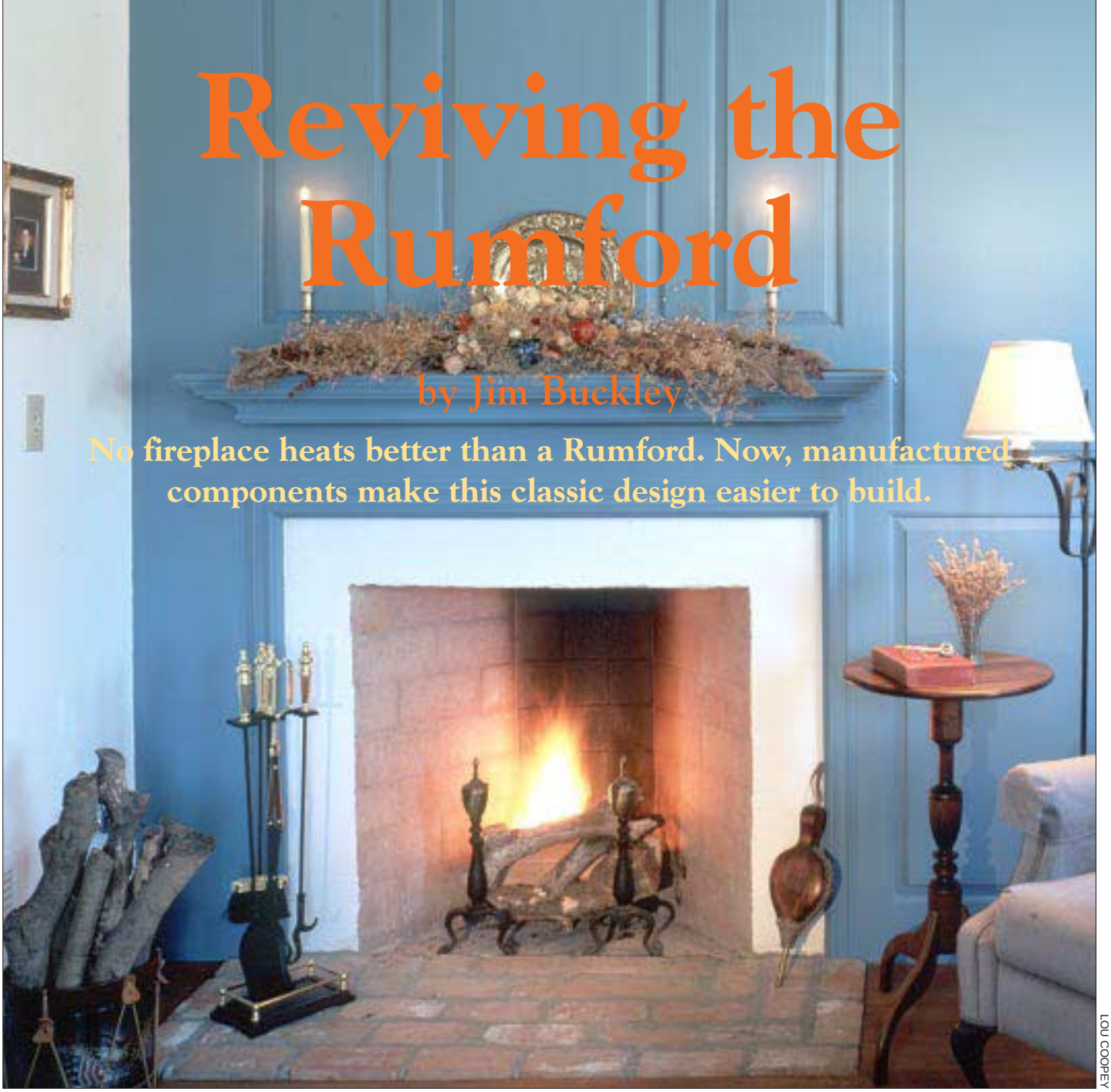
Reviving the Rumford

by Jim Buckley

No fireplace heats better than a Rumford. Now, manufactured components make this classic design easier to build.



