Building a Fireplace

One mason's approach to framing, layout and bricklaying technique

by Bob Syvanen

I have been involved in building as a designer and carpenter tor over 30 years, but building a fireplace has always been a mystery to me. I recently had the chance to clear up the mystery by observing, photographing and talking to my mason friend, John Hilley, as he built three fireplaces. I now understand more clearly than before what I should do as a carpenter and designer to prepare a job for the mason. I also know I can build a fireplace.

The job actually begins at ground level, with a footing (drawing, facing page). A block chimney base carries the hearth slab, upon which the firebox and its smoke chamber are built. The chimney goes up from there.

The importance of framing—As a carpenter, I've had to reframe for the mason too many times. This is usually because the architect or designer didn't realize how much space a fireplace and its chimney can take up, and how this can affect the framing around and above it. We'll be talking about a fireplace built against a wall, which is a pretty simple arrangement, but planning is still important.

Most parts of the country have building codes that specify certain framing details. In Massachusetts, where I live, code requires that all framing members around the fireplace and chimney be doubled, with 2 in. of airspace between the framing and the outside face of the masonry enclosing the flue.

The modified Rumford fireplaces that Hilley usually builds are my favorites because they don't smoke, they heat the room about as well as a fireplace can, and they look good. The firebox is 36 in. wide by 36 in. high, and the two front walls, or pilasters (returns) are 12 in. wide, for a total masonry width of 60 in. From the fourth course above the hearth, the rear wall of the firebox curves gently toward the throat. It's harder to lay up than a straight wall, but I think it looks a lot better. The back hearth is 20 in. deep and about 18 in. wide at the back—not in line with Count Rumford's proportions (*FHB* #3, pp. 40-43), but the minimum allowed by the Massachusetts code.

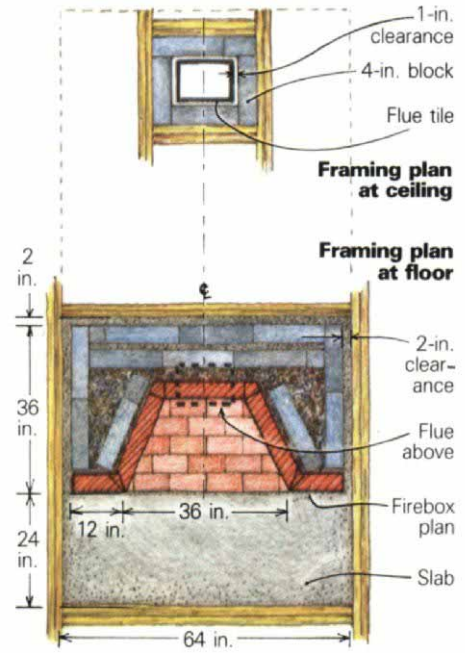
To figure the full masonry depth, you have to add to the 20-in. back hearth 4 in. for the back-wall thickness, 4 in. for the concrete-block smoke-chamber bearing wall, and 4 in. for the concrete-block substructure wall, for a total of 32 in. Thirty-six inches is better, because it gives extra space for rubble fill between the back wall and the block. Using these dimensions, the chimney base is 36 in. by 60 in. Add a front hearth depth of 24 in. (16 in. is minimum), and clearance of 2 in. on each side and rear, and you get a total floor opening that's 64 in. wide by 62 in. deep. In situations like this one, where the fireplace is on a flat wall and the chimney runs straight up, with no angles, the framing is simple-double the framing around the openings and leave 2 in. of clearance around the masonry.

To locate the flue opening in the floor above the fireplace, find the center of your layout and drop a plumb line. This determines the side-to-side placement of the flue. Its depth is determined by the depth of the firebox. The flue will sit directly over the smoke shelf, and is supported in part by the block and brick laid up behind the firebox's rear wall. The framing for the chimney depends on the flue size. An 8x12 flue requires a minimum 18x22 chimney (a 1-in. airspace all around, inside 4 in. of masonry). Once the ceiling opening is framed, you can establish the roof opening by dropping a plumb bob from the roof to the corners of the ceiling-joist opening.

