

## UI Extension Forestry Information Series

### Fireplace Adaptations and Efficiency Boosters

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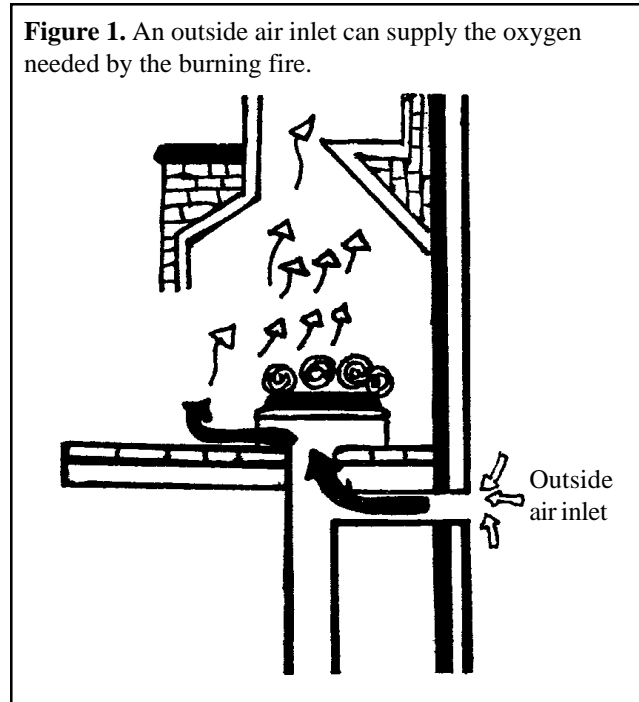
The charm and atmosphere and warm cozy glow are strong reasons to live with a fireplace. Pleasant but notoriously inefficient, a fireplace when not in use can allow enough room air to escape up the chimney to have a negative net efficiency. Even in use, 90% of the heat produced by the fire goes up the chimney and only 10% is radiated into the room.

Another problem is that the air which supports combustion, if drawn from the room, must be replaced by cold outside air. A fireplace can take 5 to 10 times more air just for burning than is required for home ventilation. Using this preheated air to burn the wood costs many fuel dollars.

**Outside Air Inlet.** Until recently, most of our homes were open enough to let the fireplace draw outside air in through the cracks and misfitting windows and doors. But now weather-stripping, caulking and moisture barriers have sealed up these holes. Tightly constructed houses probably do not permit enough air replacement to supply the chimney draft and a partial vacuum may result, pulling smoke back into the room. A simple solution is to create an outside air inlet directly into the combustion area to supply the oxygen needed for burning (Figure 1). The inlet could come from the basement, the crawl space or directly from outside. In existing fireplaces, you may be able to supply outside air by opening the ash dump door slightly.

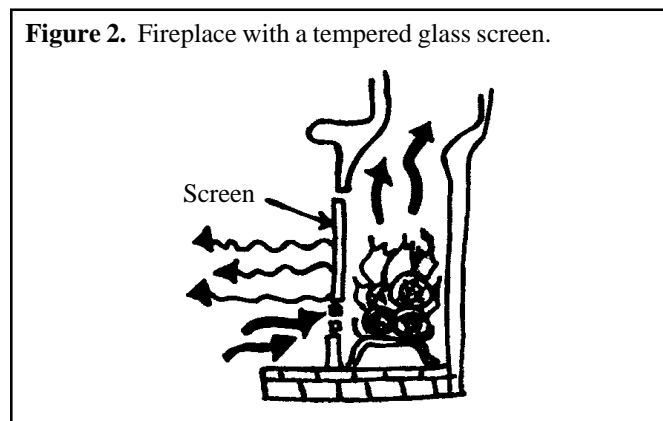
**Glass or Metal Doors.** Another way to improve the efficiency of your fireplace is to limit the available oxygen or control the oxygen flow by the use of glass or metal doors (Figure 2). Using such doors will control the intensity of the fire and slow the rush of heated air up the chimney. When you leave the fire to burn down and cannot as yet close the damper, as at

**Figure 1.** An outside air inlet can supply the oxygen needed by the burning fire.

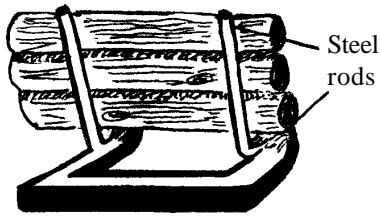


bedtime, the door will help prevent heat loss. Glass doors will reduce the amount of radiant energy you receive but controlling the rush of heated room air up the chimney will more than compensate for the loss. Additionally, the draft control allows the fuel to burn more completely.

