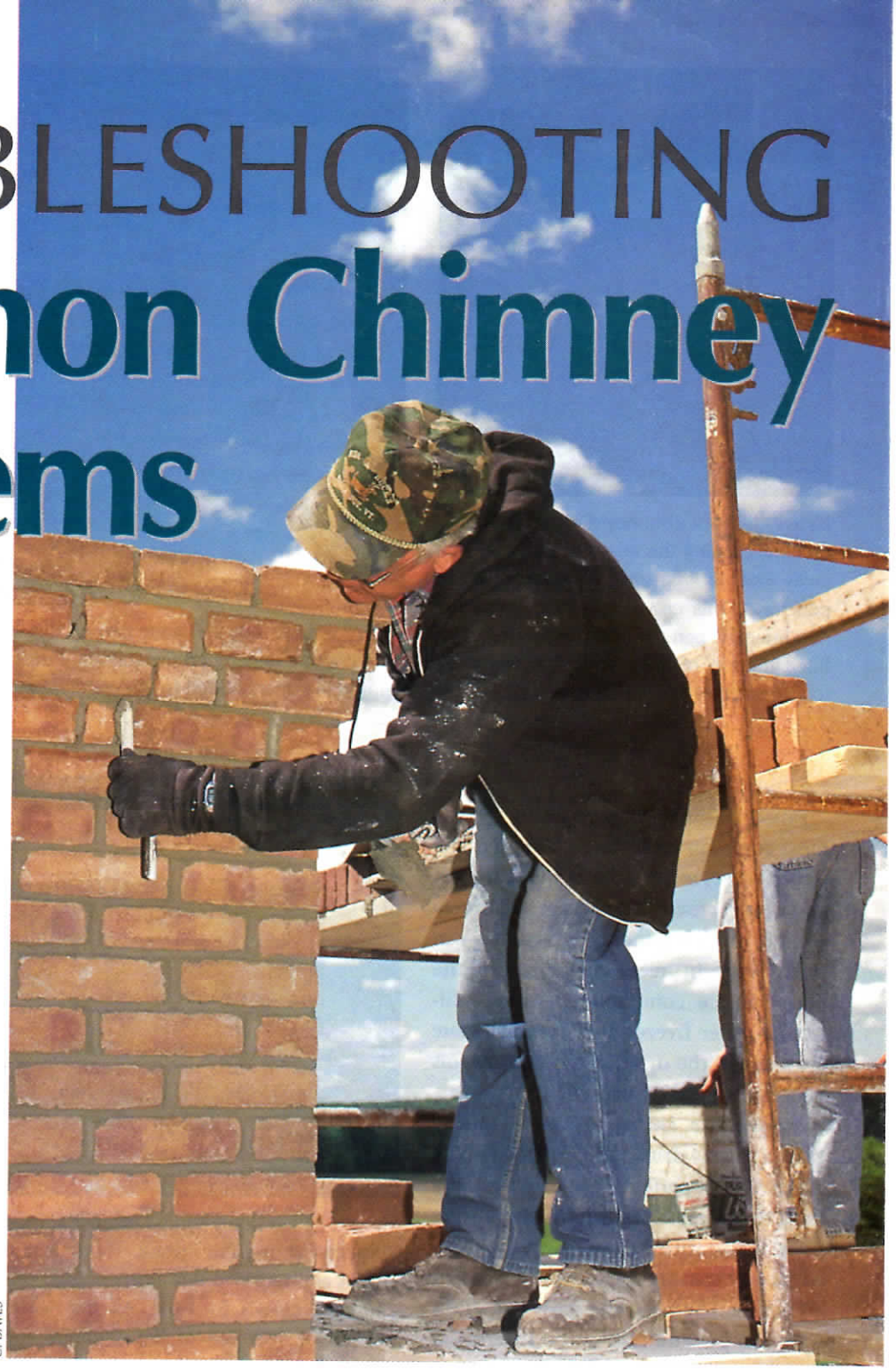
TROUBLESHOOTING
Common Chimney Problems



C. BATES

The right mortar, properly placed bond breakers, and a well-constructed crown are the keys to a long-lasting chimney

by Stephen Bushway

During the 12 years I've been repairing chimneys, I've found that most chimney problems can be traced to a handful of causes. In this article, I'll identify the problems I most often encounter, and explain the techniques I use to repair them.

Up-Close Inspection

Typically, the exterior of a chimney will deteriorate first. A few minutes spent inspecting a chimney will often reveal telltale signs of problems.

