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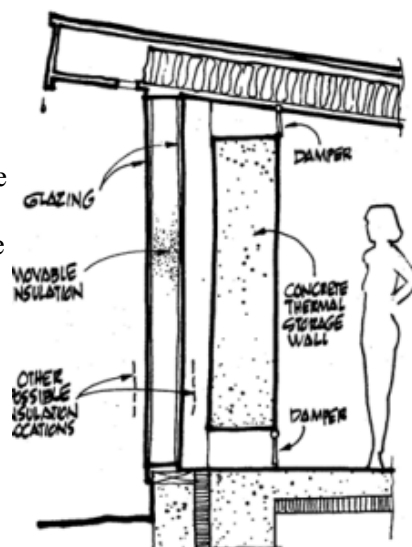
Solar Wall (or Trombe Wall)

This page provides plans for a simple solar wall collector for space heating. These walls are also known as Trombe walls. The diagram shows how the collector operates. The solar radiation heats the outside of the solar wall. The heat slowly passes through the massive wall, and arrives at the inside surface of the wall several hours later to provide heat in the evening. The glazed covering on the outside of the wall reduces heat loss, and allows more heat transfer to the inside space. The vents shown at the top and bottom of the wall in this diagram are optional -- they allow heat to be transferred to the living space earlier in the day than occurs with an unvented solar wall.

These walls can be used in new construction or as a retrofit. Some existing homes have wall construction that can be converted to a solar wall easily.

The characteristics of a Solar Wall as compared to a [direct gain window](#):

- Its efficiency in collecting solar heat is not as high as a direct gain window of the same size.
- Night heat losses are less than for a direct gain windows.
- Very simple -- no fans, no ducts, no controllers.
- Does not provide daylighting or views as a direct gain window would -- this can be an advantage or disadvantage.
- The inside surface of the wall can be used to some extent, but should not be covered with anything that reduces heat transfer from the wall to the living space.
- Depending on the current wall construction, it may be easier to retrofit a solar wall than to retrofit a direct gain window, since no wall structural members are cut.



The collectors can be used in new construction, or as a retrofit.

These plans are excerpted from the book "Passive Solar Energy" by Bruce Anderson and Malcolm Wells. The full book is available for free download [here](#). Solar walls are covered in chapter 5.

From "Passive Solar Energy", B. Anderson, M. Wells

Solar Walls -- Introduction

Solar windows let sunlight directly into the house. The heat is usually stored in a heavy floor or in interior walls. Thermal storage walls, as solar walls are often called, are exactly what their name implies- walls built primarily to store heat. The most effective place to build them is directly inside the windows, so that the sunlight strikes the wall instead of directly heating the house. The directly sun-heated wall gets much hotter, and thereby stores more energy, than



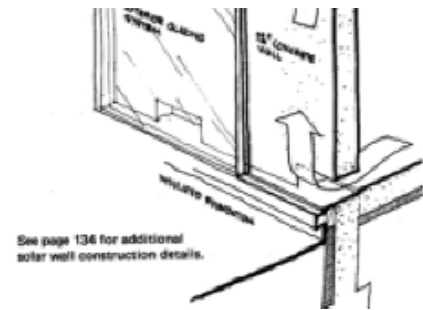
thermal mass placed elsewhere.

These "solar walls" conduct heat from their solar hot side to their interior cooler side, where the heat then radiates to the house. But this process takes a while. In a well-insulated house, a normal number of windows in the south wall will admit enough sun to heat the house during the day. Thermal storage walls will then pick up where the windows leave off and provide heat until morning.

South-facing windows with an area of less than 10 percent of the floor area of the house are probably not large enough to provide enough heat during the day. If this is the case, vents could be added at both the base and the top of a solar wall. The wall can then provide heat to the house during the day just as solar chimneys do. Although the vents need be only 10 to 12 square inches for each lineal foot of wall, they can add cost and complication. Therefore, it is best not to use them unless heat is needed during daylight hours. Thermal storage walls with vents are normally called Trombe Walls, after Dr. Felix Trombe who, in the early 1960s, built several homes with this design in the French Pyrenees. 1

One type of thermal storage wall uses poured concrete, brick, adobe, stone, or solid (or filled) concrete blocks. Walls are usually one foot thick, but slightly thinner walls will do, and walls up to 18 inches thick will supply the most heat. Further thicknesses save no additional energy. Containers of water are often used instead of concrete. They tend to be slightly more efficient than solid walls because they absorb the heat faster, due to convective currents of water inside the container as it is heated. This causes immediate mixing and quicker transfer of heat into the house than solid walls can provide. One-half cubic foot of water (about 4 gallons) per square foot of wall area is adequate, but unlike solid walls, the more water in the wall, the more energy it saves.