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A true Rumford fireplace is recognizable by its shallow firebox, angled side walls, and perfectly straight back.

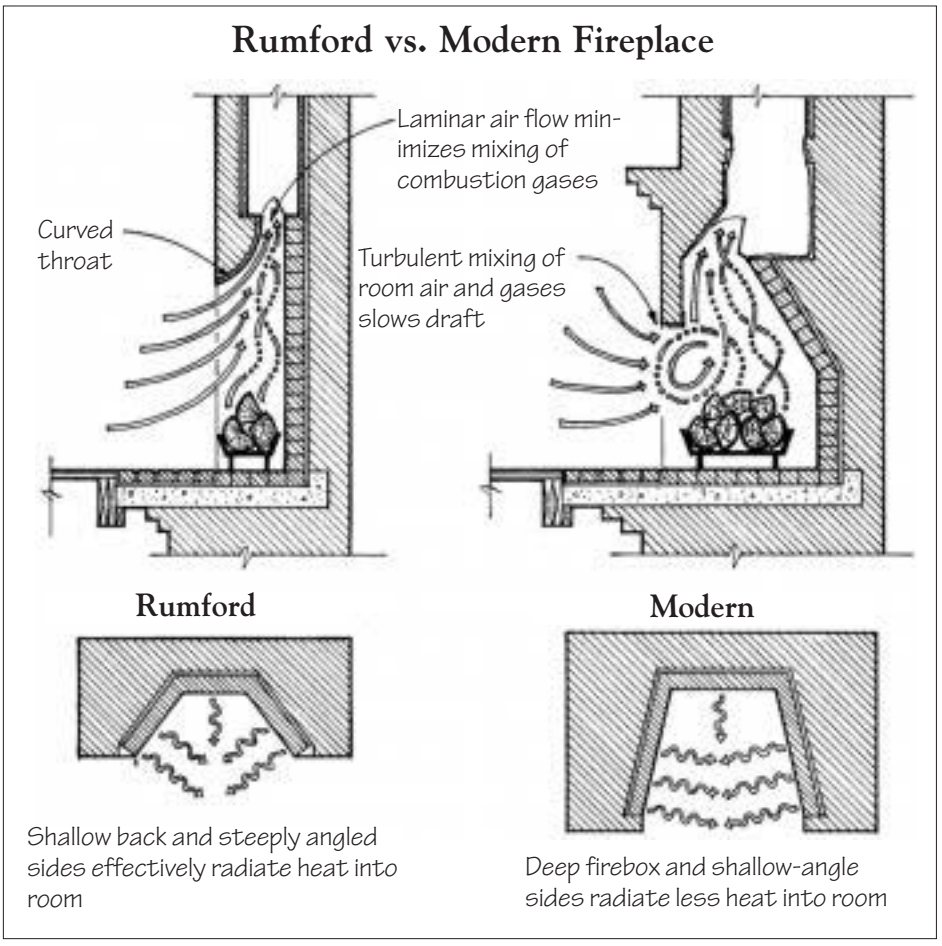
Count Rumford's elegant fireplace design became the state of the art within months of its invention in the late 1700s. Unfortunately, although thousands of Rumford fireplaces were built, few people understood the principles behind Rumford's design. When wood heat went out of vogue around 1850, Rumford's ideas were diluted by the furious competition to design and patent popular coal-burning fireplaces. And shortly after gas fireplaces replaced coal in the 1890s, wood fireplaces virtually disappeared from American homes.

Wood-burning fireplaces became popular again in the 1920s — almost 70 years after the last Rumfords were built, and by 1950 the modern fireplace had been reinvented as a result of the standardization that came with the development of modern building codes. But by that time, a number of mistaken notions about the Rumford had become popular so that most of the fireplaces — including Rumfords — built in America were modified in ways that weren't really improvements on Rumford's design. Most modern fireplaces are built as a nostalgic luxury, producing lots of smoke and not much heat.

