo (incendiary, or dragon's breath): Incendiary ammo is specialized ammunition that is specifically designed to start fires, when striking burnable materials. The blue-tipped cartridges (below) are available for rifles, shotguns, and handguns. Firefighters sometimes use it to start backfires, in difficult terrain. Needless to say, you can start a fire with this ammo, if you have any. Although it has been banned in some states, it is still legal for sale in others.


Unlike tracer ammo, this blue-tipped incendiary ammo is designed to start fires.

Dragon's Breath is a type of incendiary ammo for shotguns, that causes a flamethrower-like fire blast.

Other Modern Materials:

Everyone knows that you can start a fire with a match, but how does it work?

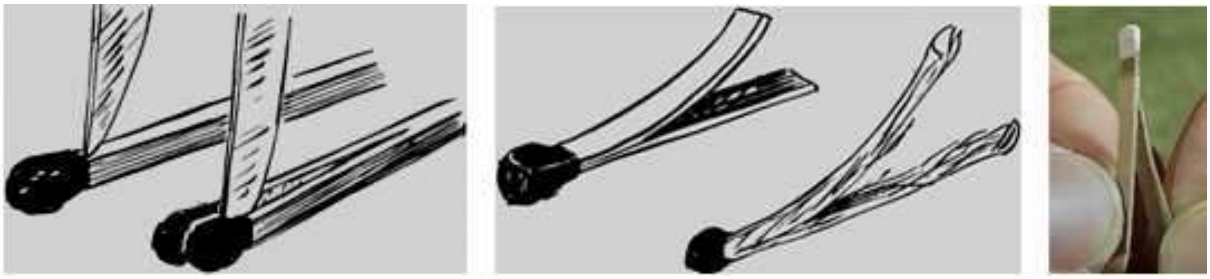
64: Matches (strike anywhere): The white tip of a strike-anywhere match contains a stable phosphorus compound, (phosphorus sesquisulfide) which is converted to flammable white phosphorus by friction, when the match-head is dragged across a rough surface. When the white phosphorus ignites, it causes the red blob of potassium chlorate on the match-head to burn, which ignites the wooden matchstick.

65: Matches (safety strike on box): Safety matches do not have phosphorus on the match-head. It is on the striker on the side of the box, so that the components needed for ignition are kept separated.

Dragging the match-head across the rough striker surface on the box converts some of the red phosphorus on the striker into white phosphorus, which ignites the blob of potassium chlorate on the match-head.

In fact, if you drag a match-head across the striker slowly, you can see little sparks that are produced when the red phosphorus is converted to white phosphorus.

66: Matches (wind and waterproof): Stormproof matches, or wind and waterproof matches, are safety matches that are waterproof, and that have half the matchstick covered with a special compound that is hard to extinguish, once lit. In fact, these matches can be blown on, dipped in water, buried in soil, or even stomped on, and they will burst back into flame (once uncovered) like trick birthday cake candles. The effect lasts for several seconds, depending on brand, with some burning for up to fifteen seconds.



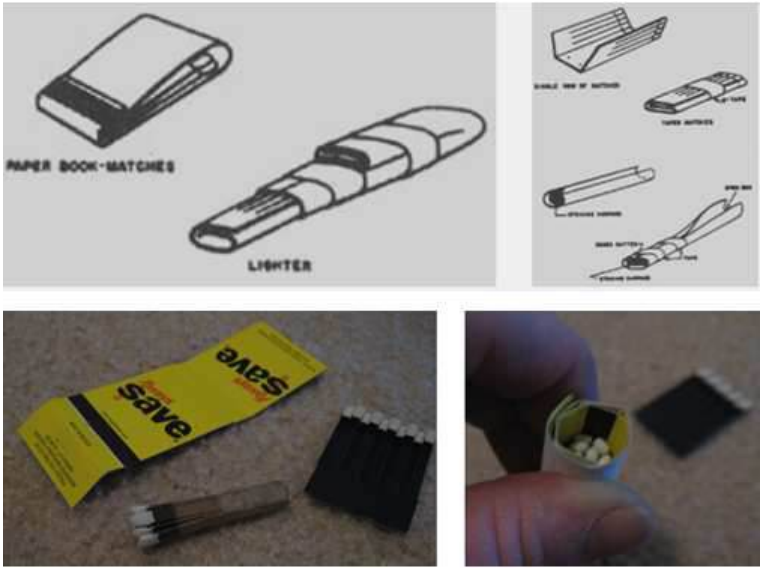
67: Matches (split wooden and paper matches): Did you know that you can light two different fires, at two different times, from one match, by splitting the match into two halves? It really works.