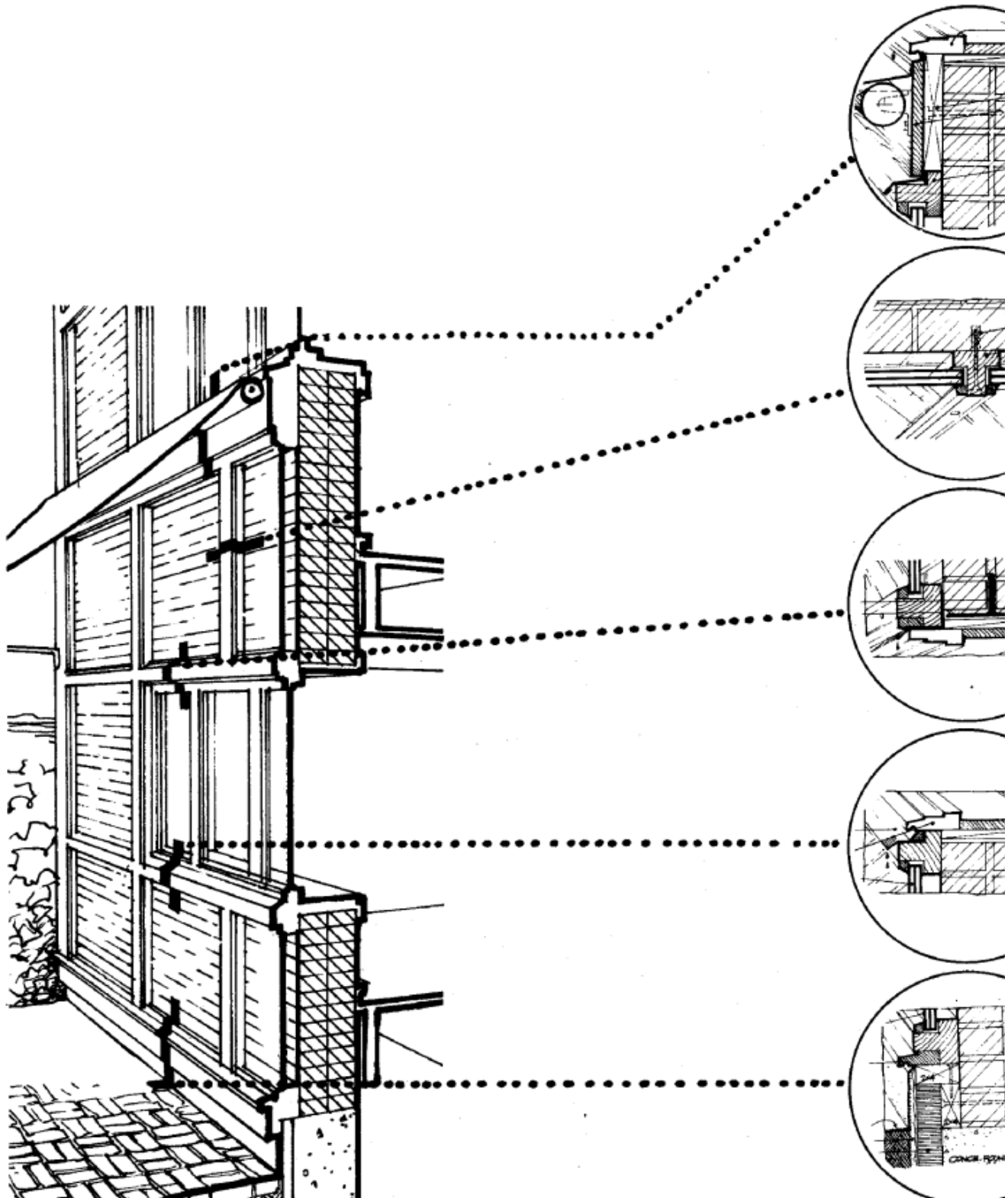
The main drawback of solar walls is their heat loss to the outside. Double glazing (glass or any of the plastics) is adequate for cutting this down in most climates where winter is not too severe (less than 5000 degree days: Boston, New York, Kansas City, San Francisco). Triple glazing or movable insulation is required in colder climates.



