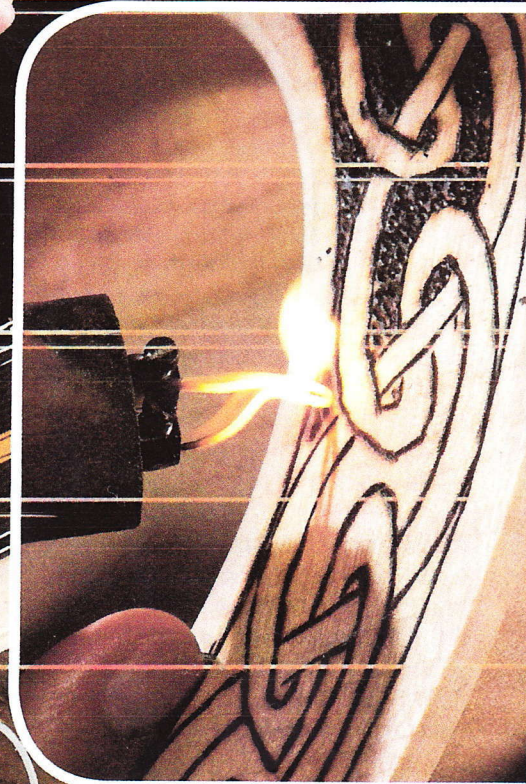


Extreme Pyrography

Deep burning requires a new kind of pen, cooled by air. Here's how to make one.

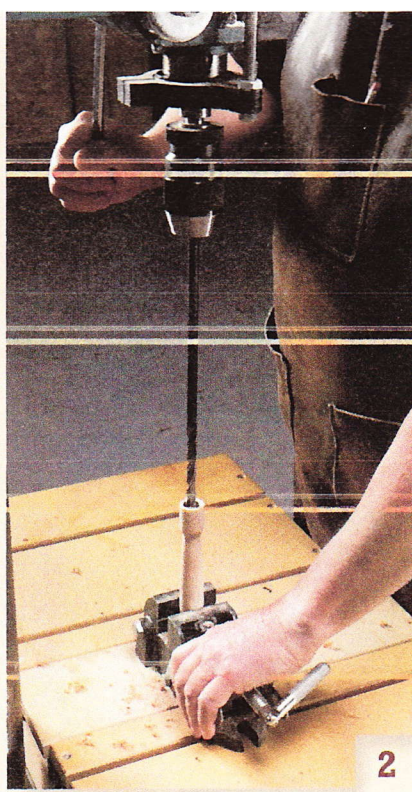
by Richard Tendick





1

Begin making the pen by drilling a large, shallow hole in a handle that you've turned on a lathe. A dowel shaped with a rasp would also work.



2



3

Insert a piece of brass tubing into the handle.

Drill all the way through the handle with an extra-long bit.

YEARS AGO, when I was a Cub Scout, a trusting den mother put a wood-burning pen in my hand. I scorched a lot of wood trying to draw a sailboat, but the results weren't all that impressive. Today, turners have taken the old art of pyrography to a whole new level. They use pens that run much hotter and penetrate deeper, creating a three-dimensional effect.

There's just one problem: The handles of most commercial pens get really hot! It's painful to hold them for more than a few minutes.

I've designed a new pen with a handle that doesn't heat up, because it's cooled by air. With this pen, you can spend all the time you need to make a complicated design. My pen is very simple to make and doesn't require any

expensive parts—but you will need a compressor.

How the pen works

Before showing you how to make this pen, let me explain how it works (see Fig. A, below).

The hot wire used to burn the wood is attached to metal terminals embedded in J-B Weld, a metal-filled epoxy. Heat from the wire is transferred from the terminals to the epoxy and then down a brass tube that runs the length of the pen's handle. Heat moves faster through these metal parts than through the handle's wood, which is an insulator.

A small air hose runs up inside the handle alongside the lamp cord that delivers power to the hot wire. Compressed air from the hose picks up the

heat of the brass tube and blows warm air out of the end of the pen. The result: The wood stays cool.