Wood shrinkage is something you should take into account when you're framing around the hearth. I think the hearth looks and works best if it's flush with the finished floor. Since it is cantilevered out from the masonry core (see below), and isn't supported by the floor framing, shrinking joists and beams can leave it standing high and dry. I've seen fireplaces built in new houses where the 2x10 floor joists rested on 6x10 beams. The total shrinkage here could leave the hearth an inch above the finished floor. A better framing system is to hang the joists on the beams and thereby reduce the shrinkage 50%.

From footing to hearth—The fireplace really begins at the footing, which is usually a 12-in. thick concrete slab 12 in. larger all around than the chimney base, and resting on undisturbed soil. The footing for this fireplace, therefore, is 48 in. by 72 in. Between it and the concrete hearth slab is a base, usually of 8-in. concrete block if it is in the basement or crawl space. To make sure the hearth comes out at the level you want it, the height of this base has to be calculated to allow for the 4-in. thick reinforced-concrete hearth slab, the bed of mortar on top of it, and the finished hearth material—in this case, brick.

Before pouring the hearth slab, the opening



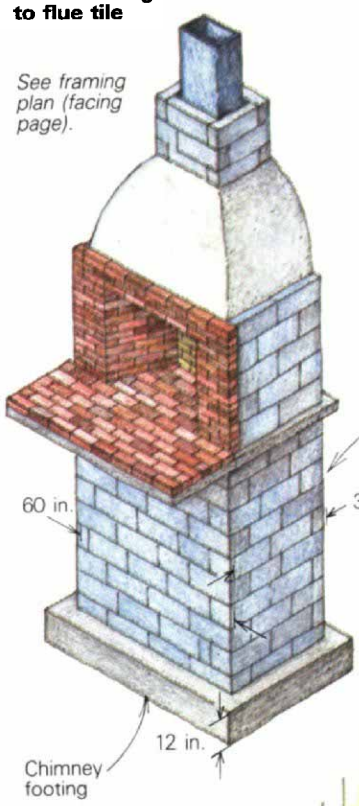
in the top of the concrete-block base is covered with a piece of ½-in. plywood that is supported by the inside edges of the blocks, leaving most of the course exposed for the slab to bear on. Cover the holes in the block with building paper or plastic, and build the formwork, secured to the floor joists, to support the cantilever at the front of the hearth. Then pour your 4-in. slab over a 12-in. grid of ⅜-in. rebar located 1 in. from the top.

Once the hearth slab has cured, it's time to lay up the structural masonry core that will support the chimney. Only the firebox, pilaster and lintel bricks will be visible on the finished chimney, so Hilley used 4-in. concrete block for the core. The blocks should be laid at least 4 in. from the face of the firebox brick and far enough in from the line of the front wall to allow for the pilaster bricks. Hilley sets a brick tie in each course to tie the pilasters in with the block.

Before beginning the brickwork, Hilley nails vertical guide boards (drawing, p. 56) to the face of the studs that frame the walls on each side of the fireplace opening, from floor to 12 in. above the lintel height. These boards are the thickness of the finished wall, and they locate the face of the fireplace. He marks off the brick courses up to three courses above the lintel on each guide board, starting from the