I start at the top, and check to see that the crown is sound and free of cracks. Next, I examine the joints, looking for any missing mortar, hairline cracks, or soft, eroded mortar. I also check the integrity of the mortar bonding by tapping the bricks or blocks with a hammer. A well-bonded wall will transmit the vibration to your hand; compromised bonding will not.

It's also important to examine interior chimneys below the roofline. The portion of the chimney that passes through an unheated attic is subject to mortar erosion from flue gas condensation. I look for soft or sandy mortar and black stains (evidence of leaking soot). If I see any of these conditions, I recommend bringing in a seasoned professional to advise on chimney relining.

Figure 1. This chimney crown dried too quickly, causing the edges to curl and pull away from the masonry, allowing water to penetrate. This crown also bonded to the flue liners. When the liners expanded, they lifted the top of the chimney, causing the top three courses of brick to crack.

Figure 2. Excessive shrinking caused this crown to crack at the weakest point — the area where a flue penetrated the surface. Proper curing reduces the amount of shrinkage, and reinforcing fibers added to the concrete crown mix add tensile strength.

Problems Start at the Top

Failed chimney crowns are by far the most common problem I encounter. The crown serves as the roof of the chimney, and a leaky crown can damage a chimney — and the surrounding structure — in many ways. In freeze-thaw climates, the problems are compounded when infiltrating water freezes and expands. Here are some of the most common problems I encounter with crowns.

Inadequate curing. When a freshly cast crown dries too quickly, the exposed top surface sets more rapidly than the interior portion. As the surface dries, it also shrinks, pulling at the outer edges and causing the crown to curl (see Figure 1). The resulting gaps will allow water to penetrate into the interior of the chimney.

Bonded flues. The photo in Figure 1 illustrates another common problem. As flue liners heat up, they expand. If the crown bonds to the flue liners, the liners can actually lift the top of the chimney as they expand, stressing the mortar joints and creating cracks that allow water to infiltrate the chimney.

Lack of reinforcement. Even properly cured crowns will shrink as they harden. Flues reduce the cross-sectional area where they penetrate the crown, creating weak links. As the crown shrinks, improperly built crowns will pull apart and crack at the weakest point (Figure 2).

Figure 3. Flue liners should project at least 3 inches above the crown. Here, a thin crown and recessed flue liners caused this chimney crown to leak. As the water worked its way out of the chimney and evaporated, soluble salts remained behind, leaving a whitish stain called efflorescence.

Feathered crown. The mortared "wash" on the top of the chimney in Figure 3 is guaranteed to fail. My guess is that the mason ran out of flue liners before bricks. The feathered edge of the mortared wash broke down quickly, and the recessed flue liners allowed rain to penetrate the interior of the chimney.

Efflorescence. The whitish haze that appears on the outside surface of the chimney in Figure 3 is called efflorescence. The staining occurs when water within the chimney works its way to the exterior surface and evaporates, leaving behind soluble salts.

While efflorescence itself is a cosmetic problem, the water penetration that causes efflorescence can lead to serious structural problems in colder climates. When the penetrating water freezes, it expands, and will eventually break the chimney apart.

Proper Crown Construction

I use the following techniques to prevent or repair the crown failures I've just described.

Mud recipe. To achieve a dense, watertight surface, I cast crowns that are at least 3 inches thick. Crowns are essentially small concrete slabs, and the size of the aggregate used in the mix controls the minimum thickness. I prefer a mix of 1 part Portland cement, 2 parts sand, and 1 1/2 parts pea gravel. To increase the tensile strength of the crown at flue penetrations, I add about 1/4 cup of "angel hair" (chopped fiberglass) reinforcing fibers to