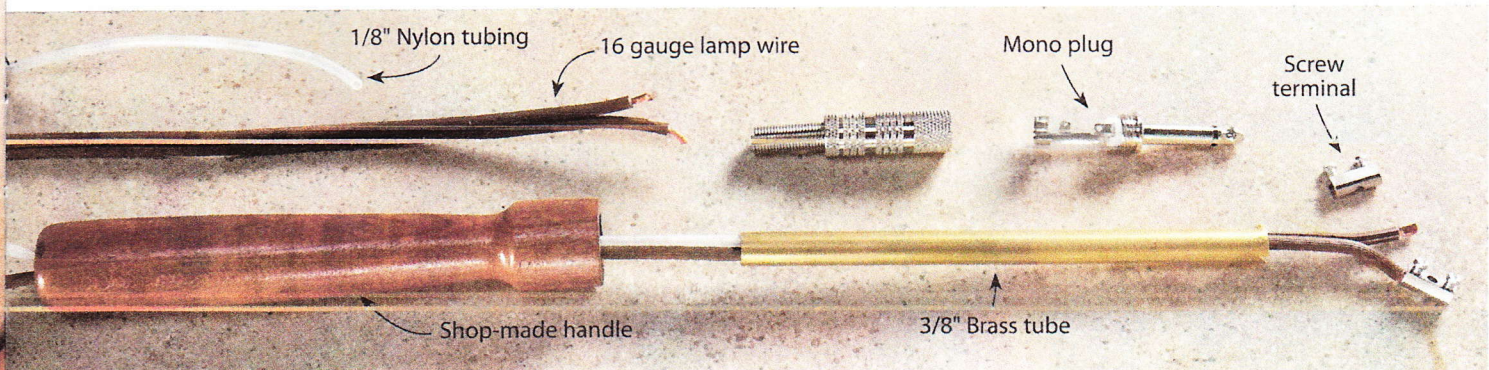
Tips and power supply

The tips of all wood-burning pens are made from nichrome wire (like the wire in a toaster). Tips are interchangeable, so you can burn a variety of patterns. My pen allows you to swap tips quite easily by tightening a couple of screws.

Like a toaster, a tip heats up when a low-voltage electrical current is run through it. This power is supplied by a transformer (see Sources, page 60). Regulating the amount of power coming out of the transformer regulates the heat of the tip. My pen plugs right into a commercial transformer just fine.

I've saved a lot of money by making

Fig. A Exploded View



How to Make Your Own Tips —and Why

The **basket weave pattern** at right looks pretty realistic, doesn't it? Of course, it's not woven or carved, but burned deep into the wood using the high-heat, air-cooled pen featured in this article. It's just one example of the many creative designs you can make with a custom-made set of wood-burning tips.

A wood-burning tip is simply a piece of round nichrome wire that's been bent or flattened into various shapes. Nichrome wire comes in two thicknesses: 20 gauge and 22 gauge (see Sources, page 60). Both of these wires will fit into the terminals of the pen I designed. As supplied, nichrome wire is easy to bend. But once it's heated, it turns brittle and can no longer be bent or shaped.

The shape of a tip is limited only by your imagination, but remember that only the portion that contacts the wood determines the design it will burn. The wire doesn't have to be a continuous, separated strand—as long as it has two ends to insert in the pen's terminals, you can cross or twist it, mangle it or flatten it any way you want. The only rule is that you can't cut it anywhere between the ends that go into the pen's terminals.

