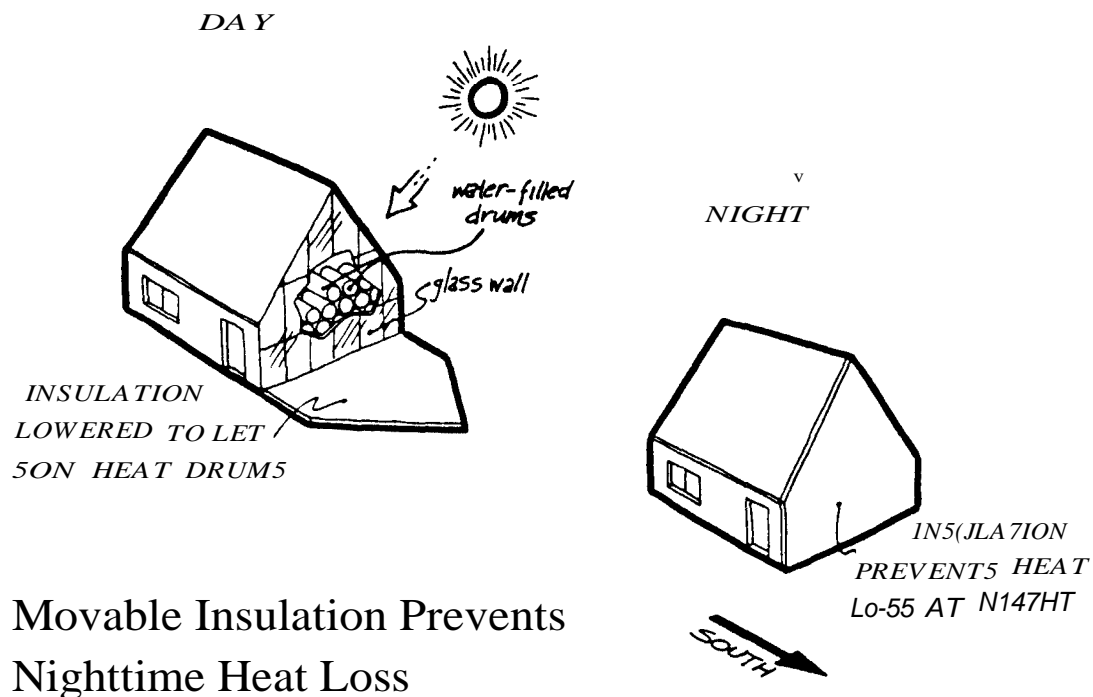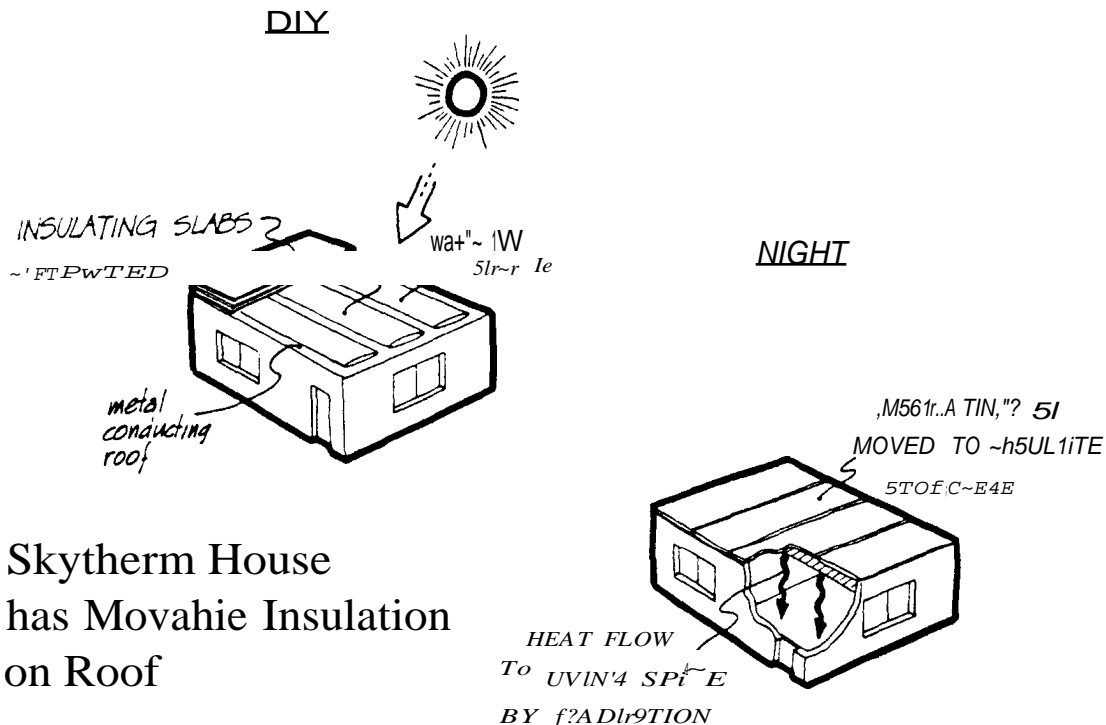The diode function--letting solar heat flow in but not letting it flow out easily--can be added to direct-gain solar heating by *movable insulation. To do* this, insulation is moved in front of the glass south wall at night. One passive heating system, called Drum-wall, has a thick insulating wall that hinges at the ground. At night it is pulled up against the glass to keep heat from leaking out; during the day it is lowered to let solar heat through the glass wall. The system is called Drum-wall because just inside the glass wall is a stack of water-filled drums used for heat storage.

