Laying Brick Arches

A masonry inglenook becomes the warm center of an architect's new house

by Elizabeth Holland

When Ed Allen and his wife Mary started thinking about designing their own house seven years ago, they knew they wanted something big and barnlike, yet New England simple and cozy. Ed, an architect, had been fascinated by domes, vaults and arches during his studies, but it wasn't until the couple spent six months living in Liverpool during the winter of 1975-1976 that an inglenook became part of their house plans.

"We spent a lot of cold evenings huddled around a fire, trying to keep warm in an unheatable English house," remembers Allen. "We kept sketching our ideas and dreaming about how we wanted to have a house where we wouldn't be so cold."

The sketches showed the influences of the English and Welsh houses they had seen, particularly of their visit to the Welsh Folk Museum at St. Fagan's. This is where the Allens encountered the inglenook.

It is thought that the word *ingle* comes from the Gaelic *aingeal,* meaning fire or light, and was originally applied to open fires burning on primitive hearths. In medieval times, it came to mean a fireplace. The inglenook was a corner or a small room near the chimney where the family would gather before the heat of the flames. This became the central idea in Ed Allen's plans, and the inglenook ultimately became the dominant design element of the house he was to build.

Allen spent a long time working out the exact dimensions of the inglenook, and was working on a 4-in. module. Then the house was designed around that, from the inside out. "I was always trying to keep it as small as I could," Ed says, "but it kept growing as I made sure all the spaces around it were the proper size."

The Allens' inglenook is all brick, part of a 50-ton masonry mass that encompasses flues and fireplaces, and divides the house into two equal parts on each floor. The inglenook was designed to accommodate four or five people comfortably. The interior dimensions are 7 ft. 4 in. wide and 7 ft. deep from front to back, not including the fireplace.

According to Allen, it was all worked out logically—the dimensions of what he wanted things to be, plus the dimensions of the necessary brick. For example, the archway is 16 in. thick because the walls contain an 8-in.-square flue plus 4 in. of brick on each side.

To make the layout easier, Allen designed the brickwork to be modular, with 7⅝-in. long bricks and ⅜-in. mortar joints, for an overall length of 8 in. Later he discovered that only about two-thirds of the assorted Full Range Belgian bricks he ordered were the right size. The rest were up to ¼ in. too long. This required some cutting when he got to his closers, the last bricks in each course (for cutting brick, see *FHB* #3, p. 43).

Mortar color and tooling can significantly affect the look of brickwork. Allen chose a standard dark masonry cement. On the horizontal mortar joints, he used a flat-joint finishing tool to make a weathered joint, flush with the brick at the bottom and cut back at the top. This joint casts a shadow on the mortar joint, accentuating the pattern of the brick. The vertical joints, however, are gently concaved.

Choosing a bond—Bonding, the overlapping patterning of the bricks, knits the various wythes (thicknesses of brick) together. For a single wythe, a simple running bond can be used. But structural brickwork is usually at least 8 in., or two wythes, thick. "An 8-in. thick wall can use any of a variety of bonds, and some of them are quite beautiful," says Allen. "I was planning to use an English Garden Wall bond because if you're doing an 8-in. wall where one side is going to be concealed, you can save a lot of time by laying up the concealed wythe in 4-in. concrete blocks."

An English Garden Wall bond consists of three courses of stretchers (bricks with a long edge showing) and a fourth course of headers (bricks with their short ends facing out and

Bricklaying tips for amateurs

After years of studying and teaching brickwork, and laying bricks, Ed Allen is convinced that interior brickwork—including arches—is well within the grasp of a reasonably careful amateur.

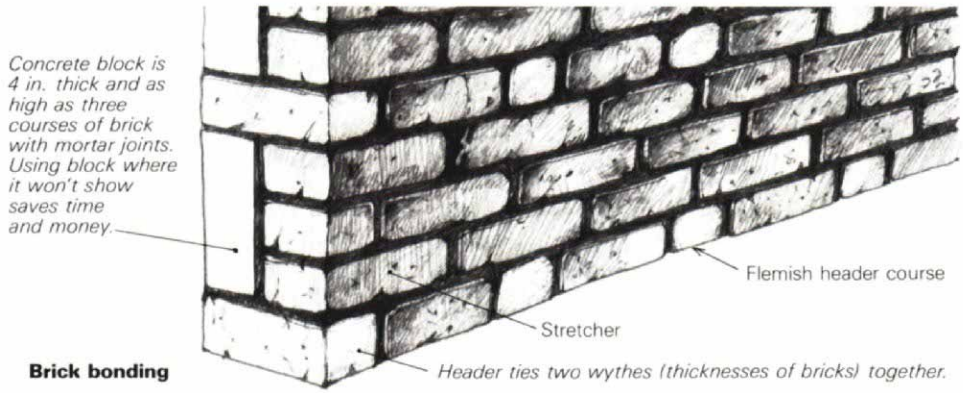
"Once you get into masonry, it's just like putting up a wood frame for a house—absolutely routine, very secure, very simple," he explains. "There's just no end to what you can do with it."