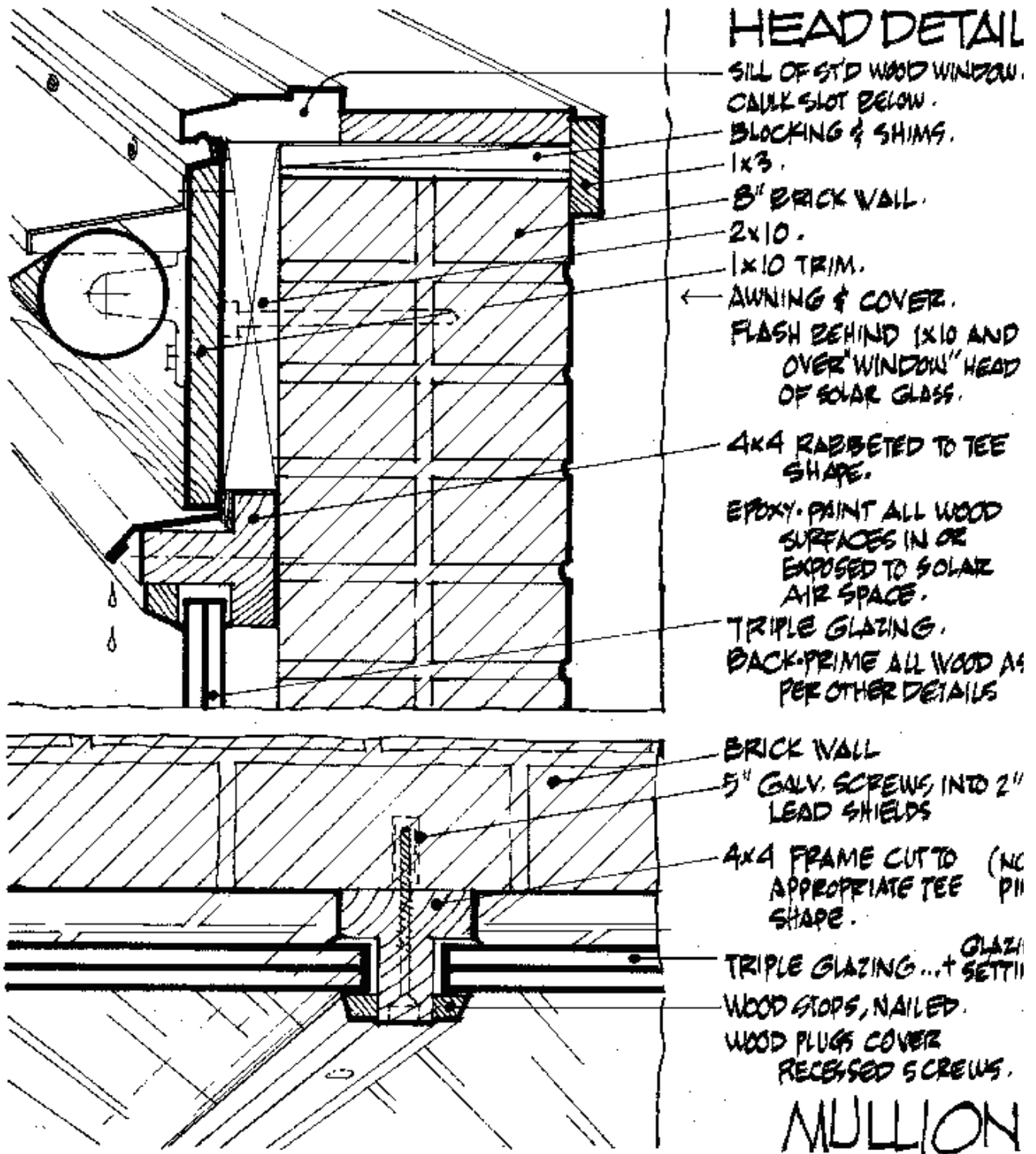
Plans for a Solar Wall

This glazed thermal storage wall is comprised of glazing frame members milled from cedar 4x4's bolted to an eight-inch thick structural brick wall. The bricks are dense paving bricks-a dark umber color on the outside, standard terra cotta color on the inside-and are laid up with all cavities filled with mortar. The triple glazed panels, designed for use in the northeast, reduce heat losses to the outside from the warm wall. Standard operable triple-glazed casement windows are incorporated into the wall to provide direct gain heating, light, views and ventilation. Double

glazing is suitable for use in milder climates. (Construction details, the Brookhaven House.)



138 Construction Details

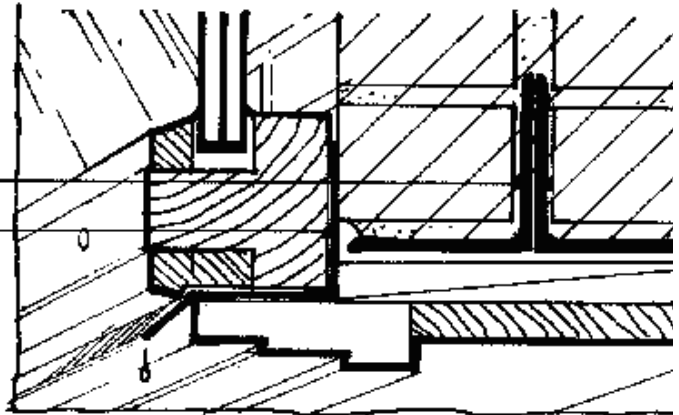



WINDOW HEAD - 3

BACK-TO-BACK STEEL ANGLES MUST
BE SIZED TO CARRY TOTAL
MASONRY WALL LOAD.