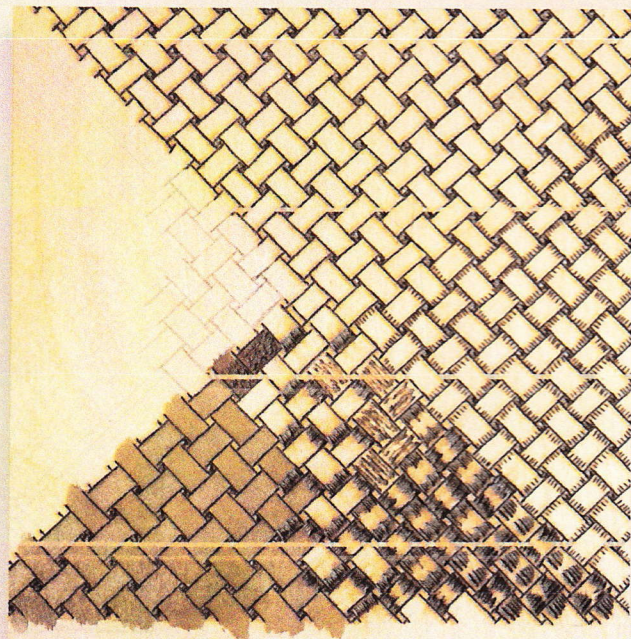
Stylus tips

I "drew" all of the lines on this board using a tip that looks like the pointed end of a knife. To make this kind of tip, cut a 3" piece of 20 gauge wire and bend it tightly in the middle, so the wires almost touch. Use a hammer to flatten one side of the bend. Refine this edge with a file to make it as sharp as possible.

Separate and bend the loose ends so they'll fit straight into the pen's terminals. Cut them off at the same length and you're ready to go. The knife's sharp edge allows the tip to penetrate farther into the wood than if it were simply a round wire.

Outlining an area with a sharp knife also has an amazing effect on dyes. As you can see on the lower edge of the board shown above, water-based dyes tend to bleed across wood, making crisp patterns almost impossible to achieve. A burnt line, however, forms a boundary that the dye won't cross. I used different shades of the same dye in this board to create an effect that looks quite real!

Let's take the same type of tip, a tightly bent "U" made from 20 gauge wire, and skip the flattening and filing steps. This is one of my favorite shapes for stippling a background (I'm using it in the photo on page 56). With burns spaced no more than 1/16" apart, I use this tip to make a random pattern that looks like the outside of a black walnut shell.



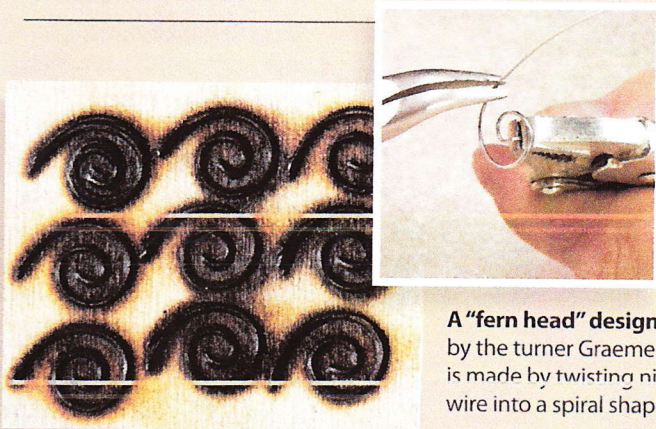
Stamping tips

The tips I just described work like a stylus—a pointed tool that creates a line, cross-hatching or a small depression. You can also make a wood-burning tip that works like a stamp. To create a repetitive pattern, you just keep stamping one or more designs.

Let me show you how to make two of these tip designs, the "fern head" (lower left) and the "basket weave" (lower right). Both are very well-known in the turning world and are closely associated with the work of particular artists.

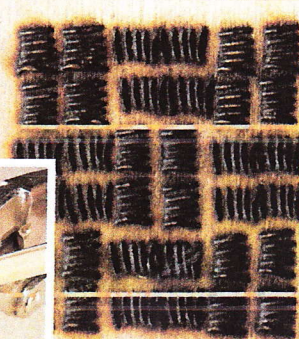
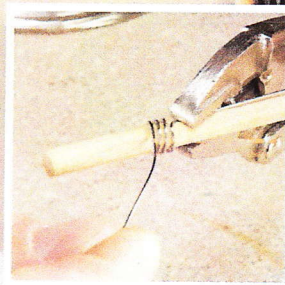
To create the fern head, snip off 3" of 20 gauge wire. Bend the wire 90° about 1" from an end. Grip this end with a small pair of locking pliers, then carefully bend the other end into a spiral with needle-nose pliers, one short section at a time. Leave about 3/16" between each revolution. When the spiral is about 3/4" across, bend another 90° leg. Cut both legs to the same length.

