

# Renovating a Chimney

## New flue liners convert fireplaces for woodstove use

by Joseph Kitchel

**I**nstalling new flue lining in an old chimney is somewhat akin to digging a basement under a finished house—it's not impossible, but it's a lot easier to do beforehand, during the original construction. Unfortunately flue liners were invented a long time after many chimneys had been built, and the older the chimney, the greater the need for new liners. Cast from fireclay or fireproof terra cotta, they provide a safe, effective exit route for smoke and combustion-related gases. Unlined chimneys are hazardous, ineffective and troublesome by comparison.

The chimney we had to work on was part of a common wall in a three-story Brooklyn rowhouse, built between 1860 and 1870. Although it served three fireplaces, we planned to eliminate the one on the third floor and convert the other two for woodstove use. This meant installing two separate flues in the chimney space, one for each stove. We decided to begin the job on the second floor, adding the first-floor flue sections at a later date.

**Getting set**—Before starting a job like this, it's important to know the type of stove to be used, because the location of the stove's exit pipe determines where you install the thimble fitting in the new flue. I had decided on a Lange 6303A/B, a Danish woodburning model with an exit pipe that can be adapted to run from either the back or the top of the stove. I chose to use the horizontal exit, since this would allow me to install the

thimble in the first flue section rather than farther up on the chimney wall. A tile or slate hearth would be added after the new linings were installed, so I took this into account when determining the height of the stove pipe and the location of the thimble fitting.

I also wanted to install the cleanout door in the same bottom flue section. Most chimney cleanouts are in the basement, but since this was a second-floor installation, I thought it best to locate the cleanout on the same level. The cleanout door is now hidden behind the old cast iron cover plate I removed from the original fireplace. It was one of three such covers provided for fireplace-to-stove adaptations, and I incorporated it in the rebuilt chimney to retain a bit of the appearance of the original fireplace.

Another important decision in planning is whether to use round or square liners. Smoke rises in a swirling motion, so the corners of square flues become cold spots where creosote and soot can accumulate. Consequently round flues are generally considered to be superior, even though they are more expensive and a bit more difficult to install. Round linings are manufactured in 24-in. sections, with inside diameters ranging from 6 in. to 18 in. (even sizes only). Since our stovepipe was only 4½ in. wide, we chose 6-in. linings. Transporting and handling the flue sections requires a gentle touch, since the castings are extremely brittle. The only other materials we needed for the job were

portland cement, sand and white cement (added in small quantities to the face mix to approximate the color of the old mortar).

Before beginning the actual work, I covered the floor around the chimney with some foam rubber carpet padding followed by overlapping sections of vinyl-covered canvas wallpaper. Unconventional as it might sound, I've found these two protective layers an ideal combination: The vinyl-covered canvas sheds water (and mortar), while the foam cushions the floor against the inevitable falling bricks. Chimney reconstruction is messy, especially when a substantial number of bricks must be removed, as was the case here. Protecting the surrounding work area from the ravages of the job is well worth the effort.

**Digging in**—Our plan was to install the flue liners in the old chimney passageway and then brick them in, restoring the wall to its original appearance. First we had to remove the facing brick layer to expose the inside of the chimney. A hammer and a sturdy, narrow cold chisel are the best tools for this job. To cope with the occasional stubborn or awkwardly placed brick, I also kept a pry bar close at hand. Generally, the old mortar was brittle and could be chipped away easily. Working from floor to ceiling, we removed the chimney wall in a staggered pattern so that the re-laid bricks wouldn't look so conspicuous. We saved all of the face bricks to use again. The entire brick wall had been



**The first step in installing new flue liners is removing bricks from the second-floor fireplace to expose the chimney cavity. Hammer, railroad spike and pry bar are essential tools. A vinyl-covered canvas dropcloth over rubber carpet padding protects the floor. At right, Kitchel aligns two pieces of angle iron, which will be cemented in place across the face of the cavity to reinforce the chimney before the new liner is installed.**



PHOTOS: J. J. PECK

painstakingly cleaned of plaster at an earlier stage in the renovation, and its rosy pink color would have been very hard to match with new brick. Besides, there was always the expense of new brick to consider, and the trouble involved in hauling it up to the work area.