DAY

water-filled drums

NIGHT

glass wall

INSULATION LOWERED TO LET 5ON HEAT DRUM5

1N5(JLA7ION PREVENT5 HEAT Lo-55 AT N147HT

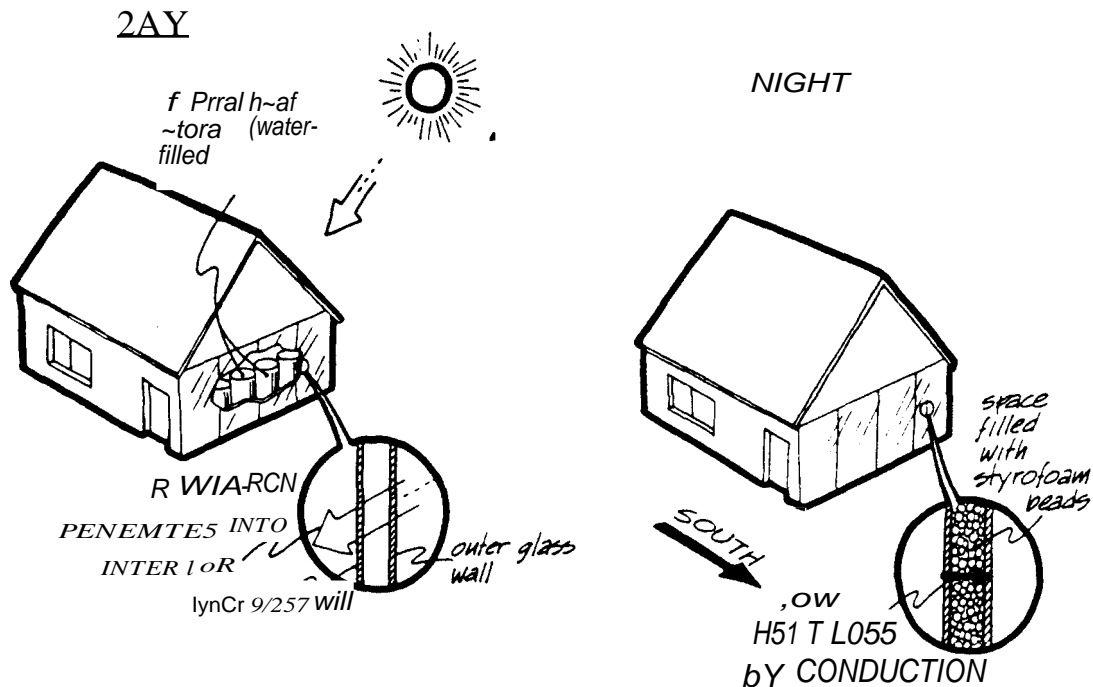## Movable Insulation Prevents Nighttime Heat Loss