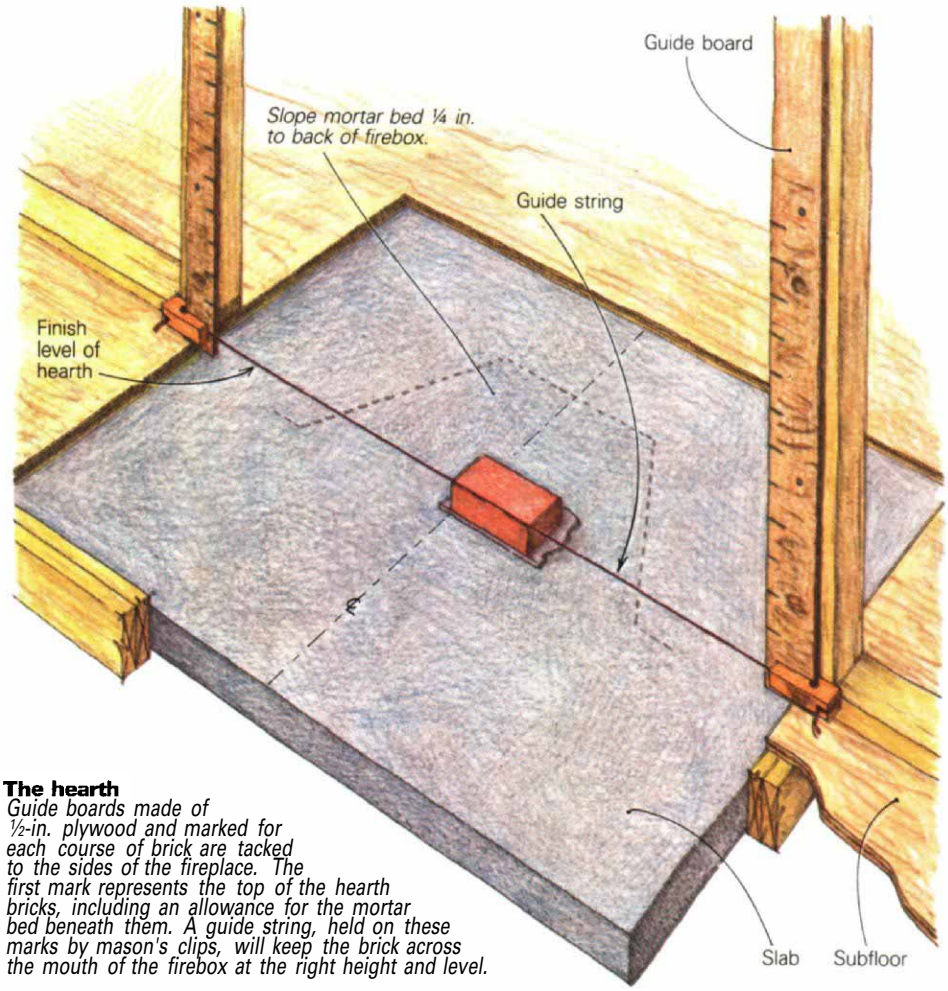
Illustrations: Christopher Clapp

From footing to flue tile

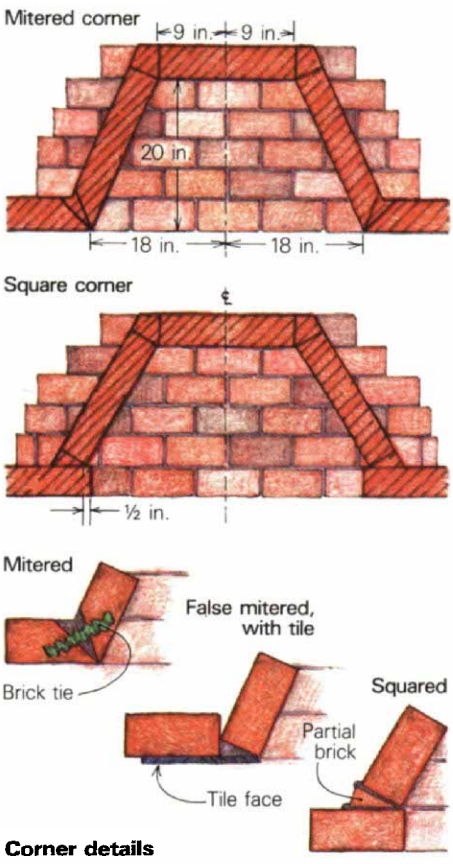


Cutaway of a fireplace

Flue tile
1-in. airspace
Interlock these bricks to get weight on the lintel bricks.
Arched brick smoke chamber
Smoke shelf
4-in. block sub-structure wall
4-in. block smoke shelf bearing wall
Loose rubble
Damper
Steel angle-iron lintel
Firebrick
Brick lintel
2-in. airspace
Pilaster (or return)
Side wall, or coving
2x4 frame
Firebox
Back hearth
Front hearth
Joist headers
Finished floor
½-in. plywood
4-in. reinforced concrete slab
⅜-in. rebar
8-in. concrete-block chimney base



The hearth
Guide boards made of ½-in. plywood and marked for each course of brick are tacked to the sides of the fireplace. The first mark represents the top of the hearth bricks, including an allowance for the mortar bed beneath them. A guide string, held on these marks by mason's clips, will keep the brick across the mouth of the firebox at the right height and level.



The firebox **is being laid to the penciled layout, starting with five courses of the back wall. Notice the curve starting at the fifth course of the back wall. The cut-brick piece for the front mitered corner will be alternated from front wall to sidewall on each course to maintain a strong bond. The V-shaped gap at the rear will be filled with rubble. Brick ties every couple of courses hold the joints together. The brick ties in the concrete block will secure the brick front wall (or return). The small torpedo level will be used to level the back wall.**

hearth, which on this job is 1 in. above the subfloor. Once the guide boards are marked, Hilley uses a guide string on mason's blocks to control the height and alignment of the brick courses as he lays them up.

Hilley picks sound, hard used brick for the firebox and hearth. The hearth is laid to the guide string in a good bed of mortar (drawing, top left). The firebox walls will be laid on this brickwork, so it extends beyond their eventual positions. Hilley likes to slope the hearth toward the back wall about ¼ in. to keep water from running into the room if any rain finds its way down the chimney. As with all brickwork, small joints look best, so pick your bricks for uniform thickness (see *FHB* #14, pp. 32-35).

