ENERGY FACTS

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FIREPLACES

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Gathering at the fireside for comfort, warmth and enjoyment is a custom as ancient as the use of fire. When fireplaces were developed they were an important part of human shelter, performing as a cooking center, heating system and relaxing and recreation area. They used large amounts of fuel which was then readily available. Today, fireplaces are still considered a place to gather for warmth and fellowship and also as a source of supplemental heat.

However, of the home wood-burning units, the open fireplace is the least efficient in terms of fuel consumed and usable heat produced. When no fuel is burning, a modestly sized open fireplace can send 18,000 cubic feet of expensively warmed interior air up the chimney every hour. When the fireplace is in use, approximately 90% of the heat from the fire escapes up the chimney — and the open draft siphons off 22% of the warm room air as well. By comparison, a small airtight stove will draw only 1/10th of the air, and will furnish several times the heat into the room rather than outdoors.

If the open flame is one of the main reasons you want a wood-burning unit, or if a fireplace is what you have, understanding the way they work may help you choose a unit or increase its efficiency.

A fireplace consists of a non-combustible fire box where the fire is built, a chimney to vent the combustion products, a damper which regulates the amount of air drawn from the burning fuel and a hearth extending into the room.

HEAT TRANSFER

Heat transfers from the fireplace to the house three main ways: radiation, conduction and convection (Fig. 1).

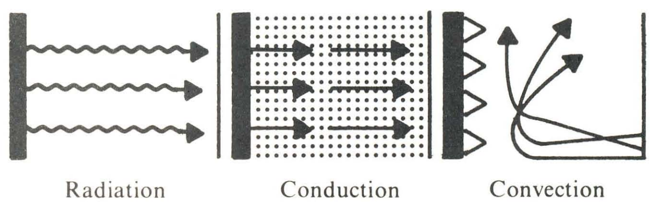

Fig. 1. Graphic demonstration of how heat transfers from the fireplace to the house.

Radiant energy heats the room it is in. Heat in the hot flue gases may conduct through the chimney walls or fireplace walls into the house, and warm house air is pulled into the fireplace by convection and goes up the chimney. The ideal fireplace will maximize the radiation and the convected heat it emits, and minimize the amount of air escaping up the chimney (Fig. 2).

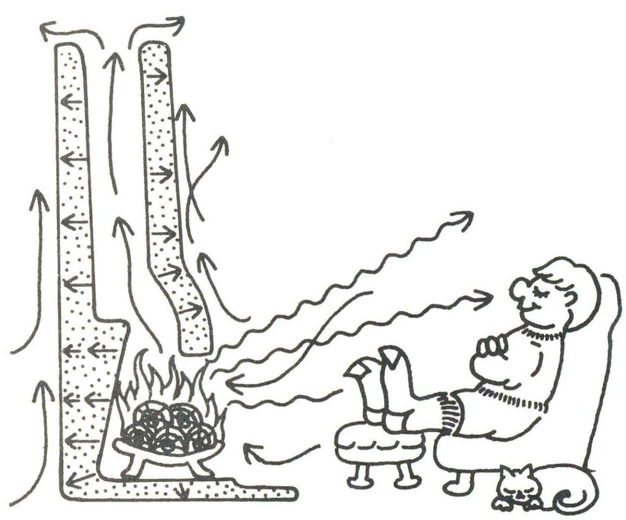

Fig. 2. How heat emits from a fireplace.

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Flue and Flue Lining

The chimney flue must be adequate in size and height to provide the necessary draft. The area should equal 1/12th to 1/8th the area of the opening of the fireplace (width x height).

Smoke Shelf and Smoke Chamber

This area is important to a smoke-free fire. Both sides slope to the flue. The smoke shelf is a horizontal surface back of the damper that prevents downdrafts from reaching the fire and re-directs them back up the chimney.

Throat and Damper

These are usually one and the same. The damper covers the opening and should be capable of being opened and closed gradually to control the draft and keep out cold air when the fireplace is not in use.

Fire Box

The fire box should be made of fire brick. It must be correctly proportioned, sealed, vented and well constructed.

Hearth

The back hearth is where the fire is built. The front hearth extends into the room 8 inches on each side and 16 inches in front of the opening. Both must be fireproof material.

Ash Pit — Ash Dump

The ash pit and ash dump are used for the removal of ashes from the hearth. This may be on an outside wall.

Support

The fireplace and chimney must rest on a solid foundation. Concrete footings are recommended.