SOUTH

The south wall of a house isn't the only place where the diode function can be utilized. Another passive design called *Skytherm* uses the roof of a flat house both as a solar collector and as a storage medium. The system stores heat in water-filled plastic bags, similar in construction to water beds. The bags rest on a metal roof so heat from them can be conducted through the roof and then radiated to the living space below. The diode function works by means of large slabs of Insulation that slide on tracks over the bags, insulating them at night. The black-colored bags absorb solar heat during the day when the insulating slabs are moved aside by a device similar to a garage-door opener.

DIY

INSULATING SLABS
~'FTPwTED

wa+"~ {W
5lr~r Ie

NIGHT

metal
conducting
roof

,M561r..A TIN,"? 5l
MOVED TO ~h5UL1iTE
5TOf C~E4E

Skytherm House has Movahie Insulation on Roof

HEAT FLOW
To UVlN'4 SPí E
BY f?ADlr9TION

Movable insulation doesn't always mean moving big slabs of insulation. In Bealfwsll, another type of passive solar heating, the diode function works by moving Styrofoam beads. A fan blows the beads Into the space between two glass layers on the south wall of a house. When in place, they provide excellent insulation against heat loss through the glass. When the beads are removed by a suction fan, solar radiation goes through both glass layers and heats the storage within. Sometimes large vertical fiberglass or metal tubes filled with water store heat in a Beadwall system.
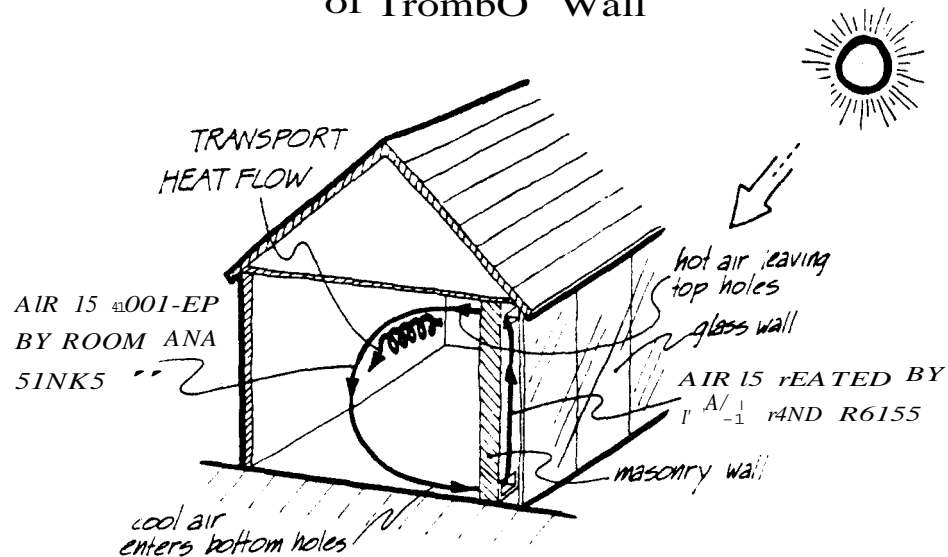
Foam Beads Prevent
Nighttime Heat Loss

2AY

f Prral h~af ~tora (water-filled

NIGHT

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PENEMTE5 INTO
INTER1oR
lynCr 9/257 will
outer glass wall