Laying out and building the firebox—With the hearth laid, Hilley finds the centerline of the opening, and marks off 2¼ bricks on each side for a 36-in. opening. Standard bricks are 8 in. long by 3¾ in. wide by 2¾ in. deep, but these measurements can vary, especially with used brick. Hilley uses bricks instead of a tape or ruler for an accurate layout, because 4½ used bricks (two times 2¼), laid end to end, don't always total exactly 36 in. The line of the back wall is 20 in. from the front line, and its length is figured by counting a little more than a brick on each side of the center line. Hilley pencils these lines on the brick hearth.

The lines for the diagonal sides of the firebox are drawn between the ends of the front and back lines. Where the side line meets the front line at the juncture of pilaster and firebox wall, you can draw either a mitered corner, or a square corner (drawing, bottom left). I like the look of the mitered corner, and I think the time it takes to cut the bricks is worth it. Cutting brick with a masonry blade in a skillsaw is easy when the brick is held securely between two cleats nailed to a plank. Both pieces of the cut brick are used, so cutting halfway through from each side is a better way to go.

One way to achieve a mitered look without cutting is to start a full brick at the front corner and butt the front return brick to the back corner of the starting brick. The triangular gap in front can be filled with mortar and covered with a tile facing, finish parging, stone, or the like, as shown in the drawing at left.

When Hilley is doing a square-cornered fireplace, he brings the side walls to a point ½ in. back of the edge of the return. This gives a neat line, which is very important with used brick because its width can vary from 3½ in. to 4 in.