But the Rumford fireplace is making a comeback. Its clean, simple lines are attracting more buyers and its effective use of radiant heat makes it a real fireplace to warm yourself by. And while other fireplaces draw lots of warm interior air up the chimney, the aerodynamic Rumford burns cleaner and wastes less heat.

The Secret of the Rumford

Science has come a long way since Rumford's day. Our modern understanding of heat and air flow is being applied to build Rumford fireplaces the way he designed them — with



ILLUSTRATIONS: NATE CLEVELAND

Figure 1. *Compared with a conventional modern fireplace, the Rumford draws better, burns cleaner, and radiates more heat. The Rumford's curved throat and straight back create a steady draft in which combustion gases and room air stay separate and flow smoothly through the small damper. By contrast, the sloped back of a conventional fireplace creates a turbulent mix of room air and combustion gases. This cools the gases and creates drag, slowing the draft and requiring a larger damper opening.*

straight backs and rounded throats (Figure 1). Here's why that design works so well.

Radiant heat. Rumford realized that the only useful heat a fireplace produces is radiant heat (in fact, Rumford coined the phrase "radiant heat"). The heated air from a fire goes up the chimney, but the radiant heat projects out into the room. Rumford thought the firewalls of a fireplace reflected the heat out; that's why he recommended whitewashing the inside of the fireplace. We now know that the fireplace walls, whether white or black, *absorb* the heat and then re-radiate it. But either way, the angled walls in a shallow Rumford direct radiant heat out into the room much better than a deep, square fireplace does.

Streamlining. But shallow fireplaces tend to smoke, especially when they're wide and tall like the Rumford. To solve that problem, Rumford removed any obstructions to smooth air flow into the fireplace and up the chimney by "rounding the breast." With an intuitive understanding of fluid dynamics that was far beyond the science of his day, Rumford essentially created a venturi. Like a nozzle or an inverted carburetor, the Rumford's throat shoots smoke and air up into the smoke chamber.

A Rumford You Can Count On

Count Rumford was born Benjamin Thompson in Woburn, Mass., in 1753. He picked the wrong side in the American Revolution and had to leave suddenly with the British. He may have been only one step ahead of Washington's army, but he was way ahead of his time when it came to understanding heat: For his work on the subject, the Bavarian government gave him the title of Count of the Holy Roman Empire.

When he returned to England in the 1790s, Rumford applied his knowledge of heat to improving fireplaces. His two essays on his improved design, published in 1796 and 1798, were immediate hits. Thomas Jefferson read Rumford's essays within months after they were published and switched to building Rumford fireplaces at Monticello. By 1834, Henry Thoreau's *Walden* listed a Rumford fireplace as one of the comforts taken for granted by modern man.

But wrong ideas about Rumford fireplaces were introduced right from the beginning by others, and have been passed along up to the present day. For example, the mistaken notion that the purpose of the "smoke shelf" is to block downdrafts in the back of the chimney was first put forward in 1796 by Thomas Danforth in an essay "fully explaining" Rumford. This misunderstanding is further elaborated in Vrest Orton's popular *The Forgotten Art of Building a Good Fireplace*, now in its 23rd edition.

There is no evidence that Rumford attached any importance to the "smoke shelf." As far as I can determine, the "smoke shelf" shown in Rumford's original drawings is an inadvertent result of modifying an existing deep fireplace to make the firebox shallower. Ironically, this accidental feature of the Rumford fireplace is the only Rumfordlike feature still found in smoky "modern" fireplaces.

Other books published over the last 200 years have contained similar errors. Modified Rumfords based on these later writings generally were not as good as the original.

Rumford's own writings are still the best source for information about his design. His essays are out of print now, but you can still find them in libraries: Look for the *Collected Works of Count Rumford*, Vol. II, edited by Sanborn Brown.

—*J.B.*

Count Rumford may not have known how ingenious his "rounded breast" really was. Recently, we began testing emissions from a Rumford made with components produced by masonry manufacturer Superior Clay of Uhrichsville, Ohio. We fitted the fireplace with four thermocouples to see what the temperatures were at various places. We placed two thermocouples at the narrowest part of the throat, one near the throat's curve and one near the back. To our amazement, with an established 1700°F fire, we recorded only 75°F near the rounded throat; just 2 inches away near the back, we recorded 730°F! As we suspected, the room air coming in over the fire in a Rumford doesn't mix with the hot products of combustion. Instead, the room air acts like an invisible glass door that keeps the smoke behind it as they both go up through the throat together.