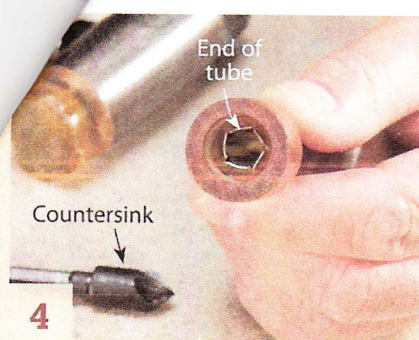
To make a basket weave tip, cut off about 4" of 20 gauge wire. Clamp 1" of the wire to a dowel or nail, using a pair of locking pliers, then turn the loose end tightly around the form using needle-nose pliers. After about five wraps, leave the wire sticking out 90° from the form. Release the locking pliers and pull the tip off the form. Bend the first end parallel to the second and cut both ends the same length. Stretch the coil to make the pattern you want.



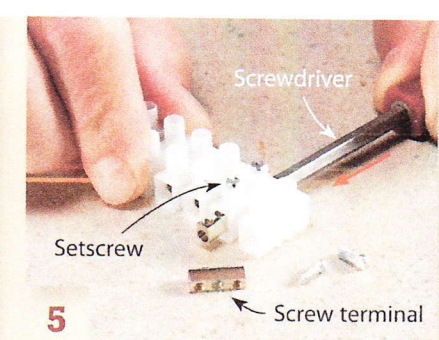
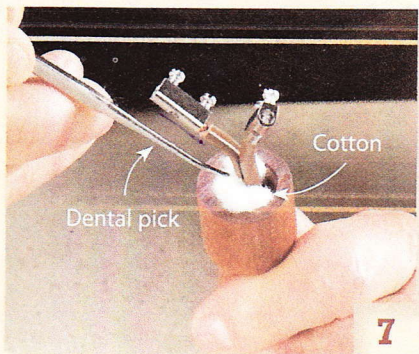
A "fern head" design, created by the turner Graeme Priddle, is made by twisting nichrome wire into a spiral shape.

The "basket weave" design, first used by the turner Molly Winton, is made by coiling nichrome wire around a dowel or nail.





4 **Widen the end** of the tube. Place a countersink in the tube and strike it with a mallet. Expanding the tube helps lock it in place.

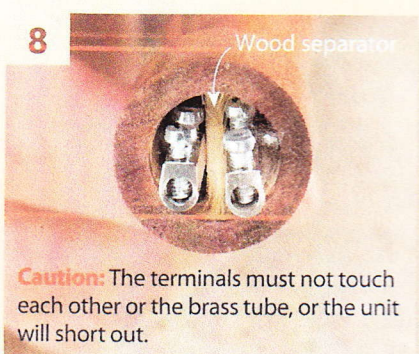


5 **Remove two pairs** of setscrews and screw terminals from a terminal strip, an inexpensive device you can buy at an electric supply store.



6 **Push a length of lamp cord** through the handle, then fasten the terminals to the wire.

Insert a small piece of wood between the terminals to separate them.



8 **Caution:** The terminals must not touch each other or the brass tube, or the unit will short out.

Stuff a small ball of cotton down the brass tube to plug up its end. Pull back on the lamp cord until the terminals only protrude halfway.

my own tips and transformer. To make tips, all you need is a length of nichrome wire, a wire cutter and some pliers (see *How to Make Your Own Tips—and Why*, page 58).

Making your own transformer is almost as easy, but you do need to be familiar with basic wiring skills. The savings are substantial: Commercial transformers can cost \$150 or more. I found plans on the Internet for converting a \$40 battery charger into a transformer, but before I started I consulted with a master electrician. He suggested a number of changes that make a much better unit. I've made a video of the process—see it at the website below.



Save big bucks by making a power supply unit from a battery charger.

Watch how at

AmericanWoodworker.com/WebExtras

Make the pen's body

Make a handle that's about 1" dia. and 6" long. You can turn it yourself, shape it by hand from a block of wood, or use a dowel. Very dense woods, like cocobolo, work best, because they're less likely to

scorch if you inadvertently point the pen straight down while it's burning.

If you've turned your handle, you can drill through it on the lathe, too, using a Jacobs chuck in the tailstock. Otherwise, it's best to use a drill press. Clamp the handle in a drill-press vise or in a hand-screw to hold it vertical. Install a 5/8" Forstner bit in the drill press and drill a hole 1/2" deep into the handle (**Photo 1**). Next, drill all the way through the handle with a standard 3/8" bit, followed by an extra-long 3/8" bit (**Photo 2**).