To split wooden matches, put the point of a pin or a sharp knife just below the match head, and force down sharply - the head will split in two, and the wood run off, or split. You now have two matches, with enough wood left on the short half to burn for a second or so; long enough to start tinder burning.

With a paper match, start to split the match at the end away from the head, by peeling the paper towards the head. The head will split, and so you now have two matches, but each has a head on one side only.

To strike a split match, the 'stalk' of the match should be held between the thumb and middle finger, with the tip of the forefinger resting lightly on the head of the match. The match is drawn lightly and 'flat' along the striking surface. As soon as the head starts to burn, the forefinger (which has been holding it gently against the striking surface) is lifted, and the match allowed to flame.

It requires practice to be certain that you can always split your match and strike a light from both halves. Wartime prisoners practiced this skill until they could light four (some claim six) fires from one match.

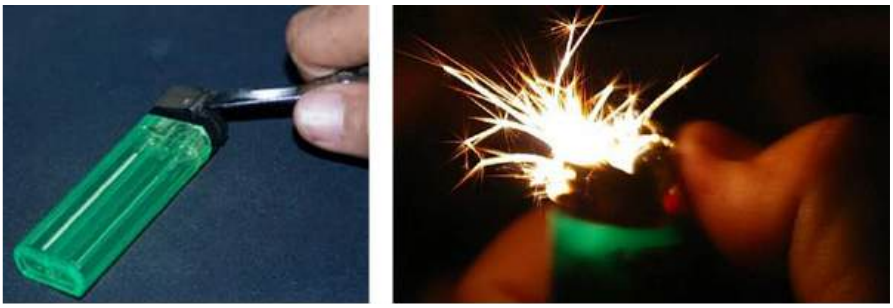


68: Matches (improvised matchbook igniters): If you have paper matchbooks, you can use them to make improvised igniters. Take a book of matches apart, and roll up one of the two sheets of matches into a little cigar shape, and secure it with tape. Then roll the cover around it, with the striker strip against the match-heads, and running lengthways along the match cigar, and secure it with tape as well. To use, pull the two pieces apart, and the striker will ignite the bundle of matches.

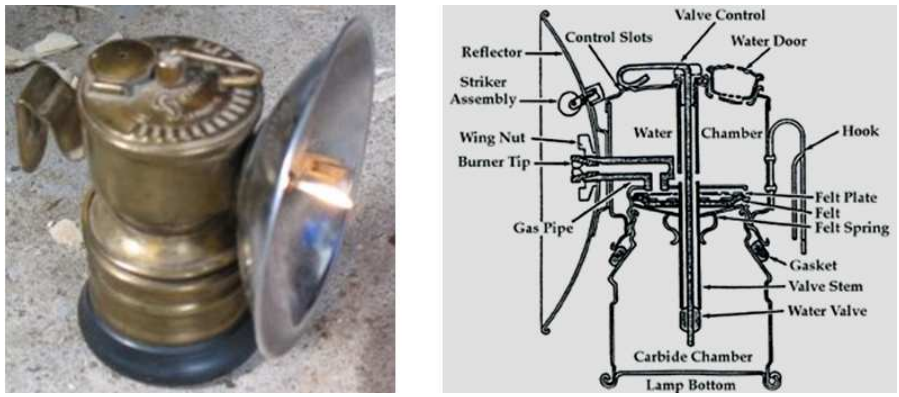
These igniters make a larger flame than a single match, and they have several survival applications. They can be used to ignite fuses (wrap the sheet of matches around the fuse, during construction), or they can be attached to tripwires, with firecrackers or similar items, to warn against intruders.

