Updating Victorian Fireplaces

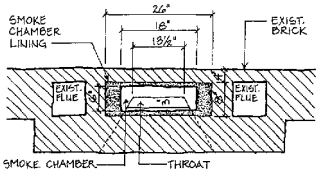
by Jim Buckley

Count Rumford understood that fireplaces produce radiant heat, and at about 1795 he came up with a design to take advantage of that effect.

Although he was an American, Rumford developed his fireplace in England. His fireplaces were shallow, with widely angled covings and light-colored masonry materials. He experimented with the shape of the throat "to find out and remove those local hindrances which prevent the smoke from following its natural tendency to go up the chimney."

Rumford rounded the breast and reduced the size of the throat to a narrow, streamlined slit measuring only about 1/20 the size of the standard fireplace opening. It forms a nozzle through which the smoke and air flow at an increased speed, and acts like a check valve against back-drafts.

The American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) requires that a modern fireplace have a flue at least 11/12 the size of the fireplace opening. If a damper is used at the throat, ASHRAE recommends that it be twice as big as the flue—about four times as

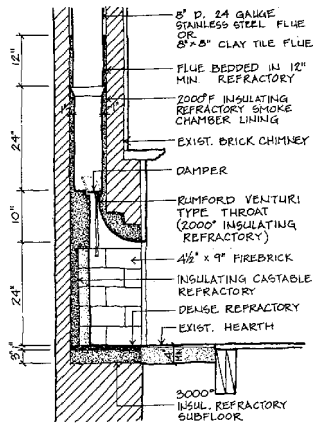


PLAN ABOVE DAMPER

big as a Rumford throat. No wonder modern fireplaces are inefficient: with their square lintels and sharp angles, they have to be deep and have gaping, oversized flues to keep them from smoking.

How to 'Rumfordize' a Fireplace

The construction of a Rumford fireplace requires several refractory materials not commonly used by home-improvement contractors. I use a 2,000-degree refractory cement for casting the throat and smoke chamber, and a 3,000-degree refractory for some fireplace subfloors. (I've found that I can mix refractories in a five-gallon plastic bucket, using a half-inch drill with a drywall mixer blade. It pours easily with the aid of a metal scoop.) I always dig out the firebox floor and replace it with 3,000-degree, castable refractory.



SECTION

Refractory cement is made in a wide range of insulating capacities and densities—the more insulating capacity the cement has, the softer it is. The insulating value of the refractory is important if smoke-chamber walls are only four inches thick. The goal is to ensure that the heat transfer through the casting and four inches of brick is equivalent to the eight-inch walls required by most codes.

If there's any wood within four inches of the hearth extension, I pour a fireplace subfloor of softer, 3,000-degree refractory cement, then a denser refractory floor over that. The finish floor of the fireplace needs to be relatively hard, because it will be subjected to abuses such as pokers and falling embers.

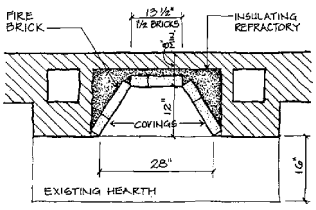
Pour the smoke chamber next, because you have to be able to get the form out at the bottom. The plywood form I use is fitted to the inside of the firebox; it is about 18 inches wide at the base, 24 inches high and six inches deep. It forms one- inch-thick front and back walls in an eight-inch rough smoke-chamber opening (a standard size in Ohio, where I live). A platform that just fits the rough opening (usually eight inches by 24 inches) holds the form in place on wooden legs 10 inches above the firebox lintel.

Using a metal scoop, pour the 2,000-degree, insulating refractory through a hole in the wall just at the top of the form. The material should be just barely pourable: If your mixture's too thick, it won't pour evenly; if it's too thin, it pours too fast.

After about three and a half hours, pull the form. (You might have to use a hammer to get it down and out through the hole.) Do it too soon and the casting will fall apart; do it too late and you'll have to burn the form out. (Charcoal applied to the top of the form works best because it burns down.)

The Floor & the Throat

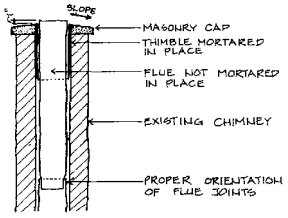
With a shop pencil or chalk, draw the firebox plan on the refractory floor. For



PLAN AT FLOOR

fireboxes up to 28 inches wide, I use one and a half standard firebricks per course for the back and both covings (this makes each course 13½ inches long). Using a level, lay the firebrick with fireclay mortar.

Keep your joints no wider than 1/16 inch. Fill the void between the firebrick and the common-brick chimney wall with insulating, castable refractory. Remember that firebox walls should be a minimum of eight inches thick, and even then it's a good idea to place some insulating refractory between the firebricks and the structural wall (especially if there's any wood on the back side of the fireplace).



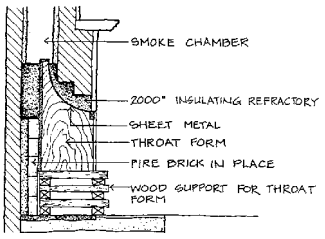
DETAIL AT TOP OF CHIMNEY

The form for the throat uses 24-gauge sheet metal for the curved part and is time-consuming to construct. For the smallest part at the top, the throat must be 1/20 of the area of the fireplace opening. For a 20-inch-wide fireplace with a 13½-inch back, the throat is 13½ inches wide by about two inches deep; for a 28-inch-wide fireplace (still with a 13½-inch-wide back), the throat is 13½ inches by about three inches. The form also must be short enough so that it can be dropped down about a foot and removed when its supporting platform is taken away.

