

PASSIVE SOLAR: THE CONTROL FUNCTION

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The control function in passive solar heating affects both when and where solar heat is delivered to the living space. *When* considers the timing aspects. Heat delivered when a house is cold is better than heat delivered when the house is already warm enough. *Where* considers distribution. Heat must be delivered to all rooms in a house, not just the ones that happen to have a southern exposure.

One aspect of the control function is *seasonal*. For example, the movable-Insulation methods (Drumwall, Skytherm, and Beadwall) can also be used to adjust the delivery of solar heat based on the season. Overheating can be reduced by varying the amount of time during the day that the insulation is in place. For example, a Skytherm house might have its heat store collecting solar heat all day in the winter, half a day in the spring, and not at all in the summer.

Seasonal control of solar heat can also be achieved by using awnings and trees, shrubs, or other plants. Awnings and leafy plants shade a direct-gain house in summer when heat isn't needed but let solar heat in during the winter. Since the sun is high in the sky in the summer, an awning generally provides more shade in the summer than in the winter. Leafy trees don't have leaves in the colder months, when solar heat is needed.

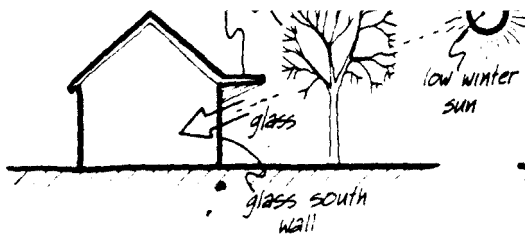
Daily control of solar heat is another aspect of the control function. One way you've already learned about to control heat on a daily basis is to use lots of storage. If storage is very large, the house never gets too hot during the day yet it can warm a house all night long. The Drumwall, Skytherm, and Beadwall systems use huge amounts of water storage to reduce the temperature swing and are still able to provide heat overnight.

The masonry wall of the Trombe wall system achieves daily control in another way. The outer surface of the wall gets

Plants and Awnings Control Solar Heating

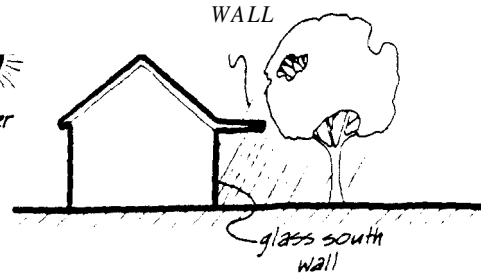
WINTER

LEAFLESS TREES
AWNINGS PROVIDE LITTLE
/w, /-



SUMMER

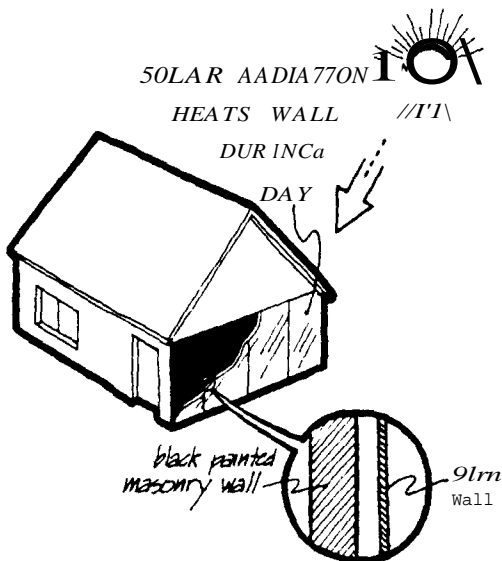
AWNINGS AND LEAFY TREES
TYPICALLY SHADE GLASS
SURFACES TO STOP
SUNSHINE



quite hot, but it is separated from the living space by the wall itself. As the wall heats up during the day, heat is conducted through the wall (in addition to the thermosyphon heating mentioned earlier). By nighttime, the wall has become quite warm and continues to conduct its stored heat to the living space. The