69: Zippo Lighters: zippo-style lighters use liquid lighter fuel, which is soaked into a felt-filled reservoir in the hollow body of the lighter. The lighter fluid evaporates, so zippos must be refilled every day or so. Despite this limitation, I really like this type of lighter, because they are basically little self-igniting oil lamps. You can light a zippo, place it on a table, and use it as an improvised lamp, leaving both hands free for the task at hand (such as replacing flashlight batteries). The lit zippo can also be placed under a teepee-shaped stack of damp tinder sticks, until they dry out enough to ignite. (A zippo and a bottle of lighter fluid can also be used as an improvised flame-thrower, in a pinch.)

70: Butane Lighters: Cigarette lighters that use butane are probably the most common fire-starting tool on the planet today. They are available in disposable and refillable versions, and the refillable lighters can be recharged with small cans of butane fuel. I keep cases of these lighters with my survival supplies.



71: Empty Lighters: Even if your lighter is out of fuel, you can still use it to start a fire. The sparks from both zippo and butane lighters can ignite charcloth, gunpowder, cotton balls coated with Vaseline, and other tinders (depending on how dry, and how finely-shredded they are). The windscreen on zippo lighters is large enough to hold a decent pinch of tinder, but you can pry the windscreen off a butane lighter, to allow better access to the spark.



72: Carbide Lamps: Carbide lamps use calcium carbide, a substance which produces a flammable gas when it comes into contact with water. These lamps (and the carbide) are still used by cavers, and are available from sporting goods stores that supply the cavers. The lamp has an upper chamber that holds water, which slowly drips down into a lower chamber that holds a few lumps of carbide. The resulting gas escapes out a small tube located in the center of a reflector. The gas is lit with a sparker mechanism, and burns as a bright flame in the reflector. The flame from a carbide lamp will easily start a fire.

73: Road Flares: A road flare is much like an oversized match, that will burn for several minutes. The end of the flare and the cap are coated with the same chemicals used in safety matches, and the body of the flare contains a slow-burning compound. A lit flare will light a fire, and it will also burn long enough to help get a fire established, if your kindling sticks are damp.

74: Signal Flares and Flare Guns: There are two basic types of signal flares, handheld and aerial. Handheld flares are just like road flares, they just burn on the ground, or while you hold them. Aerial flares (which can be a self-contained stick, or a flare pistol with several flare cartridges) shoot a flare into the sky. Both types can be used to start a fire, and you just shoot the aerial flares at the ground.

Flare gun with extra flare cartridges, and aerial flare after launch.

75: Butane Micro-Torches: Butane torches are similar to butane lighters, except that the flame emerges from the burner as a focused jet. These tiny refillable torches make it very easy to start a fire.

76: Propane Torches: Propane torches are larger than butane torches, and are handles and burners that fit onto disposable propane cylinders. They usually have a self-ignition feature, and produce plenty of fire.

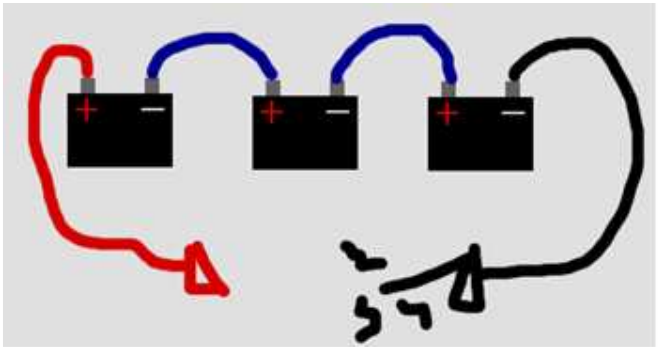
77: Cutting and Welding Torches: Oxy-acetylene torches use a combination of acetylene gas and oxygen, to produce a flame that will cut through steel plate (and set things on fire). The gas is usually lit by a separate sparker tool (see # 78), but any other ignition source will also work.

78: Cutting Torch Sparkers: These little spring-loaded sparkers (which have replaceable flints) are used for lighting gas torches, but they will also light most tinders as well as any other spark-based technique.