Inside the chimney we found thousands of brick fragments. Some had been built into the chimney to achieve the turns and separations between old flue channels. Others were simply the result of our chiseling work or age-related crumbling. All this rubble had to be removed so the cavity would be clean when we installed the new flue sections. An old railroad spike turned out to be a good tool for cleaning off the bricks. Its wide head was easy to hit and its broad, flat point broke the soft mortar away quickly.

The original chimney was constructed so that the flue of each fireplace started in the center of the chimney. As it progressed upward, the flue had to angle to the right or left to pass the fireplace above and thus make room for its flue. We wanted to keep the new flue sections as straight and plumb as possible, to make the chimney safe and efficient, and also to make the masonry work easier. Since we planned to eliminate the third-floor fireplace and its flue, both new flues could run straight up, with no sidesteps or bends. We located the first-floor flue on the extreme left side of the chimney; the flue for the second floor would run straight up the middle, and the resulting space on the right could be used as a tunnel for some electrical cables. In general, old chimneys provide a very good vertical tunnel through which wiring or plumbing can be run; keep in mind, however, that adequate separation between the conduits (in the form of air-space and solid masonry) must be provided to prevent excessive transfer of heat.

Even though we didn't plan to install a second stove on the first floor for some time, we needed to build both linings into the chimney from the second floor up. Then we could later complete the job from the floor below without disturbing the second-floor brickwork. With this in mind we dug out the chimney cavity to a point 14 in. below the second floor.

**Installation and reconstruction**—Although conventional mortar mix is available for brick-laying jobs like this, we are used to concocting our own mortar from one part portland cement to three parts sand. Our mortar board, a piece of exterior-grade plywood bordered with 1x2s, was set directly on the canvas dropcloth.

We cemented two 4-ft. lengths of 3-in. by 3-in. by  $\frac{1}{4}$ -in. angle iron across the cavity opening below the second floor. Positioned parallel to one another (the L pointing up) and joined to the cavity wall, these iron beams form a reinforcing baseplate for both flues. We set the first-floor liner between the Ls and surrounded it with a course of cement blocks, building the cavity up level with the second floor.

Because both the cleanout door and the stovepipe thimble are designed to fit into a square flue liner, we had to use an 8-in. square liner as the base section for the second floor flue. Cutting openings in the ceramic pipe to receive these fittings (photo top right) is a delicate job. You can



The first section of liner is cut to receive the thimble fitting, a tricky business since the ceramic material is very brittle. Closely spaced holes are first drilled along the cut-line; then the waste piece is knocked out with a hammer and chisel, as shown.



After the cavity has been built up to floor level, the first flue section can go in, left. The square opening at the bottom of the flue will receive the cleanout fitting. When both flue sections are in place, the chimney is bricked in around them, starting with a layer of cement blocks, right. The round flue section will eventually be connected to a new lining from the floor below; the square section in the foreground is for the second-floor lining. The back walls of old chimneys like this one usually require parging, or stuccoing over, before the new lining and interior brickwork can be laid in.



A round flue section is cemented to the square base, left. To ensure a good fit, a square piece of wire lath with a hole cut in the middle is set in the mortar between the two liners. Right, joints between round liner sections are sealed completely with mortar. The remaining interior brickwork extends to within an inch or so of the liner, allowing room for heat-induced expansion. Face ties in the last interior course will be bent into the face course as the wall is rebuilt.



A plywood sheet, top, temporarily replaces the third-floor hearthstone. The face course below has been relaid using the original bricks and repointed to match the style of the original chimney. Above, bolts sunk in the reconstructed face course just below the third floor secure a new chimney girt, to the wall. This will support a new section of floor that replaces the third-floor hearthstone.

use a rotary saw equipped with a masonry blade for the straight cuts. We made the round opening by drilling closely spaced holes with a masonry bit and then carefully chiseling out the tile between the holes.

The next step was to brick in the chimney around both liner sections. Again we used cement blocks, since they wouldn't be visible and were easy to position and level. The solid masonry around the hearth would also hold the heat well.

Laying the first round flue section on top of the square base section was a bit like fitting a round peg in a square hole. To make the joint secure, we cut a 6in. hole (the round pipe diameter) in a square piece of wire lath and placed it between the sections. Then we covered the joint with mortar and bricked in the cavity to within an inch or so of the liner. We filled this space with loose, dry rubble on the theory that the liners could expand and contract more freely, thereby minimizing the chance of cracking. Bricks were soaked in a bucket of water before we laid them into the wall. The extra water held by each brick lets the mortar cure more slowly, providing a stronger bond that won't powder with age.