Bricklaying is a relatively straightforward concept that gets fairly complex in practice. Here are some tips for beginners:

- **You can't learn brickwork on your own. Learn from someone who knows how to do it. You can pick up the rudiments in a day or two. "Probably 90% of the success in laying brick is getting the mortar the right consistency and using the trowel properly. Learning to mix mortar to the proper consistency and to use a trowel are things that simply can't be gotten from a book."**
- **Plan in advance and know your dimensions. Determine the heights at which the arches will spring, and the heights of the arches. Consider the placement of flues when determining thickness.**
- **An arch supports a vertical load by transforming it into a diagonal load. Make sure your design has enough mass on either side of the arch to absorb the thrust and keep the arch from spreading.**
- **The labor involved in laying brick is almost directly proportional to the number of corners. Called leads, the corners are laid up first, four to six courses at a time. Care in laying up the leads pays off in level courses of the right height. The bricks that fill in the flat stretches between corners, aligned with strings pulled taut between the leads, are laid relatively quickly. It's best to eliminate as many corners as possible. You've always got to decide, of course, whether it's worth the extra labor to get it the way you want it.**
- **Practice by building the foundations for whatever you are going to build. This gives you a chance to develop techniques before laying up courses that show. If you're still having trouble, get some help.**
- **It's easiest to work at waist level, or roughly between your knees and shoulders. Arrange the scaffolding accordingly. As you go higher, your work slows down because it becomes more cumbersome to transport heavy and bulky materials.**
- **Brickwork is not as precise as carpentry. The irregularity of it is part of the charm, and a real plus for amateurs. Nevertheless, you should strive for precision, so things don't get too far out of whack. —*E.H.***

their lengths extending in across the two wythes). On the concealed wall, a course of concrete block takes the place of three courses of brick plus their mortar joints. The fourth course is composed of the headers, lying across both the brick and block wythes.

A header course is laid so the bricks straddle the vertical mortar joints in the stretcher course below. Since Full Range Belgian bricks are narrow, spacing the bricks properly would have required extra-wide joints. This led Allen to change from a full header course to what's called a Flemish header course (drawing, right), where headers and stretchers alternate.



Brick bonding

Building the arch.

Allen and a friend did all the masonry work themselves, in two stages. First, in May, they laid up the block foundation for the masonry core. The brickwork began in July, and from then until mid-autumn they laid 7,000 face bricks, an undetermined number of concrete blocks and concrete bricks, and several hundred sections of flue tile. The graceful curve of the inglenook's archway is inviting, a welcome contrast to the sturdy straight lines of the brick walls. Within the inglenook and overhead, the arch repeats, each time in a slightly different form.

"Arches are really fun—they're a wonderful structural form," Allen reflects. "I think everyone has an immediate, positive emotional response to them. By the time we finished the arches we decided they were quite easy to build and not terribly time-consuming, a conclusion quite contrary to our initial expectations."

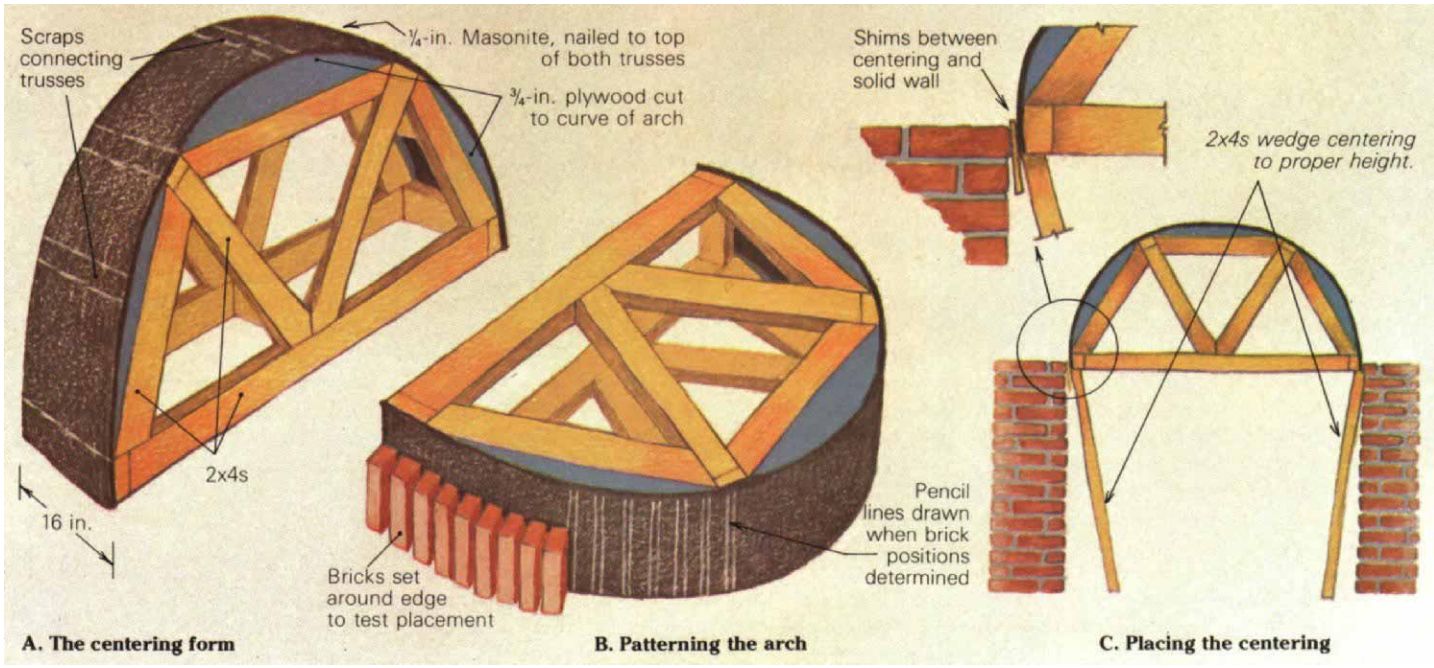
Step one: the centering form—The brick walls are laid up to the level called the springing of the arch, the point where its curvature begins. Now the centering is built—the wooden form over which the bricks in the arch will be laid.