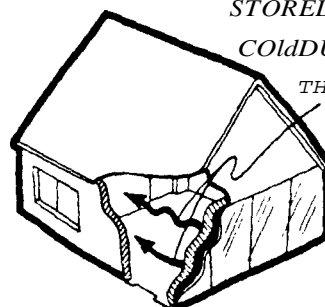
DAY

SOLAR RADIATION
HEATS WALL
DURING DAY



NIGHT

STORED HEAT
CONDUCTED
THROUGH
WALL
WARM
INTERIOR

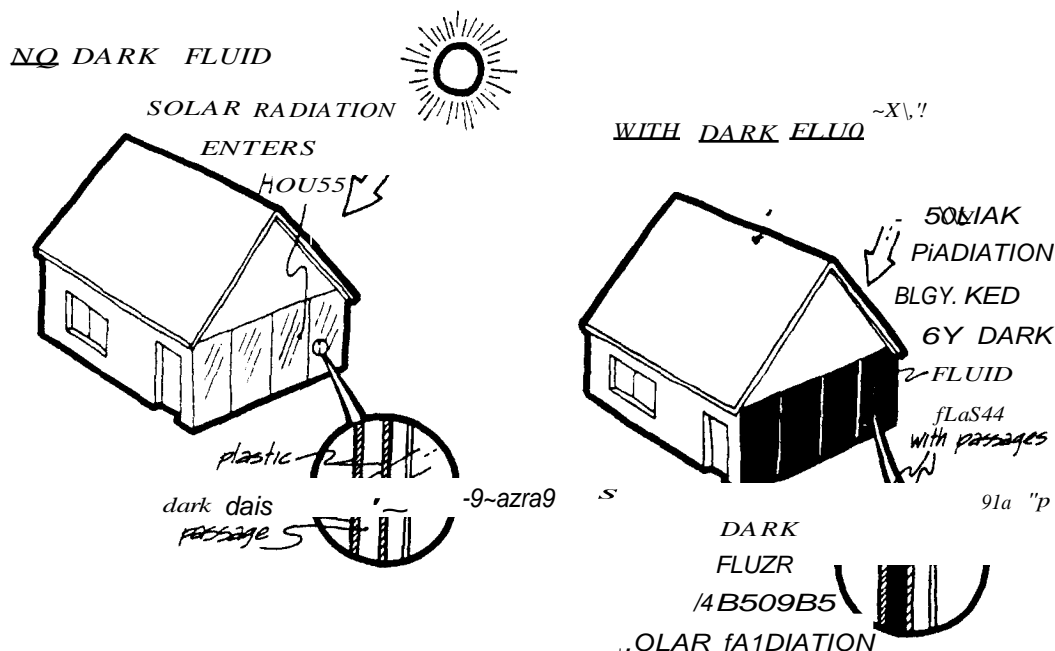


Masonry Wall Delivers Solar Heat at Night

heat delivered by the wall to the living space is delayed from the late afternoon (when it's not really needed) until nighttime (when it is needed). This delay in delivering heat depends on how thick the wall is—a foot-thick wall seems to be about the best. Once the heat gets to the inner wall surface it is transferred to the living space by radiation and convection heat flow.

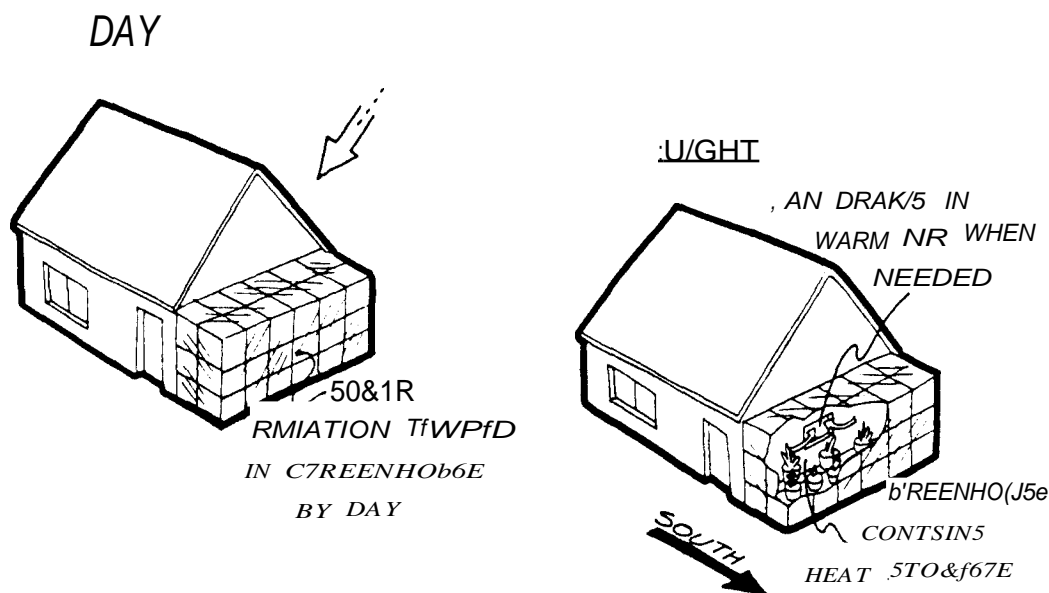
The control function may also be achieved on a daily and a seasonal basis by stopping the solar radiation from entering a direct-gain house. The *Sun Window* system, as it is called, replaces the glass south wall with a wall of clear plastic which has many passages molded into it. When the temperature inside the house gets too high, a dark-colored liquid is pumped through the passages. The passages are so close to each other that most of the sunlight that would enter the house is blocked. The effect is similar to lowering a window shade on the south wall—except that only the dark liquid moves anywhere.

Since the liquid is dark, it absorbs solar radiation. Not only does it keep the sun from entering a too hot house, but the fluid itself gets hot. The hot dark liquid is pumped to a storage tank where it can be used to heat water or the house later at night. The Sun Window system combines the simplicity of direct-gain passive heating with the control function of active solar heating.



Dark Fluid Controls Solar Heating

Passive systems can also accomplish the control function by separating the heat storage from the living space. The simplest approach to separating the two is to have a direct-gain greenhouse separated from the house itself. The greenhouse not only houses plants and stores heat but also acts as a buffer between the living space and the direct-gain system. In the late afternoon the direct-gain greenhouse might get quite warm, but that doesn't necessarily mean the living space will get too warm. A small fan can be used to draw in air from the greenhouse to warm the house when required, or vents can be opened to let the warm air flow into the living space when required.



Greenhouse Separates Storage from Living Space

You may have noticed that some of the passive systems we've been discussing aren't strictly passive. The Sun Window method uses electricity to pump dark liquid through the plastic wall, and the greenhouse method can use electricity to blow heated air into the house. In fact, many passively heated houses use active methods when convenient. For example, passive solar houses often use fans to distribute heat from warm south-facing rooms to cooler north-facing rooms. As improved diode and control functions are added to the passive direct-gain

house, the distinction between active and passive may become blurred. But after all, the purpose of any system is to provide solar heat as cheaply, reliably, and conveniently as possible, even if it means combining aspects of both active and passive solar heating.

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