FLASHING EXTENDS UP BEHIND TEE.

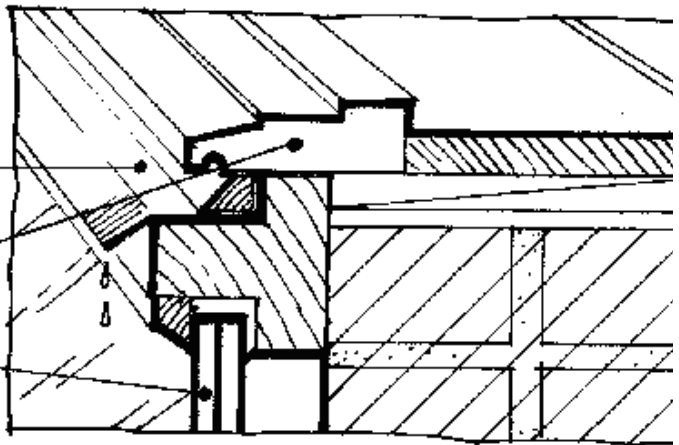
GET GOOD
ADVICE ON FASTENING
WOOD TO STEEL AND BRICK.

**WINDOW SILL - 4**

METAL FLASHING
IN  SHAPE
PROTECTS 4x4 TEE.

STANDARD WDW. SILL IS SIMILAR TO
DETAIL ON OPPOSITE PAGE.

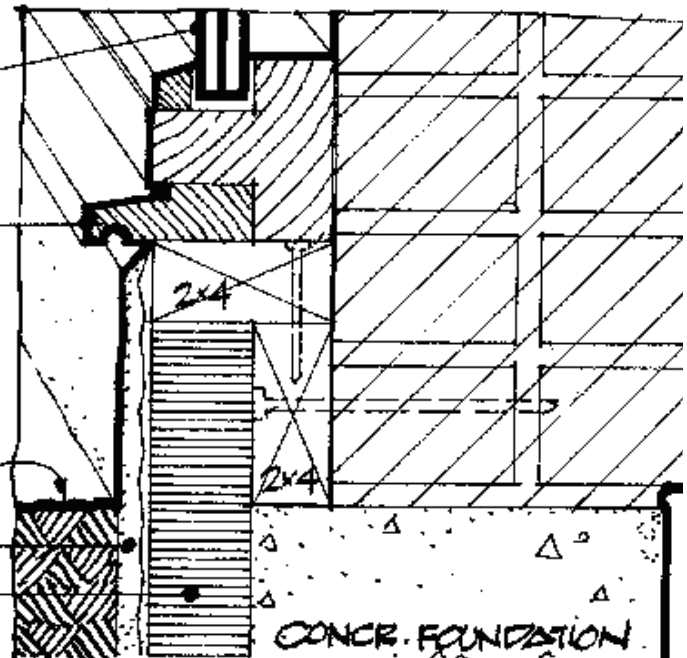
TRIPLE GLAZING.

**SILL AT GRADE - 5**

TRIPLE GLAZING IN 4x4 TEE AS BEFORE.

SILL PIECE WITH DRIP

EXTERIOR GRADE
1/2" CEMENT PLASTER ON
CHICKEN WIRE PROTECTS 2"
POLYSTYRENE BOARD INSULATION.



Other Consideration:

- ☀ The inside surface of the solar wall should not be populated with bookcases or the like that will reduce the heat transfer from the wall to the living space.
- ☀ There should be a good thermal connection between any inside wall finishes (e.g. sheet rock) and the masonry or concrete of the wall -- this will maximize the heat transfer to the living space.
- ☀ If possible, the foundation area should be insulated in the usual way with rigid insulation board that goes down a couple feet to reduce heat loss from the solar wall to the foundation. This insulation is shown in the "Sill At Grade" illustration.
- ☀ Some form of summer overheat protection is a good idea to prevent the solar wall from collecting heat and transferring it to the living space during the summer. An overhang can be used to block the summer sun, but still allow the lower winter sun to hit the wall. You can find an overhang design tool [here](#).
- ☀ Solar walls do not have as high a collection efficiency as direct gain windows or Thermosyphoning wall collectors, but can be a good choice, particularly if heat is wanted later in the day, or if a window or Thermosyphoning wall collector would be difficult to build or undesirable.
- ☀ The triple glazing shown in the plan is, perhaps, a bit over-the-top -- most Trombe walls use double glazing.

Gary 05/14/2006

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