79: Electric Cigarette Lighters: Nowadays you can buy tiny battery-powered electric cigarette lighters, which use small heating elements to set cigarettes on fire. They will also ignite any good tinder.

Of course, you can also start a fire by using the electric cigarette lighter in your car.

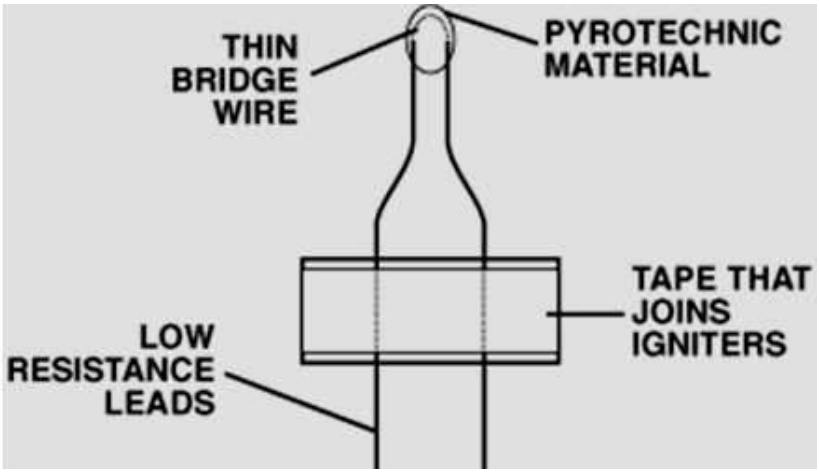
80: Electricity and Battery Power (using steel wool): Steel wool is easy to set on fire with electricity. If a bit of steel wool is spread apart (to increase surface area), even a weak battery will cause it to spark and burn, and it can be blown into a flame with little effort.



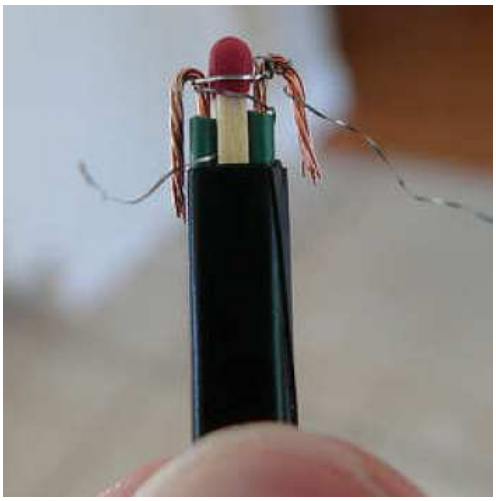
81: Electricity and Battery Power (improvised welder): Car batteries store a lot of power. In fact, three car batteries connected in series have enough power to weld metals (and enough heat to start a fire).

82: Electricity and Battery Power (improvised batteries, & flammable-soaked tinder): If you know enough basic chemistry to make an improvised battery, you can use the spark to ignite some tinder. Weak batteries make weak sparks, so for best results coat your tinder with some flammable fuel.

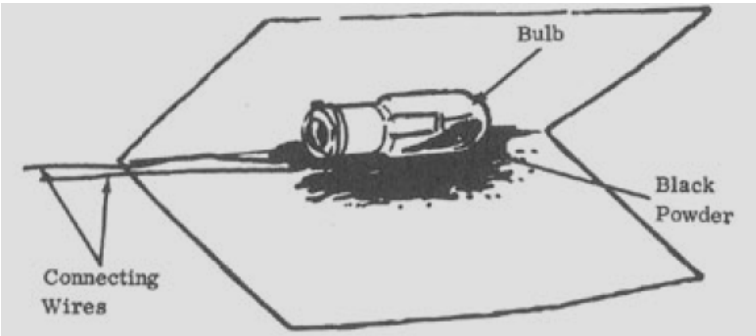
83: Electricity and Battery Power (electricity and a wooden pencil): If you run enough electricity (such as household 120 volt AC) through a short section of wooden pencil, the pencil lead will act as a resistor and generate enough heat to ignite the wood.