This laminar type of air flow — where gases move in smooth streams without mixing turbulently — reduces drag. That's why aircraft and automobile designers strive to create laminar flow. In the throat of a fireplace, laminar flow allows the smoke to escape easily into the chimney.

A Tale of Two Fireplaces

Most masons who build modern fireplaces won't believe a Rumford will draw until they see it happen with their own eyes. The rules are different for the two types of fireplaces.

In a modern fireplace, the fireback is usually sloped toward the front, casting the products of combustion forward. Incoming room air spills over the edge of a lintel and mixes turbulently with the smoke. Most masons will tell you that you need to drop the lintel 8 or 9 inches below the damper to create a pocket for this smoke and incoming room air to "roll." Otherwise, the fireplace will smoke.

But all this turbulence is inefficient. The roiling smoke and air need a huge throat to get through. A Rumford fireplace operates on a different principle. The straight back lets smoke from the fire travel straight up into the chimney. The curved throat, unlike a square lintel, lets room air pass smoothly and swiftly over the fire and into the flue. The result is that a Rumford with an opening almost a foot taller needs a throat that is less than half the size of a regular fireplace's.

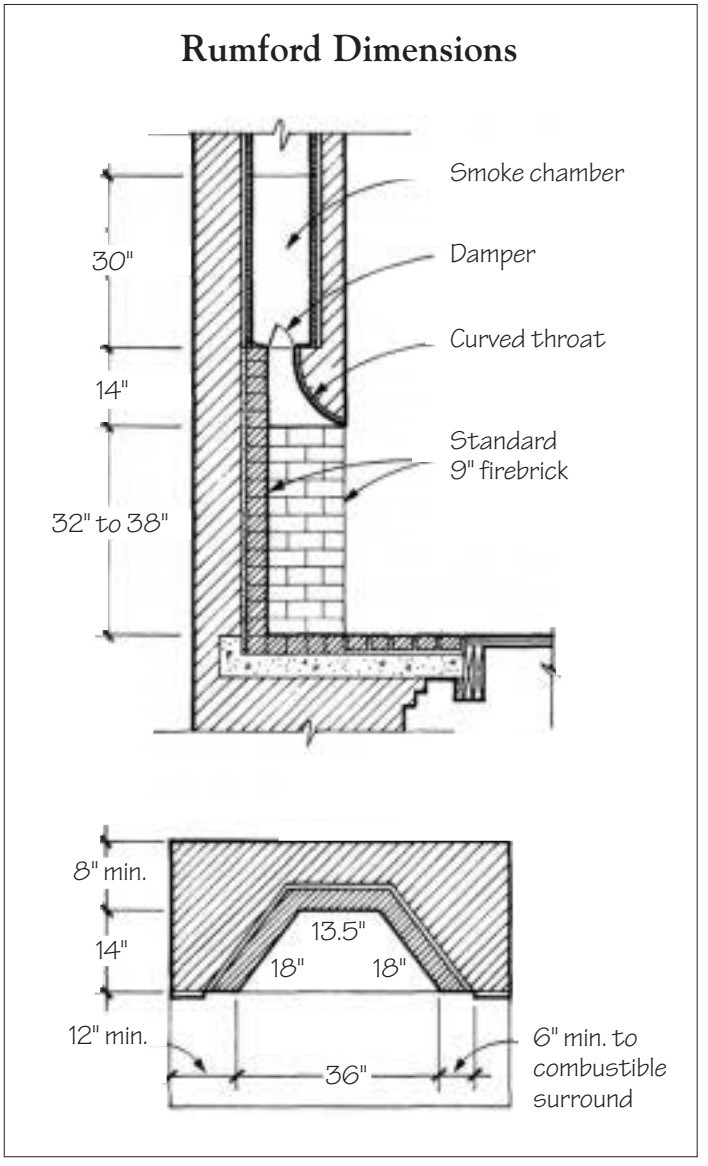


Figure 2. *The drawing gives measurements for a 36-inch-wide Rumford fireplace built with a premade throat, damper, and smoke chamber. These components, manufactured by Superior Clay of Urichsville, Ohio, are available for Rumfords from 24 to 48 inches wide, in 6-inch increments. The basic proportions of the fireplace remain the same, regardless of size.*

