File: masonry heaters

Centuries-old technology meets today's needs

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Efficient fuel use, low emissions, and even, comfortable heat have sparked renewed interest in this traditional masonry field

By J. Patrick Manley

During Europes's "Little Ice Age," from the mid-1500s through the mid-1800s, temperatures were well below what is considered normal today. Wood was the only fuel source, as its consumption increased, shortages became widespread. Air quality, already a problem from inefficient open fireplaces, also was getting worse.

'Masons who realized the heat retention value of stone, brick, and tile began to experiment with more efficient means of heating masonry mass with a wood fire. They discovered that wood could be burned efficiently and with little smoke by enclosing the fire within masonry, burning a hot fire, and passing the fire and exhaust gases through masonry baffles or channels.

'Over the centuries, as masonry stove use increased, innumerable variations of material, shape, and flue design have been created.

'Finns used their native soapstone to fashion their heaters. Soapstone is beautiful and easily carved. It has remarkable heat-retention properties and the ability to withstand the thermal shock of a hot fire.

'Sweden has a tradition of tall, round or rectangular tile and

stucco heaters, many of which are centuries old and still in use today.

`In central Europe and Russia, masonry heaters were truly the heart of the home. Built of tile or brick, they were used to bake, cook, and smoke foods and to heat water. Heated benches and even sleeping platforms on top were common.

`One wonders why more immigrants from Europe didn't bring the idea with them. One theory holds that stove masons were highly regarded, well-established tradesmen who weren't interested in open land and farming. Besides, America was fully forested. Frugal use of fuel wasn't needed.

`Interest in masonry heaters revived during the energy crisis of the mid-1970s. Albie Barden of Maine Wood Heat Co. learned of heaters built in central Maine by Russian and Finnish immigrants. With these men as a resource, Barden began building heaters himself. In the years following, Barden has passed on that knowledge through magazine articles, books, and dozens of hands-on workshops.

Heaters are not fireplaces

`The main difference between an open masonry fireplace and a masonry heater is the efficiency of the fire and the amount of pollution released. The firebox is smaller in a heater, because too large a firebox reduces combustion efficiency and causes unnecessary thermal stress.

`Glass or metal doors with draft controls are necessary in a heater. The doors control the amount of air entering the firebox.

Too much air cools the fire, and too little air starves the fire. Both result in low combustion efficiency and increased pollutants. The hotter the fire, the higher the combustion efficiency and the lower the pollutants produced. Masonry heaters routinely operate with firebox temperatures of 1,500 to 2,000o F.

`Another major difference is the path the exhaust follows from the firebox to the chimney. The open fireplace allows the exhaust to directly out the chimney. Little of the heat produced is radiated into the room, and the rest goes up the stack. The under-utilized masonry mass also absorbs a relatively small amount of heat. Once the fire is out, little retained heat is available to continue heating.

`Upon leaving a masonry heater's firebox, hot gases flow through specially designed masonry channels or flues. Ten to 30 feet of flues distribute the heat throughout the mass and keep the exhaust gases within the heater longer, giving more time for heat transfer. The masonry mass absorbs 75% to 90% of the energy released from the burn.

Masonry heaters vs. metal stoves

`Masonry heaters and metal stoves have a number of striking differences: safety, size, weight, method of firing, emissions, and fuel economy.

`The surface temperature of a metal stove is 400o to 500o F., hot enough to burn skin before you know you're burned. The operating surface temperature of a masonry heater is 150o to 250o F. The larger surface area radiates a constant, even heat, which is 60%

? Seems high.

radiant and 40% convective. Casual contact will not burn skin. The required clearance to combustible walls is 6 to 12 inches.

`A conventional metal stove controls fire by starving it of oxygen. The low combustion temperatures fail to ignite a large percentage of gases produced during the wood burning process. This shows up as smoke out of the chimney and creosote formed in the chimney.

`In a masonry heater those gases, which require combustion temperatures of 1100o F. to ignite, are readily burned off. Creosote won't form because the gases that create it are burned.

`Current EPA standards limit emissions to 7.5 grams of ??? ~~per hour~~ per hour. Tests performed at Virginia Polytechnic Institute on masonry heaters have shown emission of 1 to 4 grams per hour.

`Sometimes a masonry heater is thought to take up more floor space than a metal stove. When the unusable space required as clearance around a metal stove is factored in, however, the difference in footprint is negligible.

`A metal stove needs constant tending, to keep a fire going 24 hours a day. A masonry heater only needs a fire for a few hours, once or twice a day. There need never be a fire burning overnight or when no one is home.

`Any fireplace or wood stove works better with dry wood. This is equally important with a masonry heater. A maximum 20% moisture content is ideal. But for a masonry heater, a hot fire is more important than a long-lasting bed of coals, so you can burn a greater variety of wood. Pine, fir, or other softwoods, not good for a metal stove because they burn too hot and fast, can be

excellent fuel for a masonry heater.