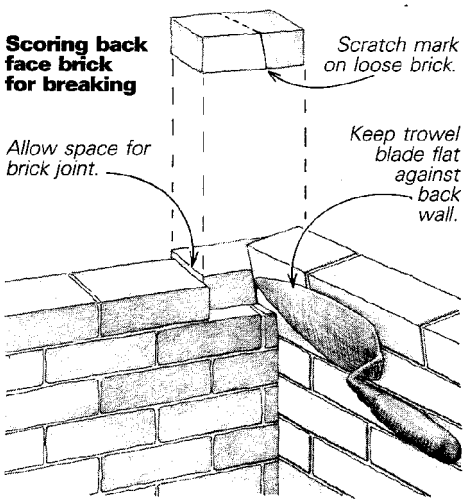
Firebrick isn't required when you're building a firebox like this one, but Hilley uses it because heat-stressed common brick sometimes fractures violently. Most people don't like the look of firebrick in a Colonial fireplace, so he uses it only for the first six or eight courses—just high enough to cover the hot spot of a fire. You can see this blackened hot spot on the back wall of any fireplace. After a few fires, the firebricks soot up and blend in with the used brick in the rest of the

fireplace. Hilley doesn't use refractory cement with the firebrick, but he does keep his mortar joints under ¼ in. thick.

Hilley begins by sprinkling sand or spreading a piece of building paper on the brick hearth. This simplifies cleanup later. Then he lays up four courses of the back wall plumb, level, and parallel to the front—a small brick wall about 20 in. wide by about 11 in. high. The fifth course is a tad longer. It's also tilted or rolled in slightly by troweling on more mortar at the rear of the joint than at the front. This is the beginning of the curved back wall (photo facing page).

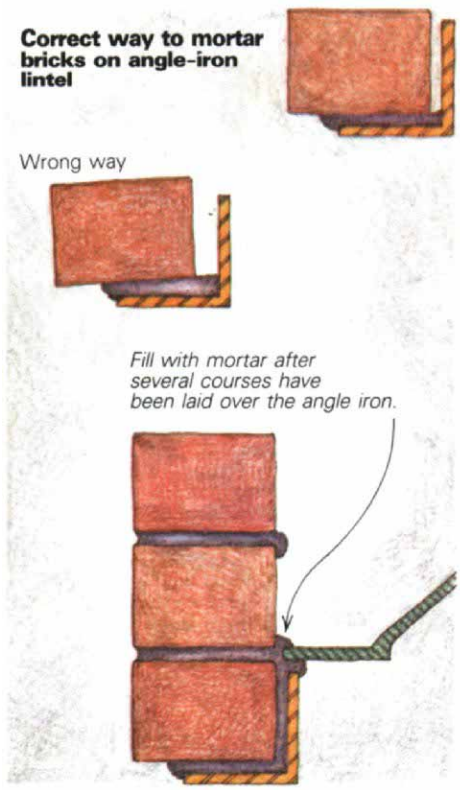
Next, five courses of the mitered side and front wall are laid up using the angle-cut brick at the front corners and by cutting and butting the rear brick to the back wall. The way to do this at the back wall is to score each end brick in the back wall with the tip of the trowel as you hold the brick in the rolled position. The coving is plumb, so the trowel should come off the bricks of the coving below and follow through in a plumb line, as shown in the drawing below. The scratch is very visible, and cutting is done with a brick chisel or the sharp end of a mason's hammer.

The two pieces of angle-cut brick at each front corner should fit together tightly where they show, and the V-shaped gap behind should be filled with mortar and a piece of brick. Hilley also likes to use a brick tie across this corner every couple of courses. This corner can get out of plumb easily, so a constant check with a level is a must. If a running bond



is to show on the lintel course over the opening, you will have to watch the bond on your pilasters so that it will flow right into the bond on the lintel course.

Continue by rolling a few courses of the back wall, then building up the side walls. The roll will produce a gentle curve up to the damper, and it will make the back wall wider at lintel height than it is at the base. Each back-wall course is a little longer than the one below it, which is why the end bricks have to be marked in place for cutting. When a back-wall course needs to be a tad longer than two bricks, Hilley stretches it by setting a half-brick, or less, over the middle of the back course below. The stretch, in other words, is accomplished in the middle of the course, not at its ends.