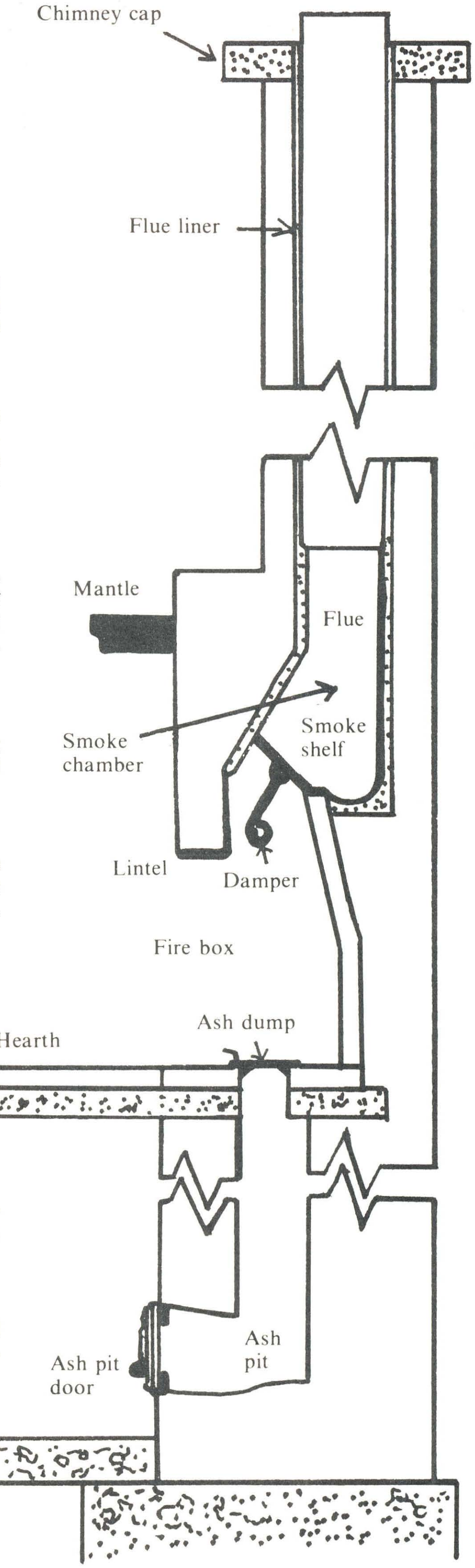
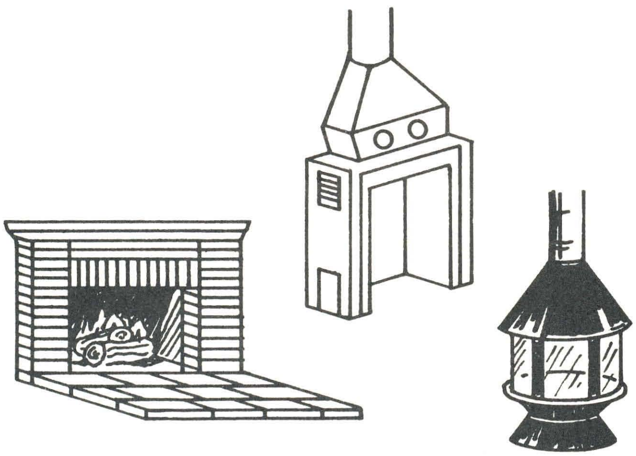


Fig. 3. Fireplace cross section.

TYPES OF FIREPLACES

There are many variations and types of fireplaces and no clear distinction between fireplaces and stoves. There are openable stoves and closeable fireplaces, non-metal stoves and metal fireplaces, free standing fireplaces and stoves with visible fire boxes. Most of the time "fireplace" is used for a device intended to be usable open and with the flame visible. In this publication, fireplaces are divided into three types: masonry or built-in; manufactured or modified; free-standing or prefabricated.

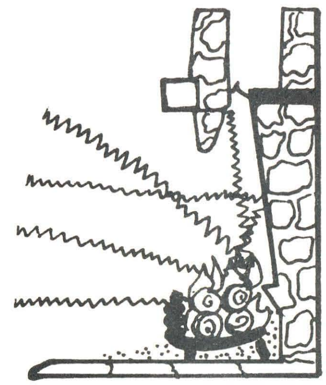


Masonry

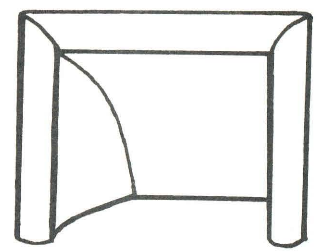
Masonry or built-in fireplaces are constructed completely on the site, generally when the home is built. It consists of the parts shown in cross-section in Fig. 3.