Insert a 3/8" dia. brass tube (.014" wall thickness) into the end of the handle (**Photo 3**). (You should be able to find this tubing at a hardware store.) Extend the tube 1/8" into the 5/8" dia. hole. Mark the point where the tube sticks out of the handle. Withdraw the tube and cut it to length at the mark. Reinsert the tube into the handle.

Flare the end of the tube, so the tube can't slip out (**Photo 4**). Stand the handle on end, place a countersink into the end of the tube and give the countersink a smart tap with a mallet.

Wire the pen

To make the device that will hold the hot-wire tips, you'll steal some parts from an inexpensive electrical component (see Sources). Remove two pairs of set-

screws from the terminal (**Photo 5**). (You may have to cut off the top of the sleeve around the setscrews in order to remove them). Push out two of the connecting terminals with a screwdriver or punch.

Cut about 48" of 16-gauge lamp cord and insert it through the base of the handle. Strip about 1/4" of the insulation from both wires. Place one terminal onto the end of each wire (**Photo 6**). Orient both terminals to face the same way, then tighten the setscrews as hard as you can.

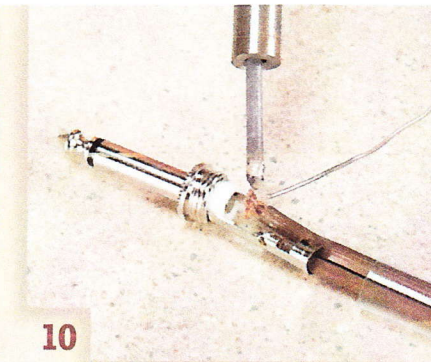
You will be "potting" the terminal ends into the handle by pouring in J-B Weld epoxy, which is available at most hardware stores. To keep the J-B Weld from running down the brass tube, stuff a portion of a cotton ball into the tube around the wire to form a plug (**Photo 7**). Pull the lamp cord back through the tube until the centers of the terminals are even with the rim of the handle. Place a toothpick or sliver of wood between the connectors to separate them (**Photo 8**).

Caution: The terminals must not contact the brass tube. They must also be separated by a non-conductive spacer. If the terminals do touch the tube or each other, the unit will short-circuit and blow a fuse in the transformer.

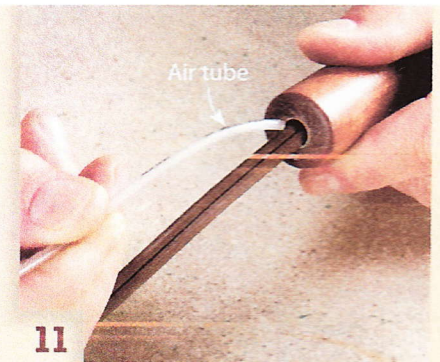
Mix up the J-B weld and pour it into the hole holding the terminals