84: Electricity and Battery Power (model rocket igniters): Hobby stores sell electric igniters, used to set off model rockets. They ignite from battery power, and will light any reasonably flammable material.



85: Electricity and Battery Power (improvised match and wire igniters): You can also make your own improvised electric igniters, using a match, wires, and strands from steel wool, as shown. Works great.



86: Electricity and Battery Power (improvised igniters, auto lamps and gunpowder): Many small incandescent auto lamps, such as turn signal lamps, can be used to make improvised igniters. First, solder wires to the lamp contacts (or use a lamp socket that fits the lamp). Break the glass of the lamp, leaving the filament intact, and then fill the lamp with gunpowder. Wrap the lamp with paper, adding more gunpowder around the lamp, to make a larger ignition fire. To use, connect to a 12 volt battery, using your choice of initiating circuits. You can also use ground-up safety match heads as the powder.


87: Electricity and Battery Power (hot light bulbs): Any normal household lamp with a regular incandescent light bulb can be used as an igniter, by harnessing the radiant heat from the light bulb. Trapping the heat is as easy as wrapping the light bulb in several layers of paper. When the lamp is turned on, the heat buildup will quickly set the paper on fire.

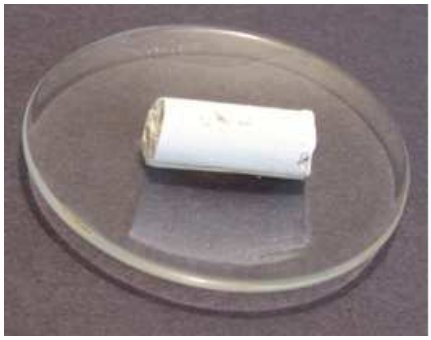
88: Other Machinery Sources (Engine Exhausts, Microwaves, Lasers, Grinders, Etc.): Many other modern items can be used to start a fire. Some examples are sparks from grinding tools, the intense light from lasers, heating flammable items in microwaves or toasters, and placing flammable items on hot engine exhausts. Almost any building that has power will also contain some way to use it to make fire.

89: Wicked Lasers Torch Flashlight: A company called Wicked Lasers sells a very bright flashlight, with a light output so intense that it will set paper (or other flammables) on fire, if placed on the lens.

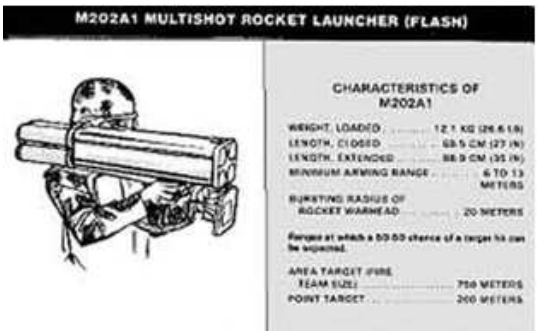
90: Flamethrowers (improvised): There are many ways to build improvised flamethrowers, such as the example shown here. They can use flammable liquids or gasses as fuel, and there are a number of different ways to build the ignition systems. Check the internet, for design ideas.

91: Molotov Cocktails: This improvised weapon is just a glass bottle containing a flammable liquid, such as a mixture of gasoline and motor oil, and an improvised wick, usually a cloth rag twisted into the open bottle. The traditional Molotov is used by igniting the fuel-soaked rag with a match or lighter, and then throwing it at the target you want to set on fire, so it breaks and coats the target with burning fuel.

92: Self-Igniting Molotovs: This improved version of the Molotov has its own built-in ignition source. There are several chemical mixtures that will ignite when mixed (see # 96 through # 100), and these have all been used in various ways, but the easiest ignition source is to just tape a stormproof match to the side of the bottle (use a corked or capped bottle, not one with a rag wick). Stormproof matches are coated with a compound which will burn even in a strong wind (see # 66). To use, just light the match and throw. A stormproof match will keep burning for several seconds, which is more than enough time.