**Figure 2.** Fireplace with a tempered glass screen.



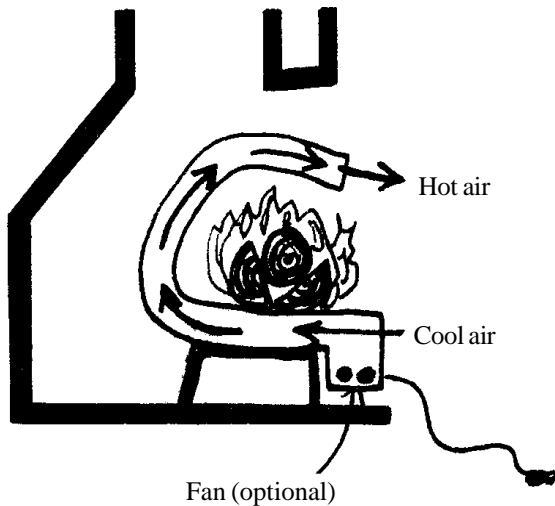
**Figure 3.** Heat radiant grate.



**Heat Exchangers.** A third way to improve fireplace efficiency is to install a heat exchanger. These are available in many forms. Some are simple structures, called radiant grates (Figure 3), designed to hold the burning logs in a way to increase the radiant exposure. Heat circulation units are another classification of exchangers. Most of these are on the fireplace floor below the firegrate and the burning logs. In some units, the fire is built directly on ducts which take the place of the grate. Air moves from the room under the fire and back into the room by convection or by fans. The ducts can be simple hollow C-shaped tubes or elaborate systems with blowers or even steam heating systems (Figure 4).

Some units extract the heat from the top of the fire or above it. Hot gases flow around and over them. Proponents of these systems claim they are better because they do not take the heat from the fire's core and thus do not reduce burning efficiency. They take many forms – C-shaped tubes, grid patterns, pipes

**Figure 4.** Convection heat exchanger.



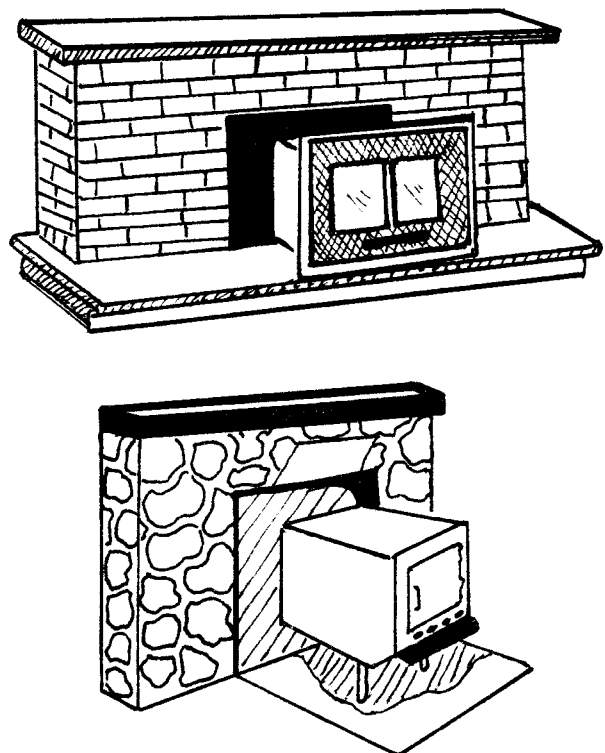
and units that heat water for supplementing other water heating or for radiator heating.

When selecting and using heat exchangers, take heed of these precautions:

- Heat exchangers should be sized to fit the fireplace. Be sure they do not interfere with the damper control arm.
- Never install a blower exchanger with glass doors unless the doors are designed as part of the unit. The superheated air blowing on the glass can cause warping and even glass breakage.
- Any unit that supports the fire can burn out, some faster than others. When small holes occur, the hot embers can drop into the air channel and be blown into the room causing a fire hazard. Be sure you purchase a unit that is well enough constructed to last. Inspect it often.

**Fireplace Insert Units.** If these methods do not gain the heat that you require, you might consider replacing the fireplace with a stove unit (Figure 5). Some units are designed to fit directly into the fireplace opening,

**Figure 5.** Fireplace insert unit (top) and fireplace stove.



giving you draft control and glass or metal doors. Some have heat exchange blowers incorporated into the design. Some stoves are designed to stand in front of the opening or partially in, partially out.

You can also purchase an airtight stove, seal off the fireplace opening and use the chimney. You can evaluate these free-standing units on the same basis as stoves and heaters. The diagrams in Figure 6 show possible methods of installation.

**Summary.** A conventional fireplace handles heat transfer three ways: by radiation, convection, and conduction. To improve the efficiency we need to maintain or increase the radiant heat, use the conducted heat fully and trap or return the convected heat to the room. Radiant heat is determined by the design of the fire box and opening and can be increased by

use of special grates. Secondary radiant heat produced by convection through the fireplace walls is used better if all surfaces are within the house and not on an outside wall. Convection heat can be manipulated and controlled in various ways, including heat exchangers and glass enclosures.

When adding a fireplace efficiency improver, the energy and money saved should be carefully weighed against the cost of the installed unit and the convenience change it might involve.

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**Figure 6.** Three methods of installing free-standing stoves.