Durable Chimney Crown

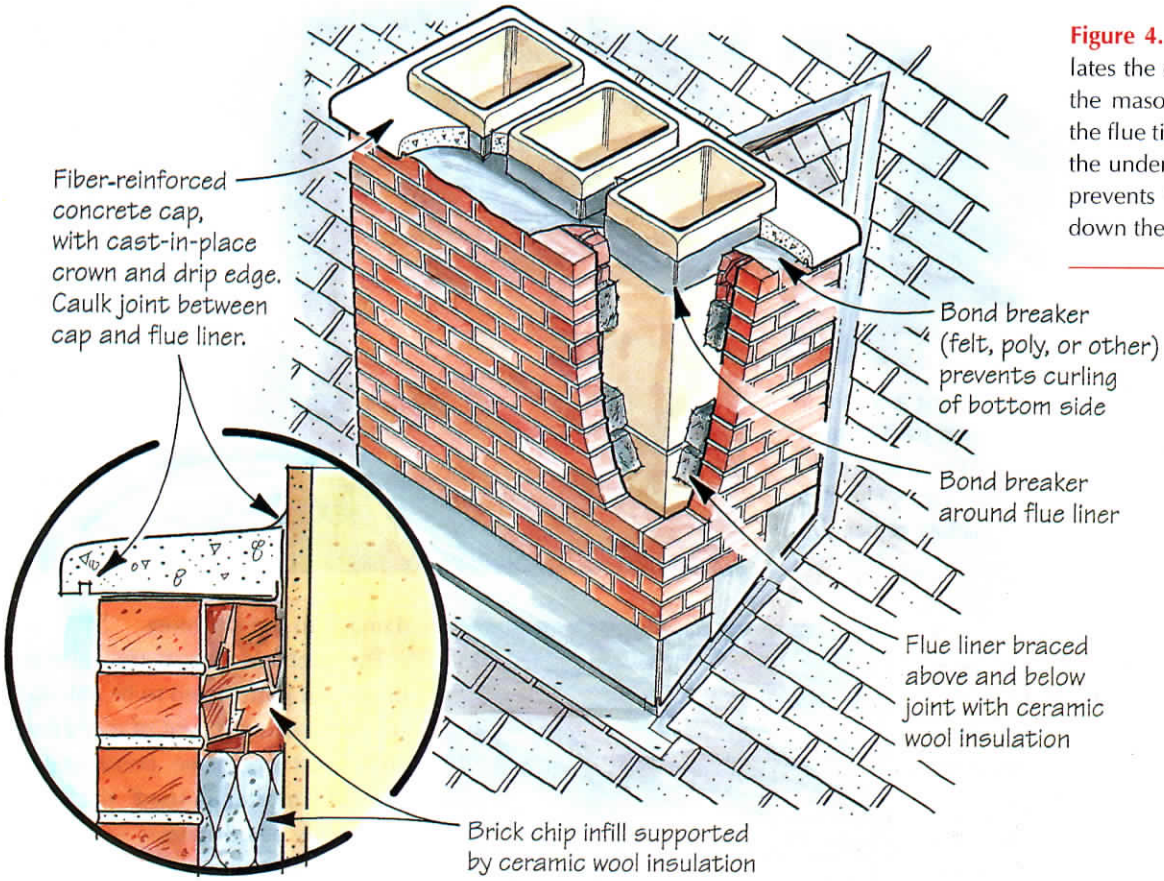


Figure 4. A bond breaker isolates the chimney crown from the masonry below and from the flue tiles. The drip edge on the underside of the overhang prevents water from running down the face of the chimney.

the mix. The fibers, which are available from local concrete suppliers, tie the crown together so it shrinks as a unit.

The mix must be workable, but to minimize shrinkage, I keep it as stiff as possible.

I detail my crowns with a generous overhang that includes a formed drip groove on the underside of the overhang (Figure 4). I use adjustable steel crown forms from Ahrens Chimney Technique (2000 Industrial Ave., Sioux Falls, SD 57104; 800/843-4417). They cost about $150, and eliminate the need to custom-form each chimney crown.

A sure cure. I place a bond breaker between the bottom of the crown and the top course of masonry. This prevents the masonry units from wicking moisture from the crown mix, and functions as a slip joint, allowing the crown to shrink as it dries. I use either a lightweight sheet of poly or aluminum flashing material.

After I've mixed and placed the crown, I mist the surface for a few hours to prevent it from drying prematurely. During the time it takes for the crown to make its initial set, I keep busy installing counterflashing and starting the general jobsite cleanup (for more on flashing, see "Leakproof Flashings for Masonry Chimneys," 1/96). After the crown has set, I cover it with a tarp and wet burlap. This extends the drying time and ensures a slow, strong curing process.

Figure 5. The code-required air space between the flue liners and the chimney walls allows the liners to expand and contract freely. In this chimney, the void between the bricks and the flue liners was filled solid with mortar, and resulted in a 7-foot-long crack when the liners expanded.

Bond breakers at flues. At crown level, I wrap the flue liners with a bond breaker. I use "caution" tape, the yellow-poly tape I use to keep traffic away from the work area. The point is to prevent the crown mix from bonding to the flue liners, allowing the liners to move independently through the crown. I seal this joint with a high-quality urethane caulk. I include a stainless steel chimney cap (RMR Products, 110011 Glenoaks Blvd., Pacoima, CA 91331; 800/366-8677) to keep weather, leaves, and small animals from getting into the flue.