In laying up successive flue sections, we established a working plan: First, we'd check the back wall of the cavity for loose joints. More often than not this course of brickwork (the face brick of the room next-door) would need parging (stuccoing over). Then we'd set the new liner section in a bed of mortar on top of the lower section, lay up the bricks around it until we were one course above the top of the liner, and repeat the operation. Since the first liner of the left-hand flue had been set 14 in. below the first liner of the right-hand flue, the joints of the liners were automatically staggered. We laid up all the liners and their supporting brickwork first, inserting face ties in the last layer of back brick to ensure a good bond with the face course.

In reconstructing the chimney face, we had to work into the irregular pattern deliberately created when we removed the brick. Whenever we could, we matched color and texture in fitting the new brickwork into the old. We even tried to imitate the rather haphazard pointing style of the original wall. The mortar had to be allowed to slump a little in the joint before being struck off flush with the brick face. If voids appeared, we left them. This took a little self-discipline, but the result was successful.

When we reached the ceiling of the second floor we had to remove a brick arch, which supported the marble hearthstone of the third-floor fireplace. This arch had originally been installed so that the hearthstone did not touch any of the floor joists. To make it safer and easier to work on the third floor, we temporarily covered the gap left when the hearthstone was removed with a sheet of  $\frac{3}{4}$ in. plywood. Later on, when the masonry work was complete, we could frame in a new section of the floor, since no stove or flue was planned for this level. With all this in mind, I sunk three bolts in the reconstructed chimney face just below the floorline to hold the new chimney girt that would support the flooring, as shown at left.

Work on the third floor went smoothly. We

moved our cushioned dropcloth upstairs before tearing out the bricks and continuing to lay in the flue sections. We stopped just short of the ceiling. This was also the roof of the building, and we didn't want to disturb the brickwork at this juncture because the flashing joint between chimney and roof was fine—the bricks were all sound and the flashing didn't leak. We figured we'd just be asking for trouble by disturbing the seal. Instead, we decided to leave the face course of bricks intact and remove only the interior cross-bricking that divided the original flues. These interior partitions had to come out in order to keep the new flue sections running plumb, since the chimney narrowed slightly near the roofline and the two original right-hand flues jogged to the left. Working from the inside, we cleared out as much of the chimney cavity as we could reach before we went topside to complete the operation.

**On the roof**—The chimney wall continued above the roofline, separating our flat-roofed building from the higher gable-roofed building next door. Above the flashing, we discovered that the brickwork was not in very good condition; even the wall on either side of the chimney needed to be rebuilt. We carefully dismantled the damaged areas and cleaned out the chimney cavity above the roofline. Now all we had to do to finish the job was to install the remaining flue sections and to rebuild the chimney and wall around them.

To protect against downdrafts caused by wind deflecting off the gables, a chimney should extend well above the roofline. We built ours up about 3 ft., topping off the two flues with the bell end of a sewer-tile section and a wall-capping tile. Decorative chimney tile manufactured specifically for this purpose is four to six times more expensive than the substitutes we used. (The wall-capping tile has perforations cast into it, since each cylindrical section is meant to be divided in two. We used the paired pieces together to make the final flue piece.) High temperature resistance would not be a consideration here, since the stoves we were planning to install have internal baffles that prevent most of the heat from going up the chimney along with the smoke.

We extended the tiles about 16 in. above the brick line and topped the brickwork with a sloped cap, mixing the mortar just as we had throughout the job. The exposed chimney had been quite weathered before we rebuilt it, so we decided to give the entire chimney face above the roof line a stucco finish, as additional protection from the elements.

We completed the lining and rebuilding in November of last year and quickly installed the woodstove on the second floor. Since then, the heating bill for our gas-fired steam system has been reduced by about two-thirds. We still have the option of putting another woodburning stove in on the first floor—and the satisfaction of having improved an old chimney without altering its original character. □

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The chimney cavity, top, hollowed out at the roofline in order to accommodate the two flues. Only the top part of the chimney has been removed; the flashing joint where chimney meets roof remains intact. Center, flue-pipe installation proceeds on the roof just as it did inside the house, the only difference being that some of the adjacent wall has to be rebuilt as well. Once the final flue sections have been bricked in, the chimney gets a sloped cap, above, so that water will run off. The stucco finish on the exposed brick provides additional protection from the elements.