There are many ways to build a centering. Mine consists of two identical curved trusses with a single rectangular piece of ¼-in. Masonite nailed securely to the top of them (drawing **A,** below). You should check the centering's fit by holding it between the brick sidewalls.

Step two: patterning the arch—Lay the centering on its side on the floor. Stand the bricks you're going to use on end, all around the curve **(B).** You should have an odd number of them. Using an even number results in a mortar joint positioned at the crown of the arch. This looks bad and makes the structure weak. Because of the curvature of the arch, the mortar joints will be wedge-shaped. They should be about 3/16 in. wide at their narrowest point, next to the centering. Shuffle the bricks around until the spacing looks good. You could have wedge-shaped bricks specially made, but these are usually expensive, and must be ordered well in advance of when you'll need them.

With a pencil, mark the thicknesses of the mortar joints on the centering itself. Take away the bricks and use a square to run the joint lines across the curved surface of the form. When you're finished, the centering will be marked to show you where all the bricks belong, and how thick the mortar joints should be. This step is crucial—without it you will end up with uneven joints, and you'll have to trim bricks to fit odd spaces.

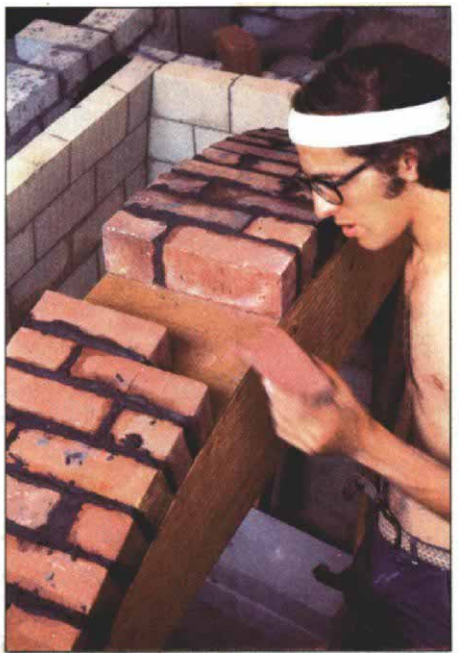
Step three: placing the centering—Lift the centering between the existing brick walls. The bottom of the centering should be just a couple of inches below the spring of the arch **(C).** Support it by four lengths of 2x4, cut just a little longer than the distance from the floor to the spring of the arch so they can be angled under the four corners of the centering and wedged in place. It's best to align the centering so its front edge is even with the brick walls; then bricks in the arch can be laid to the front edge of the form. If your centering is wider than the arch, pencil a line on it to indicate where the front ends of the arch bricks should be laid. Level up by tapping the bottoms of the wedged 2x4s. Once the centering is level and in the right position, drive shims into the small gaps between the centering and the walls at the four corners, to hold the form firmly in place.