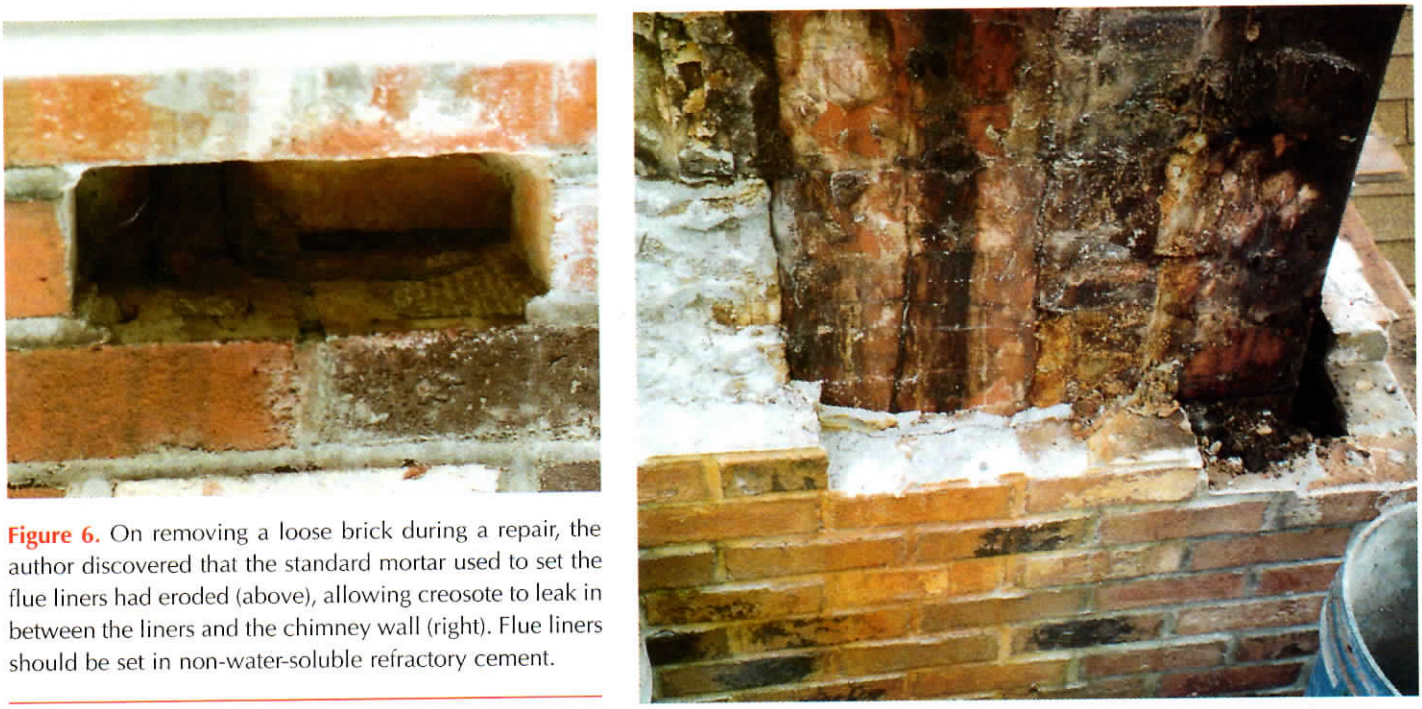


Figure 6. On removing a loose brick during a repair, the author discovered that the standard mortar used to set the flue liners had eroded (above), allowing creosote to leak in between the liners and the chimney wall (right). Flue liners should be set in non-water-soluble refractory cement.

No Room to Move

While faulty crowns cause a lot of the chimney damage I see, they're just the tip of the iceberg. Flue liners that cannot expand freely can also cause serious damage to a chimney.

Recently, I was called in to repair a chimney that had a 1/2-inch-wide vertical crack 7 feet long, starting at the crown (Figure 5, page 51). I discovered that the space between the bricks and the flue liners had been filled solid with mortar. The homeowners had adapted a wood stove to the existing fireplace, and creosote accumulated on the walls of the oversized flue liners. At some point, the intense heat of a chimney fire caused the flue liners to expand, literally pushing the chimney walls apart.

The NFPA 211 Standard (National Fire Protection Association, Batterymarch Park, Quincy, MA 02269) requires a 1/2- to 1-inch *free* air space between the flue liner and the chimney wall. To stabilize the liners within this free air space, I cut strips of ceramic wool insulation (available from Sleepy Hollow Chimney Supply, 85 Emjay Blvd., Brentwood, NY 11717; 800/553-5322), and wrap the liners above and below each flue joint.

