

“Lichtenberg figures” are branching tree-like patterns that are created by the passage of high voltage discharge along the surface, or through, electrically insulating materials (dielectrics). The first Lichtenberg figures were actually 2-dimensional “dust figures” that formed when dust in the air settled on the surface of electrically-charged plates of resin in the laboratory of their discoverer, German physicist Georg Christoph Lichtenberg (1742-1799). Lichtenberg figures are not true fractal patterns. A fractal pattern is a mathematical construction so designed that it looks the same at any scale. Because Lichtenberg figures and fractal patterns both have similar appearances such as lightning or trees, the term “Lichtenberg Fractal Patterns” has commonly but mistakenly been used to describe these figures.



Safety notice: The output voltage and current (12,000 volts @ 35 mA) from this burner can cause serious burn, injury, or death if these instructions and safety precautions are not followed. The safe use of this burner is entirely the responsibility of the purchaser. If you have any electronic implant, consult your doctor before using. If you do not agree with this, do not use it and immediately return the burner for a full refund.

Instructions for decorating wooden objects or gourds.

Safety steps that must be observed to ensure a safe and enjoyable experience:

- **Do not use the burner until you understand all of the instructions and safety precautions.**
- Read and follow all instructions prior to the use of the burner.
- Keep under the control and supervision of a responsible adult at all times.
- Do not plug the burner in until you have completed all preparation steps and are ready to decorate the item.
- Ensure both probes are under your control prior to activating the foot switch.
- Hold the probes like you would a pencil and keep them vertical to the surface of material being decorated. Avoid touching the area below the probe's clear plastic hilt or near each probe's tip.
- Depress the foot switch to activate and turn on the burner. The red indicator lamp will illuminate when the foot switch is depressed.

- Release the foot switch to deactivate and shut the burner off.
- Wear shoes and stand on a rubber floor mat. Electrically insulated rubber gloves that are designed to protect you from high voltage (Class II) are recommended. Electrically insulated gloves may be purchased from most safety supply stores or from the internet. Ensure the glove's safety procedures and protocol are followed.
- Do not use on or near any electrically conductive surfaces including tools.
- Ensure the material to be decorated is stable on a nonconductive work surface.
- Do not attempt to decorate the item while mounted on a lathe or has a lathe chuck attached.
- Never work alone. Have a second person serve as a safety observer.
- Do not allow anyone to touch any work surface or the item being decorated while the burner is activated.
- Do not coat or spray electrolyte solution on the item while the burner is activated.
- Unplug the burner once you have finished the decorating.

Getting started:

- What wood works best?
 - Just about any wood can be used; however, tighter grained, light colored woods such as Basswood, Birch, Cherry, and Maple tend to work best to show a contrast between the Lichtenberg pattern and the background. The fine hair-like fingers can be produced much easier in tight grained wood. Woods such as Ash and Oak will work, but the burn pattern will generally lack the fine hair-like details that can be obtained in denser woods. Veneer grade plywood and high density particle board works very good. Green wood or wood with a high moisture content, above 15%, may not create fine hair-like fingers.
 - Gourds that are dry and clean tend to burn quite well.
- The Electrolyte solution.
 - The wood is a fairly good insulator and will not typically support an arc between the probe tips; consequently, it must be coated with an electrolyte solution.
 - The best solution to use is two tablespoons of baking soda per quart of water. It goes a long ways and can be stored in a glass container indefinitely.

The burning process.

- The amount of electrolyte solution that should be applied to the object is difficult to determine. It's based on several factors including the type of material, the amount of solution applied, how the material absorbs the solution, its moisture content, and even the humidity. Too little and it won't conduct enough current to create a pattern. Too much and the current will flow through the solution so freely that it will not generate enough heat to burn the material. The solution will stain the surface slightly; thus, you might want to cover the whole surface to ensure grain color uniformity. This can be done after the burning is completed.
- Apply the solution with a sponge or brush. The material does not have to be saturated but should be thoroughly moistened. If you find that the material is too wet, wait a few minutes to allow it to dry. Evaporation will reduce the conductivity where the arc will start at both probes. Wiping the surface with a dry cloth will normally leave a sufficient amount of moisture that the burning will start immediately. Ideally, you will notice the surface of the material drying along the arc path. This indicates the ideal moisture level for the electrolyte solution.
- While holding the probes near the cable end and avoiding the area of the tip, activate the burner by stepping on the footswitch. Do not allow anyone else to operate the switch for you. Place one probe in firm contact with the object and place the second probe in contact with the object at the other end of the desired burn pattern. It is best not to hold the probe tips above the object and cause an arc between the tip and the object as this will cause a deep burn spot on the surface. Do not place the tips close enough to each other to cause an arc between the tips.
- Generally, the arc path created on the object from both tips will eventually meet. Once the paths meet, the arc path will glow a bright red, continue to burn, and will create an increasingly deep

and wide path pattern. This may be desired as it tends to create a main channel with lines spreading out from it all along its path. You may move the probes around the surface of the object to create different paths for the arc.

- The beauty of the Lichtenberg Figure burning is its randomness. You will learn that you can control the burn pattern to a degree; but, the arc has a mind of its own and will take the path that defies explanation. The one factor that somewhat tends to be true is the burn path appears to follow the grain of wood probably due to the absorption of the electrolyte solution in the grain. Don't bank on this fact as always being true; especially, if that is what you want.
- Use a small spray bottle of the electrolyte solution to spritz the object's surface if it dries out too quickly and your arc tends to stop or to control the arc if it becomes too aggressive. With experience, you may use the spray bottle to guide or direct the direction of the pattern. Do NOT spray the object while the burner is activated. Turn off the burner and place both probes in their pockets prior to spraying the object. A small spray bottle can be purchased at any cosmetic counter for around \$1.00. Well worth the investment.
- You can oftentimes get a very delicate burn pattern by only using one probe on the object. Simply leave the second probe parked in the unit. The burning is much slower with only one probe.
- A safety point here! There is sufficient electrostatic conduction in the air to allow one probe to oftentimes burn the object. Do NOT touch the object or any surface near it during the burn. A shock will result. Ensure your safety observer and anyone else watching follow these procedures.
- The burning of the pattern will create smoke. Ensure the work area is well ventilated. If you are planning to burn patterns for an extended period of time, a mask approved for exposure to organic vapors is recommended.
- Release the foot switch and ensure the red lamp is off before touching any surface with anything other than the probes. Unplug the burner when you are through with the burning process.
- The probe tips may get a char buildup on them. This does not affect the efficiency of the burning; however, you may clean the tips with a Scotch Brite® pad and alcohol. Do not use other solvents to clean the probe tips.

Cleaning and finishing the decorated object.

- Once you have completed the Lichtenberg pattern, there will be a significant amount of char that needs to be removed. The best method is to scrub the burnt area with a soft bristled brush such as a toothbrush while holding the item under running water. Do not sand or use the brush without running water on the burnt area because the char will fill any open grain and create black smudges that is nearly impossible to remove. Once the char is washed away and the object has dried, it may be lightly sanded (220 or higher grit) to remove any raised grain and to highlight the hair-like fingers. Do not be aggressive with the sanding as the hair-like fingers are very shallow and can easily be sanded away.
- Any reasonably clear finish may be applied to the decorated object once it is dry.

Be safe and follow all the safety precautions. Use common sense and have fun.