Building the Rumford

The key to building a well-functioning Rumford fireplace is to stick to Count Rumford's original design. His instructions explain how to carefully lay out the shallow firebox with a plumb bob and the special jigs he developed. Rumford recommended plaster to achieve smooth, rounded curves at the throat.

Nowadays, you can get modern manufactured components that save a lot of time. The method I'll explain uses a manufactured throat and smoke chamber I helped to develop. The components are produced commercially by Superior Clay Corporation (P.O. Box 352, Uhrichsville, OH 44683; 614/922-4122).

The firebox. Build the Rumford firebox using standard 9-inch firebrick and refractory mortar. Although a Rumford can be built to almost any size, the proportions stay roughly the same. Figure 2 shows a 36-inch-wide fireplace. Rumford fireplaces are usually about as tall as they are wide, but you can adjust the height by a few inches. A slightly shorter opening makes the fireplace draw better, especially when a small fire is built in a large fireplace.

The side walls of the firebox are angled inward no more than 135 degrees off the back wall. Use refractory mortar to lay the firebrick. The firebox walls should be at least 8 inches thick, so back up the firebrick with solid masonry. Pack any voids full of ordinary mortar.

Throat and damper. Set the curved Rumford throat in refractory mortar on top of the firebox (Figure 3, next page). Lay up surrounding masonry to the top

Figure 3. *The curved throat sits in refractory mortar at the top of a Rumford firebox built with ordinary firebrick.*

Figure 4. *The cast-iron damper mounts directly on top of the curved throat component.*

of the throat, packing the throat solid with ordinary mortar as you go. The throat is designed to carry the load, but place a length of rebar in the first thick mortar joint above the front edge of the throat to provide an extra margin of safety.

Set the cast iron damper in a bed of mortar over the throat opening (Figure 4). Make sure the valve plate can open and close freely. Close the valve.

Smoke chamber. You have some leeway in positioning the smoke chamber (Figure 5) over the damper. Line it up with where you want the flue to be, but check again to be sure that the damper valve can still open and close freely.

After surrounding the smoke chamber with masonry at least 4 inches thick, you are ready to set the first flue tile. Build the rest of the chimney just as you would any other chimney.

The Surround

As with any fireplace, Rumford surrounds should be at least 6 inches wide, which keeps combustible materials away from the source of heat and flame. But Rumford surrounds should be almost flush with the wall of the room. Any masonry that projects around the side of the fireplace will block some of the radiant heat.

Figure 5. *The smoke chamber provides a transition to standard-size flue liner. It sits above the damper and is surrounded with ordinary bricks and mortar.*

At the top of the fireplace opening, bring the surround material just low enough to cover the edge of the throat, but maintain the streamlined curve of the throat. This curve is like the leading edge of an airplane wing, and you will ruin the air flow if you drop a header several inches below the opening. Again, try to avoid a brick surround that requires an angled lintel to support the header, because that would make it hard to maintain the streamlining.

Glass doors. Rumford fireplaces don't need glass doors, but if you choose to have them, mount the doors on the outside surface of the surround so that the lines of the covings and the curved throat are not interrupted. Since glass blocks about 80% of radiant heat, open the doors when the fire is lit.

The scientific data aren't in yet to put numbers on the Rumford's comparative efficiency. But anyone who owns a well-made Rumford can tell you that lighting a fire in it is a great way to warm up a room. If you haven't tried it, you don't know what you're missing. ■

Jim Buckley, of Seattle, Wash., has been a mason for 15 years and has built more than 600 Rumford fireplaces.