93: White Phosphorous: This is a piece of white phosphorus, a substance which burns after contact with air. White phosphorus is usually stored under water to prevent ignition, but this piece was removed from the water temporarily to take these pictures. Upon exposure to air, the phosphorus starts to oxidize, causing it to heat up and smoke, and it quickly bursts into flame. If you had some white phosphorus, it would be easy to start a fire with it, just by taking it out of its container of water.



94: Incendiary Grenades & Rockets: The four-shot bazooka shown here has replaced flamethrowers as the standard military incendiary weapon, because it has a longer range, and the payloads are white phosphorous grenades (see # 93). The blast radius of these grenades makes this weapon dangerous to use on any targets at extremely close ranges, but you can easily set a building or vehicle on fire from a safe distance, if you have one of these disposable launchers.

95: Thermite: Thermite is a mixture of a metal and an oxidizer (usually iron oxide and aluminum powder) that burns very hot and very energetically. When ignited, burning Thermite produces a shower of molten Iron at well over 4,000 degrees F. Thermite requires a very high temperature to ignite. Ignition with a Magnesium Ribbon is sometimes successful, but this method is notoriously unreliable. But if you happen to have an army surplus thermite grenade, I guarantee that you can start a fire with it.

Chemical Based:

There are several chemicals that will self-ignite when mixed together. Here are a few examples:



96: Chemical Fire #1 (potassium permanganate, glycerin, & water): Add a few drops of glycerin to a few crystals of potassium permanganate. Accelerate the reaction by adding a couple of drops of water. (Potassium permanganate was used as a mild antiseptic in old first aid kits, and is still available today.)



97: Chemical Fire #2 (potassium permanganate and antifreeze): Fire can also be produced by using potassium permanganate mixed with antifreeze from a car radiator.

98: Chemical Fire #3 (acetone, sulfuric acid, & potassium permanganate): Soak a tissue with acetone to make it more flammable. Draw sulfuric acid into a glass pipette. Dip the pipette into potassium permanganate so that the tip of the pipette is coated with a few crystals. Dispense the sulfuric acid onto the tissue. The potassium permangante and sulfuric acid mix to produce manganese heptoxide and fire.

99: Chemical Fire #4 (sodium chlorate, sugar, & sulfuric acid): Mix a small amount of sodium chlorate and sugar. Initiate the reaction by adding a few drops of sulfuric acid.

100: Chemical Fire #5 (ammonium nitrate powder, finely ground zinc powder, & hydrochloric acid): Mix together a small amount of ammonium nitrate and zinc powder. Initiate the reaction by adding a few drops of hydrochloric acid.

CAUTION: If a chemical reaction does not burst into flame immediately, do not ignore the mixture, because it may start to burn after more time passes. Chemical ignition times can vary due to several variables, such as strength of chemicals, type of tinder, and local temperature and weather conditions.

Nature Based:

101: Spontaneous Combustion: Oils from grains and plants are more prone to spontaneous combustion than petroleum oils. Linseed oil seems to be one of the worst/best candidates, depending on whether or not you want a fire. (This oil comes from crushed Flax seeds, if you want a natural source.)
Spontaneous combustion works by oxidation. An oil in its liquid form will oxidize, but there will be little heat buildup due to the limited surface area. If we spread out the oil, then there is a large exposure to oxygen, and more heat is generated.
If we soak oil into a rag, and confine it to some degree, we can end up with a combination which will ignite. There are various factors that have to be properly balanced. Air needs to be able to get to the oil to enable oxidation. If there is too much air, then heat will be drawn away. If there is too little air, then there won't be enough oxidation, and the ignition temperature may not be reached. Having the whole rag/oil mass somewhat insulated also helps to retain/build heat.
Lastly, there is a "critical mass" which must be established. A small piece of cloth will lose too much heat to its surroundings. You need a large enough "pile" to make things work. Practice makes perfect.

102: Lightning Rod Bonfire: Just as lightning strikes trees (left) and other tall objects, it will strike any isolated conductor when nothing better is available. You can actually start a fire by driving a long metal pipe or bar into the sand at the beach (right), and piling a bonfire-sized pile of firewood around it. Of course you have to wait for the next thunderstorm, but if you are stranded on a tropical island, you may get one every evening. This also works if you run a wire rope or similar up a tall tree. Just don’t stand around nearby, waiting for the strike. Come back after the thunder fades, and gather some burning coals.