Insert the throat form up into the firebox. (It will extend a bit into the smoke chamber.) Positioning it somewhat toward the front of the smoke chamber's opening will make it easier to get the damper in later. Make sure the form fits tightly against the firebox on all three sides and that the bottom of the form is lined up precisely with the bottom exterior edge of the fireplace. Pour the refractory to the top of the form so that the two castings overlap.

Pull the form after about three and a half hours. Sometimes it's hard to get the refractory to fill the entire breast area, or it fails when the form is removed. But it usually can be patched with a trowel using the same refractory. The casting also may need a little cutting and trimming with a trowel to make a smooth transition to the firebox and to form the throat properly.

Make a damper out of a steel plate (3/16x3¼x16) and fasten a steel-bar handle to it with a cotter pin (or have a metalworker fabricate a conventional damper hinged to a metal frame). The damper then can be inserted through the throat and sit on a ledge formed of



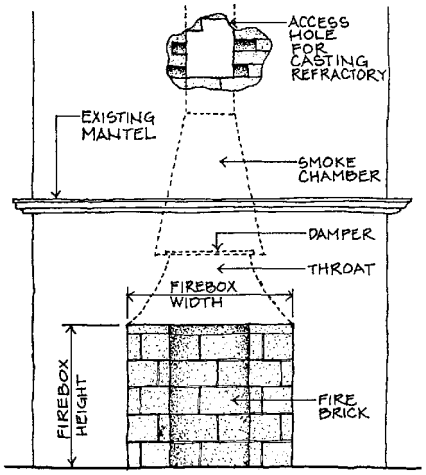
CASTING THROAT

refractory cement. This way, the damper can open and close as if it were hinged at the back to the smoke shelf (see detail).

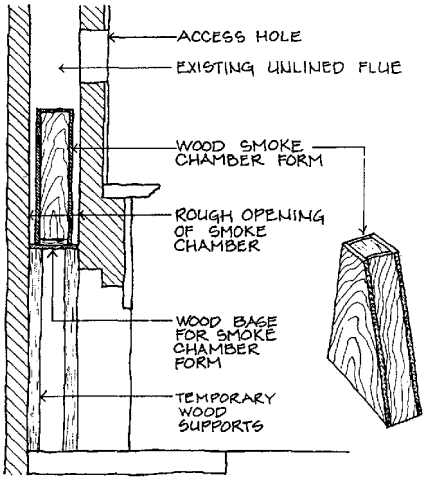
Flue Fabrication

For the flue, I use either modular, 8x8 clay-tile flue liners or eight-inch, rigid, 24-gauge, stainless-steel flue pipe. With clay-tile liners, I like to fill voids between the tile and brickwork with insulating, castable refractory, because leaky butt joints and random air spaces scare me.

Stainless steel makes an excellent flue because it's smooth, round and has lapped joints. Just make sure you get the male ends down so that any creosote dripping down the pipe stays inside the flue. As an added precaution—because wood framing is often right up against old chimneys—I pour insulating, castable refractory around the outside of the



ELEVATION



SETTING SMOKE CHAMBER FORM

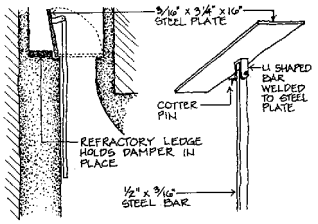
drawings courtesy The Old-House Journal

pipe, filling the voids.

Whichever liner you use, fit it to the top of the smoke-chamber casting through the pour hole, brick up the hole, and pour more refractory from the roof (or the upstairs fireplace, if available), seating the flue at least one foot deep in the refractory.

Most bends in old chimneys occur so that downstairs flues can go around upstairs fireplaces, but you usually can gain access to these bends through the upstairs fireplace opening by taking out part of the side of the firebox.

We broke a few mortar caps because the stainless-steel flue pipe expands when it gets hot, so now we use a standard eight-inch thimble as a sleeve. Run the flue pipe through the sleeve, and mortar the sleeve to the brickwork. Saw



DAMPER DETAILS

off the stainless-steel flue pipe about one inch above the masonry cap so it won't be seen from the street.

You can use a clay chimney pot to finish off the chimney. Sometimes a 40-foot-high chimney that's 12 feet above a steep slate roof can be pretty scary, but the view's great! Figure out the type of scaffolding and safety-harness arrangement that's safest for your situation, and use it.

After I finished my first fireplace (which happened to be in my own home), I named it the "Victorian Rumford Compromise." After all, it was somewhat anachronistic to put a 200-year-old fireplace in a 100-year-old house. And besides, I built it about 12 inches deep, rather than Rumford's recommended one-third of the width, because it was only 20 inches wide.

Satisfying the Codes

Despite the benefits of Rumford's design, most building codes require fireplaces to be 20 inches deep. I did some research and learned that this requirement was adopted in the 1940s, more or less arbitrarily, as a guide for the builders who rarely had engineers or architects designing their fireplaces.

To get the required building permit for my first fireplace, I had to appeal to the Columbus Building Regulation Commission. First I had to satisfy the commission that I understood the code and that my fireplace complied with all safety-related issues. Then I argued the differences in the Rumford design, showing that the heat transfer through my insulating, refractory-lined smoke chamber and four inches of brick would be as safe as that of the eight-inch walls required by code.

To make a long story short, the entire commission gathered at my house early one July morning in 1982 for a "burn-in." The officials were quite pleased with the demonstration, and I went into the business of building Victorian Rumford Compromises for other old-house owners. ■

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