It is important while you're laying up the firebox to keep the side walls plumb. (In a square-cornered fireplace, the front and back walls are laid up first, a few courses at a time. The side walls are filled in.) You also must keep the back wall parallel with the hearth bricks. To do this, eyeball down the face of the back wall as it is laid, or measure from front to back on each side.

At the top of the firebox, the width of the opening from the outside face of the lintel brick to the rear face of the back-wall brick should be around 16 in. Hilley's formula for the amount of roll to give each back-wall course is simply experience. This is how most masons work. I'm always amazed at the way they seem to come out exactly where they want to be with exactly the right-sized opening, with no measuring at all. A novice might want to make a cardboard template to use as a guide, or spring a thin strip of wood against the first few courses to see how the curve projects up to lintel height.

Standard firebrick is thicker than used brick, so the back-wall courses will be higher than the side-wall courses. But the height should even out by the time you reach the lintel because the upper back-wall courses are tipped or rolled forward. As the back wall approaches lintel height, you can see how its courses relate to those of the front and side walls. By varying the joints, the wall heights can be adjusted to match.

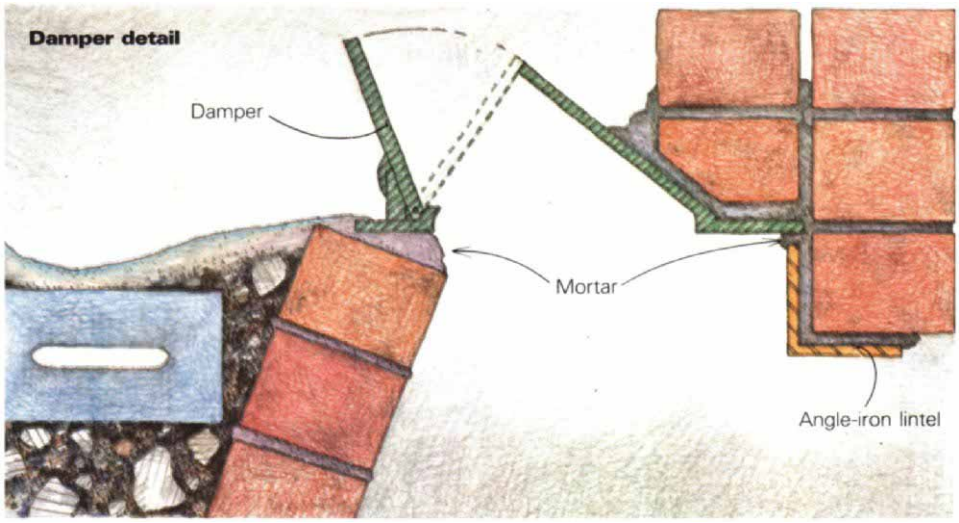
When the firebox is at lintel height, Hilley fills in the space between the concrete-block wall and the back face of the firebox almost to the top with loose rubble. The rubble acts as a heat sink, and more important, keeps the firebox positioned while allowing for expansion. A little mortar thrown in now and then will keep some of the rubble in place if a burned-out brick ever has to be replaced.

The lintel. **Side walls, back wall, and angle-iron lintel are at the same height to support the damper. The first course of bricks over the lintel overhangs the flange of the angle iron, and these bricks have to be laid up carefully so they won't roll forward. Pieces of building paper tucked at the ends of the angle iron serve as expansion joints.**

The lintel—A very important step in fireplace building is the proper installation of the angle-iron lintel. In this 36-in. fireplace, Hilley used 3-in. by 3-in. angle iron, which he installed with its ends bearing 1 in. or so on the pilaster bricks with a minimum of mortar—just enough underneath to stabilize it. The lintel's ends must be free to expand, and to ensure this Hilley tucks rolled-up scraps of building paper at each end. They act as spacers, keeping mortar and brick away from the angle-iron ends, and allow it to move.