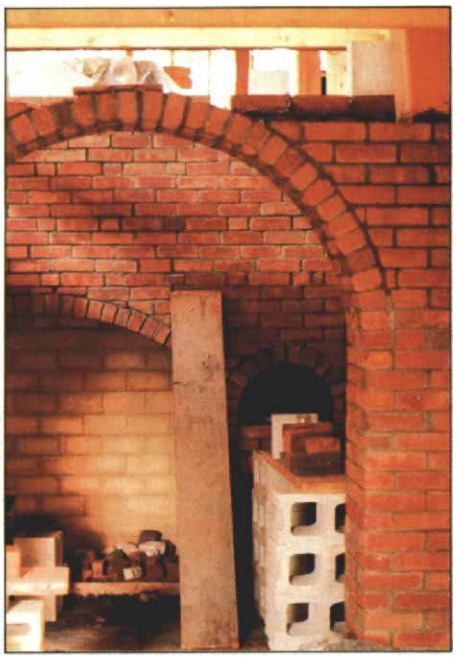
A. The centering form **B. Patterning the arch** **C. Placing the centering**

Illustrations: Frances Boynton

D. The ends of the bricks in the arch must be in the same plane as the wall. Check for alignment with a trammel board tacked to the center of the horizontal truss member.



E. Bricks are set between the pencil lines that were drawn on the centering during a test-fitting on the ground. This guarantees a proper fit and mortar joints of uniform size.



F. Bricks have been trimmed with a mason's hammer where wall meets arch. It looks best if the width of the curving joint between wall and arch remains constant.

Step four: laying up the arch—Lay bricks from both lower edges until they meet at the top. As they go up, check the bricks with a level to make sure their ends are in the same plane as the wall, or with a board tacked to the center of the truss **(D).** If you follow your pencil marks, you'll end up with the right number of bricks, and uniformly wide joint spaces **(E).**

Step five: finishing the wall—With the centering still in place, lay up the flat walls around the sprung portion of the arch. If the centering is removed too soon, the arch might collapse, because the mortar is still fresh and because a semicircle is not the strongest arch form. It could well bulge out at the sides and drop in at the center. Once the walls are laid up around the arch, however, it can support a lot of weight.

In the Allens' house the vaulted ceiling over the inglenook carries a concrete slab floor above it.

Always work in from the leads at the outer end of the wall, keep the vertical joints lined up properly and use taut string lines to keep the courses perfectly level.

On each course you will have to cut the last brick to fit, where it intersects with the arch. A diamond saw is the most efficient tool for this, very precise and sure. But a diamond saw is expensive and to Allen's eye the cut is too sharp-edged and cold. An abrasive masonry blade ($5 to $6 in a hardware store) in a circular saw is a good alternative. "It's a messy operation and it doesn't cut the brick as well as a diamond saw," he says, "but you can score the brick deeply and then crack it with a hammer to get a pretty clean break."

For his own arches, Allen used a mason's hammer to cut the bricks. This takes some skill, he cautions, and results in a somewhat ragged break and a lot of wasted bricks because you can't always get the bricks to break exactly as you want. The flatter angles that are required near the top of the arch are particularly difficult to make with a hammer.

A ragged cut on a few bricks, though, is less important than making sure that the curved mortar joint between the arch and the entire brick wall around it is a constant thickness **(F).** A curved joint that varies in thickness is unattractive, and once it's there, you can't do much about it.

Once the courses are laid up around the arch, tap out the 2x4s carefully, drop the centering gradually, then remove it and admire your arch.

Tooling the joints—In typical brickwork, after the brick is laid in the wet mortar, the mason cuts off the excess mortar at the face of the brick. In one to three hours the mortar will be thumb-print hard, the proper consistency for tooling with a V-shaped or rounded metal rod called a jointer or striking tool. This produces a clean and attractive joint. (For exterior brickwork, tooling is doubly important because it helps compact the mortar at the face, making it much more weather-resistant.)

But with an arch, the bottom mortar joints can't be tooled when the mortar is thumb-print hard, because the centering is in the way. By the time it is removed, the mortar is too hard for tooling.

Yet old arches and vaults have well-tooled joints. Allen was puzzled. Books on the subject were no help. Several masons suggested rubbing the joints with full-strength muriatic acid. The acid quickly dissolved the excess mortar that had been stuck between the brick and the centering, but the joint remained undefined and fuzzy.

Allen eventually learned that before the era of portland cement, arches and vaults had been laid up with lime mortar, which sets very slowly. He says that even if the centering were kept in place for several weeks, when it was removed the lime mortar would still be soft enough to be tooled. Although lime mortar is not as strong as portland cement, the arches themselves are structurally stable enough to be able to compensate for the weaker mortar. Allen recommends either using lime mortar alone for the arches, or using it for only the bottorn part of the joint that meets the centering, and then using mortar made with portland cement for the work above this.

Living with the inglenook—The Allens' inglenook can hold up to six people within its candlelit confines. The snug spot sits off a spacious country kitchen, and is used more often on social occasions than on weekday evenings. "It can get a little crowded," Allen says, "but in that kind of space it doesn't feel crowded. I think people are accustomed to drawing close around a fire." □

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