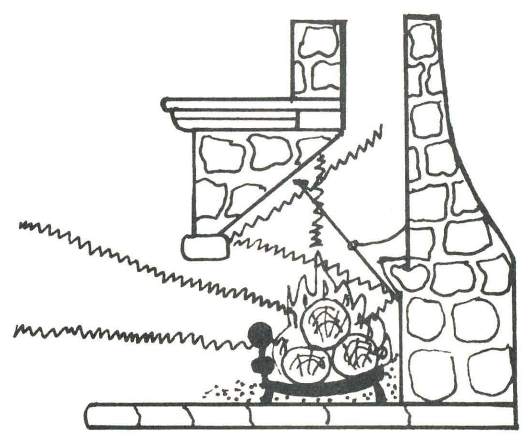
Two basic theories of fireplace design are the conventional and the Rumford. About the time that Ben Franklin was modifying the cooking unit, Count Rumford had become an expert on repairing smoking fireplaces in Europe. His method was to construct or rebuild the fire box to be tall and shallow with sloping, outward flaring sides and a back with a gentle forward arc leading to a narrow throat. This resulted in maximum direct radiant energy release, increased secondary radiant heat from the increased absorbtive mass and smaller air loss through the narrow throat. The Rumford takes great skill to design as the open and shallow fireplace can require relatively large total airflow to prevent smoking. The conventional fireplace does not emit as much direct radiant energy. However, it also does not draw out as much warmed room air as the average taller, shallow one will (Fig. 4).

Masonry construction, especially brick, absorbs large amounts of infrared radiation. This heat is in turn radiated (referred to as secondary radiation). To use this secondary radiation and the conducted heat most efficiently, a fireplace should be on an inside wall.



Rumford





Conventional

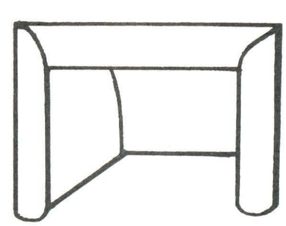


Fig. 4 Rumford and conventional fireplace designs.

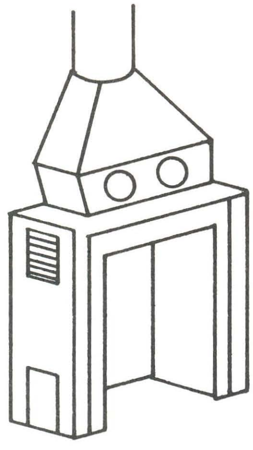


Fig. 5. A manufactured or modified fireplace.

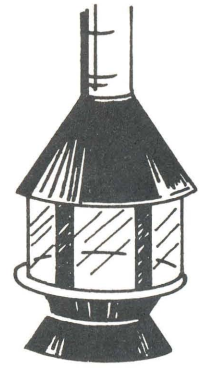


Fig. 6. A free-standing or prefabricated fireplace.

Manufactured or Modified

The second type of fireplace is the manufactured unit (Fig. 5). The insulated or zero clearance fireplace is built of metal and constructed so that it can be placed directly against combustible walls or floors. The insulation in some of these units consists of double wall construction with a space between through which air can circulate. These are often used in mobile homes as they require less bulk and weight for fire safety. Some of these air-circulating units use duct systems that circulate outside or room air around the heated chamber to warm the room. Some units come with blowers, others rely only on convection. On some, an outdoor air supply is available for fire combustion.

Prefabricated fireplaces designed to heat water are also available. With careful design, the efficiency of this type of unit could approach that of some stove units. They are, however, an unfinished shell and still need to be "built in" or faced with a material of your choice.

One point to keep in mind is that due to the insulative quality, even if masonry is used as a finish, the convected heat will not be stored for secondary radiant heat.

Free-Standing or Prefabricated

There is not a clear distinction between fireplaces and stoves in the free-standing or prefabricated category (Fig. 6). They come in many shapes, sizes, materials and styles. Most are metal but some are pottery, tiled or masonry, and some are even made primarily of glass. Some have doors of glass or metal that open or remove. The Franklin Fireplace (or stove) is a good example of this type. Some are completely open as with the cone funnel or suspended (fire pit) types. The inverted funnel is capable of drawing tremendous amounts of warm air up the flue unless fitted with glass or metal shields. There are trade-off considerations. For example, the large area of heated metal above the fire is capable of a great deal of radiant heat emission. Another positive factor is that open wood burners do not generate as much chimney creosote as do closed stoves.

These factors, trade offs and considerations are presented to you to help you decide which is the right wood-burning unit for your particular needs.

For more information on making your fireplace more efficient, see Current Information Series No. 494, Fireplace Adaptations and Efficiency Boosters.

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