The bricks in the first course above the lintel overhang the steel, and they have to be laid carefully (photo above) so that they won't roll forward. To help keep them from rolling, Hilley doesn't trowel any mortar behind them until a few courses have been laid, as shown in the drawing above. This eventual filling in, though, is important. Hilley feels that it prevents distortion of the angle iron from excess heat.

The damper—The damper should be sized to cover the firebox opening. The opening should be about as wide in front as the damper's flange, and from 2 in. to 5 in. narrower at the rear, depending on the damper's shape. The front flange rests on the top edge of the angle iron, and the side and back flanges rest on the firebox brick. The damper should be set in a thick bed of mortar on the brick and angle-iron edge, after three lintel courses are laid up, as shown in the photos at



The damper **is mortared in place after three lintel courses are laid up. The space between the back wall of the firebox and the concrete-block core is ready for loose rubble fill, as shown in the drawing above.**

The smoke shelf **behind the damper is a 1-in. mortar cap over 4-in. concrete blocks on top of the loose rubble fill behind the firebox. The damper side is higher than the rear so any rainwater will drain away from the opening.**

Laying up the smoke chamber **is not fussy work. Hilley uses soft brick and concrete block, and then he parges the smoke shelf and chamber walls with mortar.**

center left. As with the angle-iron lintel, it is important to keep masonry away from the ends of the metal to allow for expansion.

Smoke chamber—The smoke chamber is the open area behind the damper, where cold air coming down the chimney bounces off the smoke shelf at the bottom and is deflected upward, along with smoke rising from the firebox. As a base for the smoke shelf, Hilley lays a flat course of 4-in. concrete block on top of the rubble and concrete-block back wall. He sometimes lays a few concrete blocks, dry, directly on top of the loose rubble behind the rear wall. Then about 1 in. of mortar is smoothed out to make the smoke shelf's surface. Rainwater will puddle up here, so pitch the shelf away from the firebox and trowel it well. (Accumulated water will eventually evaporate or be absorbed into the masonry.)

The smoke chamber (drawing, p. 55) is formed by rolling the bricks of each course inward until the opening at the top is the size of the chimney flue tile. Hilley rolls the bricks a few courses at a time, alternating the corner bricks to maintain a bond.

Where the rolled brick courses meet at a corner, Hilley breaks off a piece of the lead corner for a better fit. He uses soft, spalling used bricks for this work. They are easy to shape, and it's not fussy work. In fact, Hilley had me hold up a sagging wall while he finished an adjacent supporting corner. A wall will collapse if laid up too much at one time.

Hilley says rolling the bricks to meet an 8x10 flue should give you a smoke chamber 24 in. to 36 in. high. Don't reduce from damper size to flue size too fast, and keep the smoke chamber symmetrical. Hilley once built a fireplace with the flue on the right side of the smoke chamber. This created unbalanced air pressures in the chamber and caused little puffs of smoke on the right side of the firebox.

The inside face of the smoke chamber is parged with mortar. (Be sure you leave enough clearance for the damper to open.) A piece of building paper or an empty cement bag laid on the damper before parging will keep things clean. You don't want your damper lid locked in solid with mortar droppings. The smoke-chamber walls must be 8 in. thick, so Hilley builds out their lower part with interlocking brickwork, and the upper part with flat-laid 4-in. concrete block. Then he parges the whole business with a layer of mortar (photo bottom left).

The rolled brick and outer block shell of the smoke chamber transfer the flue and chimney weight to the lintel, keeping the lintel bricks in compression. The first flue tile sits on top of the smoke chamber, fully supported by the brick, and the chimney is built around it. Brickwork against a flue will crack as the hot flue expands, so there must be at least a 1-in. airspace between the tile and the chimney shell. If the chimney is concealed, the masonry can be concrete block. □

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