Faulty Flue Joints

I was recently replacing spalled bricks on a chimney, and after removing one of the damaged bricks, I discovered that the flues had been set in conventional mortar. Portions of the joint were missing entirely (Figure 6).

Upon deeper inspection, I found that creosote had leaked into the interior of the chimney walls, causing extensive damage to the chimney.

Figure 7. The decorative, deeply raked joints in this chimney allowed water to pool and soak into the brick. When the saturated brick was exposed to extended sub-freezing temperatures, the water froze and expanded, causing the brick to spall.

The problem was in the mortar. Flue liners and joints need to be able to withstand the intense heat of a chimney fire and resist corrosive condensation. If standard mortar is used, the joint will eventually deteriorate.

I always set flue liners in a non-water-soluble refractory cement from Ahrens Chimney Technique. Whenever possible, I use round, lap-joint refractory flues or stainless steel liners designed for solid fuel appliances (wood stoves, for example). The stainless liners are available from Heat-Fab (130 Industrial Blvd., Turners Falls, MA 01376; 800/772-0739).

Poor Joint Profiles

Improperly designed mortar joints can also create problems. The brick chimney in Figure 7 was built using raked mortar joints that were recessed nearly 1/2 inch, forming a shelf at each horizontal course. Rainfall tends to collect on these ledges, and if the brick happens to tilt towards the chimney core, the water can be absorbed by the brick. When a heavy rain is followed by an extended stretch of sub-freezing temperatures, the absorbed water freezes and expands, and can cause spalling.

If the damage is extensive, replacing all the spalled bricks can be expensive. In cases where the customer cannot

Getting There Is Half the Work

When it comes to chimney repair, it can take longer to set up shop than to make the actual repair. Since scaffolding is such a large part of the equation, I've developed efficient staging strategies that make setup costs more predictable. If the roof configuration isn't straightforward, I take photos or make a sketch, then analyze the layout for a few days before submitting a bid.

Two products that I have come to rely on are Ultimate Ridge Hooks, which I developed for my own work and now manufacture (Deer Hill Enterprises, 224 West St., Cummington, MA 01026; 800/588-9660), and Vanguard chimney brackets (Lynn Ladder and Scaffolding, 220 S. Common St., W. Lynn, MA 01905; 800/225-2510). The ridge hooks provide a secure nail base that is hung from the ridge of the roof, and is independent of the finish roofing material (see photo). The adjustable chimney brackets provide a level launch base for my tubular steel scaffolding frames.

Before I started using these products, I was custom-building rickety wood staging (nailing into the roof where I could), or adapting ladder hooks and hoping for the best.

When repairing chimneys, it's easy to cause more damage than you repair. To protect the roof I'm working over and walking on, I lay 1/4-inch lauan plywood under roof ladders, and heavier plywood over skylights and at the base of the chimney where a falling brick could damage the roof.

Coming up with a safe and efficient scaffolding method significantly affects the cost of the repair — on a recent job, my bid was exactly half my competitor's, and we still covered our labor costs.

— *S.B.*

Roof-supported scaffolding increases safety, and provides a more efficient work area. The heavy-duty ridge hooks (inset) are attached to 2-bys, which provide a nail base for the adjustable scaffolding brackets (visible to left of chimney).

afford to have the chimney rebuilt, I've used a water-based product called Chimneysaver (Saver Systems, 1751 Sheridan St., Richmond, IN 47374; 800/860-6327). It's a vapor-permeable siloxane treatment that usually prevents further spalling by imparting an electrostatic charge to the bricks. I'm always careful to advise my customer that some bricks may have already experienced internal damage that has yet to become visible.

In new work or rebuilds from the roofline up, I prefer to use a concave mortar joint. It's attractive, holds up well in my climate, and the concave striking tool compresses the mortar into a dense, weather-resistant surface. I'm careful to wait until the mortar is "thumbprint hard" before striking. Mortar that's tooled too early will not compress properly.

Figure 8. Older chimneys with deteriorated lime-and-sand mortar must be torn down to the roofline and rebuilt.

Old Age

Sometimes, the problem with a chimney is just plain old age. Many older chimneys were built with weak lime-and-sand mortar (Figure 8). In most cases, I tear the chimney down to the roofline, install new flashing, and rebuild the chimney. Typically, these chimneys come apart very easily. I was able to dismantle the chimney shown in less than an hour, with hardly the need for a chisel blow.

I've developed a good rule of thumb for assessing the condition of a chimney over the phone. If the homeowner tells me that they can see the problems from the ground, chances are I'll be rebuilding the chimney from the roofline up.

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