9
Cement the terminals in place with J-B Weld. This adhesive can withstand high heat and doesn't conduct electricity.

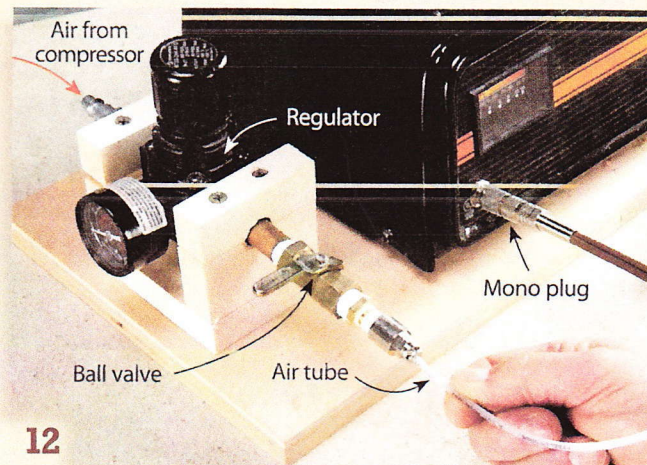


10
Solder the other end of the lamp cord to a 1/4" mono plug.

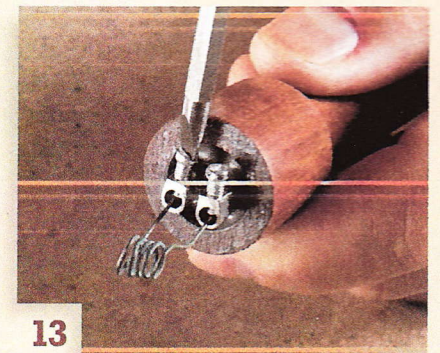


11
Insert an air tube two-thirds of the way up the handle. Tape the tube to the lamp wire in a number of places.

Insert the air tube into a push-in fitting connected to a ball valve and air regulator. Hook up a hose from an air compressor to the other side of the regulator. Insert the mono plug into a commercial 12 volt transformer, or one you've built yourself.



12



13
To burn patterns, install a tip into the terminals. It's easy to make custom tips by bending pieces of nichrome wire. Turn on the transformer and you're ready to go!

(**Photo 9**). Make sure you don't get any epoxy inside the terminals or on the setscrews that stick out of the handle. Fill the hole almost up to the rim. Allow the epoxy to cure for 12 hours.

Solder a 1/4" mono phone plug onto the other end of the lamp cord (**Photo 10**; see Sources). First, unscrew the plug from its sleeve and remove the clear plastic insulator from the plug's solder lugs. Insert the lamp cord through the sleeve, then through the insulator. Split apart the two wires of the lamp cord for about 1" and shorten one of the wires by 5/16". Strip about 1/4" of the insulation on both wires. Insert the wire ends into the holes in the solder lugs. If the holes are too small, enlarge them with a drill. Bend the wire to keep it from being pulled out and bend the tabs around the wire's insulation. Solder the wires in place. Slide the plastic insulator down the lamp cord and screw the sleeve in place.

Cool the pen with air

Cut a piece of a 1/8" OD nylon tube 48" long and insert it about two-thirds of the way down the metal tube (**Photo 11**). Tape the tube to the lamp cord with electrical tape at 12" intervals.


Of course, you'll need an air compressor to provide air to the tube. For convenience, I built a unit next to my transformer that allows me to hook up the nylon tube and regulate the amount of air pressure quite easily. This unit consists of an air regulator, a ball valve and a push-in fitting (**Photo 12**; see Sources). Wrap the threads of these components with Teflon tape to seal the connections.

When I'm ready to start burning, I turn off the ball valve and turn on the compressor. Then I insert the nylon tube into the push-in fitting, turn on the ball valve and the air supply is ready to go. To remove the tube, push in the collar of the fitting and pull out the tubing.

Start burning

Before you plug in the pen, select the tip you'd like to use. Insert it into the terminals and tighten the setscrews (**Photo 13**). Turn the heat control on the transformer to its lowest setting, plug in the pen and turn on the transformer. Gradually adjust the heat control until the nichrome wire turns red-hot. Turn on the air valve and start burning.

The best way to hold the pen is at an angle, as shown on page 56. You'll have

to experiment to find out how long you should hold different tips on the wood, and how hard you should press down. Creating a small flame is not unusual, so take common-sense safety precautions, including eye protection, and provide plenty of ventilation. If you notice the pen handle starting to heat up, increase the airflow to cool it down. 

SOURCES

- Hardware store: 3/8" dia. brass tube, .014" wall thickness, 12" long; J-B Weld; 16-gauge lamp cord, 48" long.
- Radio Shack, radioshack.com, 800-843-7422, 12-Position European-Style Terminal Strip, #274-679, \$4.19; 1/4" Mono Phone Plug, #274-1545, \$4.19.
- Packard Woodworks, packardwoodworks.com, 800-683-8876, Winton Nichrome Wire Kit (includes 3 pieces each of 20 and 22 gauge wire, enough to make 6 tips), #210101, \$16.95; Burnmaster Eagle Woodburner power supply, #219301, \$154.
- McMaster-Carr, mcmaster.com, 330-342-6100, 1/8" OD nylon tube, #5548K71, \$.17 per ft.; Push-to-connect air fitting for 1/8" tubing #5111K662, \$4.22; 1/8" air regulator with gauge, #9892K21, \$26.02; 1/8" ball valve, #4912K16, \$6.48.