of appliance *input rating*. If horizontal ducts are used, the vent area should be doubled. If more than one appliance is enclosed in the same space, their input ratings should be added.

The open-topped partition (Figure 2) has a duct delivering fresh air to the bottom of the enclosure. The logic is that the basin created by the partitions will tend to trap the cold air and minimize its mixing with conditioned house air. For details and specifications, you should get ahold of the NCAT booklet ("Introducing Supplemental Combustion Air to Gas-Fired Home Appliances," $4 from NCAT, P.O. Box 3838, Butte, Mont. 59702).

According to Rick Kutina, director of building energy codes and standards at the American Gas Association, there are several reasons for having both high and low vents. They allow heat to dissipate from the enclosure. They allow combustion gases to escape should there be any backdrafts. And they can permit a freer flow of combustion air to the furnace.

A few cautions: These guidelines were written only for gas appliances. While combustion requirements for other fuels are similar, the specifics should be checked out with manufacturers and local codes. In all cases, local codes take precedence. Second, any water pipes that pass through a cold enclosure should be insulated against freezing and water tanks should be insulated to limit stand-by losses. Finally, make sure you observe all the proper clearances in building the enclosure.

Direct venting

A number of combustion appliances are designed to isolate the combustion process completely from the living space, saving you the need for any complex venting schemes. These *direct-vented* systems are engineered and tested to burn and draw properly even when high winds hinder the draft. Needless to say, trade spokesmen recommend against modifying a standard appliance to operate in this fashion.

Ah! Wilderness

Asked about the combustion air problem, a woodburner's trade association told me that houses shouldn't be so tight anyway. An oil-burning institute told me the same thing. On the other hand, many superinsulators tell me to keep woodstoves and fireplaces out of their tight houses. Well, there's no shortage of opinions in this business. Too bad you can't heat your home with them.

For those who wish to burn wood for warmth, cheer, or economy, all hope is not lost. Since the average airtight woodburning stove requires only 10 to 25 cfm of combustion air, even the tightest of houses can probably keep the logs ablaze. However, the tighter the house, the more the stove will contribute to air infiltration. Also, as with fuel-burners, a backdraft can be induced by competing exhaust fans.

What to do? According to Laird Graeser, senior research engineer at Shelton Energy Research, Santa Fe, N.M., supplying outside combustion air to the stove through a floor or wall register ducted to the outside is probably not the answer. Calculations indicate that the net effect would be added infiltration.

A more promising approach, Graeser feels, is to supply the combustion air through fixed ducts. At this time, few woodburning appliances are equipped for this, but he expects we'll see more in the future.

In fireplaces, the air needed and consequent infiltration penalties are worse—50 to 150 cfm. An outside air supply can help offset this if engineered properly. Tight-fitting fireplace doors can help by saving conditioned house air after the fire has burned down. Perhaps most important is a tight-fitting top damper to isolate the chimney from the outdoors when the fireplace is cold. A solar engineer we know was recently stumped when his company's new model home tested out for air infiltration at a full 1.2 air changes per hour. After discovering and closing an open fireplace damper, he cut the infiltration rate in half. Interesting.