103: Volcanic Lava: If you happen to be in an area of active volcanoes, such as Hawaii, you could get fire from a lava flow, under the right circumstances. All it takes is getting a long wooden pole close enough to the lava to ignite, without getting gassed or burned yourself.

Coal Based:

104: Starting A Fire With A Preserved Coal: Although it might seem like cheating, an easy way to start a fire is just to keep some of the coals from your last fire alive, until you are ready to start your next fire. There are several different ways to preserve coals, but we will just count them all as one technique:

Coal Preservation Techniques (campfire ash pile): Simply gathering up a heap of campfire coals and covering them with a thick layer of ashes will keep the coals alive for a surprisingly long time. (Works best if the pile is protected from winds and rain.) When you want to restart your fire, dig through the ashes until you find the live coals, add tinder, and then fan the tinder and coals until you have a flame.

Coal Preservation Techniques (coal pot): Filling a cast iron dutch oven with coals (and putting the lid on) works almost as well as the ash pile technique, but will also remove the seasoning from the iron pot.



Coal Preservation Techniques (coal cans): A tin can with a wire or wooden handle, and ventilation holes punched in the sides, can be used to keep coals alive. To use, put some coals in the can, and add more fuel (wood chips or wood shavings) as needed. When the coals die down, wave the can around until they liven back up. To restart the fire, wave the can around rapidly, until the coals and fuel bursts into flames.


Coal Preservation Techniques (green bamboo coal carrier): A section of green bamboo can be used as a coal carrier, as shown here. Use a short section of any large green bamboo, with a closed node as the bottom, and the open end as the top. Make holes near the bottom for ventilation, and use shavings from dry bamboo as the fuel. A small bamboo stalk can be used as an air tube, to blow into the vent holes as needed, to keep the coals alive, or bring them to a flame.


Coal Preservation Techniques (slow match): A slow match is a length of very slow-burning material, such as cotton rope, that will keep smoldering once lit, much like a cigar. The cotton rope is usually held in a short length of metal tubing, to make handling easier. To use, the smoldering rope is held against your tinder while you blow on it, to make it burn hotter and set the tinder on fire.

Flame Preservation Techniques:

105: Starting A Fire With A Preserved Flame: Another easy way to start a fire, similar to # 104, is to keep a small live flame burning, until you need it to light your next campfire. This is usually done by using improvised torches, or improvised lamps.



Flame Preservation Techniques (Improvised Torches): There are several different ways to make improvised torches, for keeping a flame alive. Many dry tree barks, such as birch and cedar, can be rolled up into a bundle, and tied with cordage, and will make good torches.


Cloth rags (soaked in oil, or coated in pine pitch) can be wrapped around green wood handles, to make torches, and wooden sticks or poles can be bundled together and braced upright, to make a Swedish Torch. Whatever type of torch you make, make enough of them in advance, so that you can light them one at a time, as each previous torch burns down, and keep your flame alive until needed.


Flame Preservation Techniques (Improvised Lamps): You can improvise a simple oil lamp from a seashell, or empty tuna can, or by pecking and grinding a hollow into a soft stone, and then adding a flammable oil and an improvised wick. Flammable oils include coconut oil, olive oil, nut oils, oils rendered from animal fats, and motor oils (or fuel) salvaged from wrecked or abandoned vehicles.


Wicks can be made from strips of cotton cloth torn from clothing, or suitable plant materials, such as dried mullein pith (in seashell), or a pinch of dried cattail fluff (in stone lamp).


Flame Preservation Techniques (Natural Gas): If you happen to have a water well that also produces natural gas (and many of them do), you could seal the well, and pipe the gas to a Bunsen burner, and effectively have an eternal flame. Wells that produce lots of gas can also run generators, stoves, etc..

So that is a pretty good collection of ways to start a fire, but there are probably several I forgot to list.