`After a fire has burned down, the damper in the flue should be closed to prevent stored heat from going up the stack until the next firing. All the stored heat then slowly radiates to heat the home.

`A masonry heater will not provide instant heat as a metal stove can. There is a 1- to 4-hour time lag from initial firing to bring the mass from stone cold up to operating temperature. The time lag depends on the size of the heater and the masonry materials used. Once in daily operation, however, the heater never feels cool but rather radiates a constant, even heat.

Custom heaters

`Ten years ago, virtually all heaters in North America were custom designed and built with locally available materials. The advantage of such a heater is that it can be designed to suit the builder and the homeowner. A competent heater builder can use almost any locally available brick, fieldstone, or granite. One popular design has the firebox located in the basement and the flue system within a masonry mass on the floor above.The masonry upstairs could have warming or baking ovens facing the kitchen or dining area. Another side could have hot seats or benches, or even an open fireplace.

`Considerable precision is necessary in the construction of a quality custom heater, but it is not difficult for a competent mason to master. The work involves a fair amount of cutting and fitting firebrick. Cast refractory firebox and flue system kits are now available that save much time. After the core is assembled,

simply face it with any masonry material.

`Because of the extreme heat, expansion joints are needed around the firebox and some of the flue system. Space must be maintained to prevent the hot core from expanding against the facing. Refractory brick are used for the firebox, and sometimes for the flue system. The firebox should be no more than 18 inches wide. Its depth can vary from 12 to 30 inches. Height is determined by the style of the heater.

`The cost for an average custom brick stove to heat a 1,200-square-foot area is $5,000. This price includes heater materials and installation, but not the construction of the chimney or base. However, this price will vary based on ~~local~~ the availability of local materials and labor.

Manufactured models

`In the past 10 years a number of excellent manufactured masonry heaters have appeared. One company produces Finnish-designed soapstone heaters for the North American market. In this type of heater, often called a contra-flow, flames rise to the top of the fireplace, then flow back down to the bottom through channels located on both sides of the firebox. Flue gases then exit at the bottom of the heater out the back.

`These soapstone heaters range in size from 2,000 pounds (able to heat 650 square feet of living space) to 7,000 pounds (good for 1,500 square feet). Retail prices range from $3,000 to $9,000, plus $900 to $2,500 for shipping and installation. Excluding base preparation and chimney, installation takes 1 to 4 days.

`One Swedish manufacturer makes a very elegant masonry heater that follows a centuries-old design similar to the contra-flow, but with

Bob Fore

a longer flue run and a top exit. These stoves are rectangular or round, faced with stucco, porcelain tile, or soapstone. All are about 7 1/2 feet tall, with a footprint of 2 feet by 3 feet. The Swedish stoves weigh between 3,500 and 4,000 pounds, will heat 500 to 1,500 square feet, and cost $3,860 to $6,130, plus $1,000 to $2,000 shipping and installation.

Planning a masonry heater

`The home size and layout will determine heater size and placement. The larger the area to be heated, the more open a layout is preferred. Central location also is important. The more it is to be used as a primary heat source, the more central the heater should be. In western Europe and Scandinavia, though, many homes have multiple heaters for different areas because the owners prefer to heat just the areas in use.

`Though many architects are enthusiastic about masonry heaters and some promote them, most masonry heaters now are built for the homeowner who has learned the ways of heaters. Ideally, a stove builder should be contacted when a new home is in the design stage. That way, the heater can be integrated into the home and details such as getting outside air to the heater can be worked out more easily. This is important, because today's tight homes may not allow enough air in for proper combustion, especially when a kitchen or bathroom exhaust fan is in use.

`On the other hand, installing a masonry stove in an existing home is no more difficult than retrofitting with a fireplace or metal stove and chimney. In fact, because a masonry heater's low surface

temperature allows only 6- to 12-inch clearance to combustible surfaces, often it is easier to integrate one into an existing home.

Becoming a stove mason

I've been a self-employed brick and stone mason for 20 years. After reading a newspaper article about heaters 12 years ago, I decided to specialize in masonry heaters. Little information was available in this country at that time so I, like many other heater masons, made several trips to Europe to learn more about their design and construction. Now there is an abundance of information on masonry heaters. Besides dozens of magazine articles, there are also good books on the subject (Refs. 1, 2).

`The Masonry Heater Association of North America (MHA), established in 1986, combines the experience of dozens of the best heater builders. MHA has played a leading role in the development of emissions test methods for masonry heaters and has developed a draft standard through ASTM for masonry heater construction.

`It feels good to bring masonry into another facet of daily life. Stone and brick are the oldest, most basic and beautiful building materials known. Add modern refractory materials, cast or fabricated doors and fittings, and you have a safe efficient masonry heater of lasting beauty.

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[BIO]

J. Patrick Manley is a mason and stove builder, the owner of The Brick Stove Works, Washington, ME.

References

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2. Barden, Albert and Hyytiainen, Heikki, The Heart of the Home, 1988, Building Books, Ltd.

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