SOUTH

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H51 T L055
bY CONDUCTION

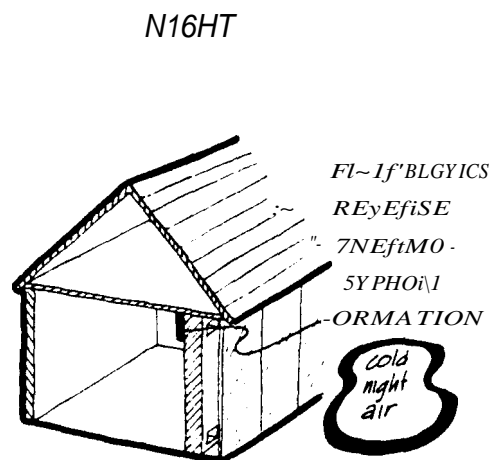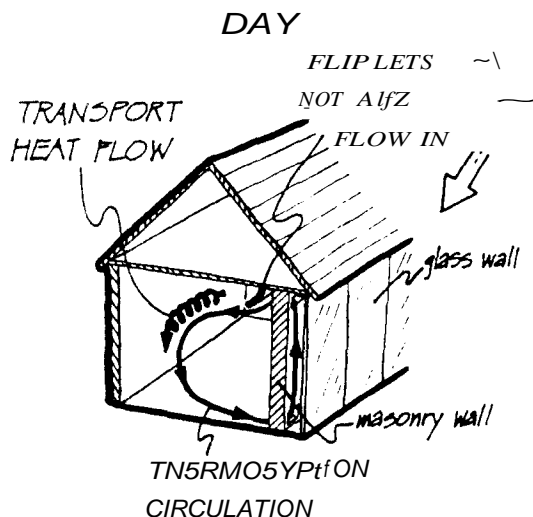space filled with styrofoam beads

Not all passive heating systems use movable insulation to achieve the diode function. A system called the Tromb6 wall (named after its French inventor) uses quite a different technique. A masonry wall is built just inside the glass south-wall of a direct-gain house leaving a gap a few inches wide bet%Neen the masonry and the glass. This gap is connected to the living space by holes in the masonry near the floor and the ceiling.

Air in the gap between the glass and masonry is heated by convection from the black-painted wall. The lighter, heated air tends to rise, just as hot air in a chimney rises. It flows out through the upper holes and is replaced by cool air flowing in through the bottom holes. This cool air is, in turn, heated by the wall and flows out through the top holes. Of course, the cool air flowing in the bottom is the previously heated air which has given up Its heat to the room. The process of circulation based solely on heating and cooling is called *thermosyphon* circulation. Instead of a fan blowing air from the solar collector into the living space, the air moves there by Itself. Heat moves by transport heat flow, In a process very similar to natural convection.

Thermosyphon Circulation
of TrombO Wall

TRANSPORT
HEAT FLOW

AIR 15 ₄1OO1-EP
BY ROOM ANA
51NK5

hot air leaving
top holes

glass wall

AIR l5 rEATED BY
I A/₋₁ r4ND R6155

masonry wall

cool air
enters bottom holes

Heat can be *lost* by thermosyphon action at night. Air in the gap cooled by the cold night air tends to sink and flow out through the bottom holes and is replaced by warm air flowing in through the top holes. To prevent reverse *thermosyphon,* as it is called, the top holes are loosely covered by a thin plastic flap. The flap operates like the one in the check valve of our rainwater analogy-it lets warm air flow into the house during the day but won't let it flow back out again at night.

DAY

N16HT

FLIP LETS ~\
NOT AlfZ —
FLOW IN

TRANSPORT
HEAT FLOW

glass wall

masonry wall

TN5RMO5YPtf ON
CIRCULATION

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REyEfiSE
7NEftM0 ·
5YPHOi\1
ORMATION

cold
night
air

Flap Blocks Nighttime Heat Loss

The passive heating systems we've just discussed illustrate the diode function. They show how a direct-gain system can be modified to reduce nighttime heat loss. But that Is not to say these same systems can't perform a control function as well. Next, we'll see how these and other passive systems can control solar heat delivered to the living space.