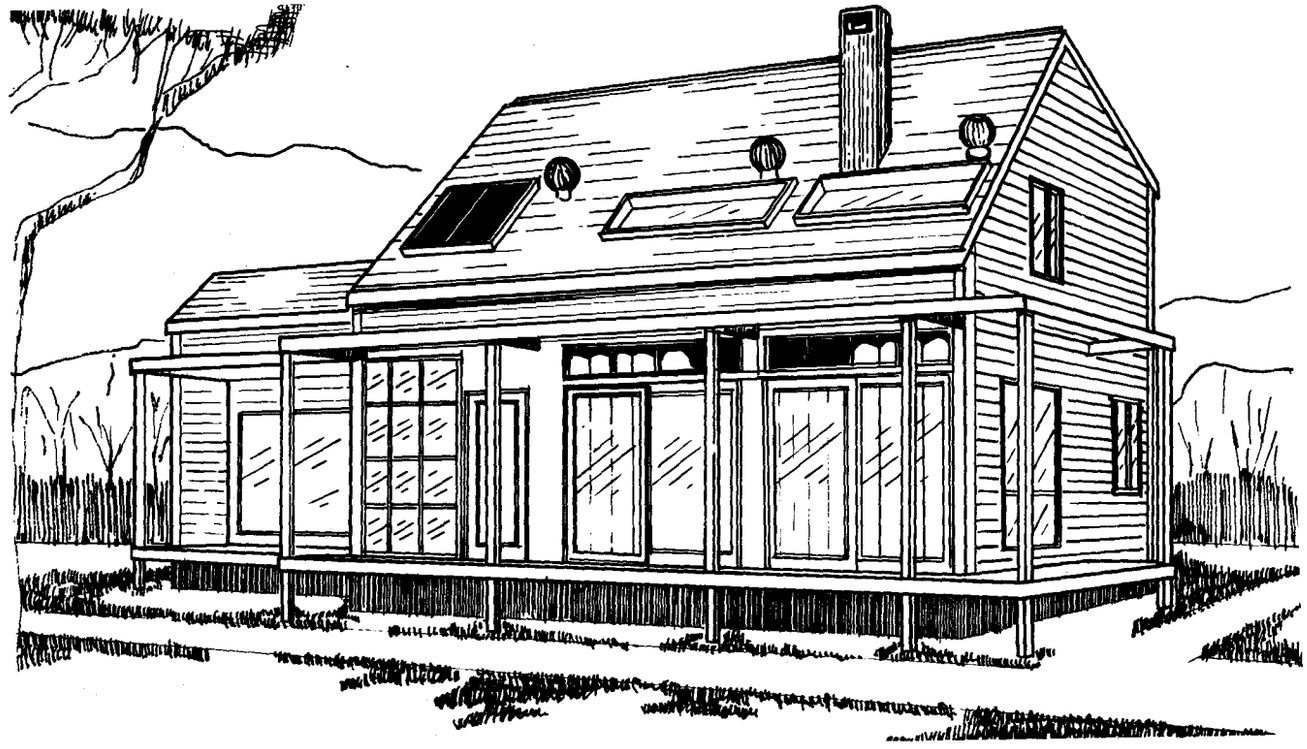
Carrboro, NC



Builder: Capricorn Building Company, Carrboro, NC

Designer: Designworks, Carrboro, NC

Solar Designer: Aircomfort, Inc., Raleigh, NC

Price: $70,000

Net Heated Area: 1304 ft²

Heat Load: 39.1 x 10⁶ BTU/yr

Degree Days: 3514

Solar Fraction: 41%

Auxiliary Heat: 4.65 BTU/DD/ft²

Passive Heating System(s): Direct gain, indirect gain

Recognition Factors: Collector(s): Double-glazed sliding glass doors, skylights, south-facing panels, 269 ft² **Absorber(s):** Water tubes, brick pavers **Storage:** Water tubes, brick pavers—**capacity:** 6781 BTU/°F **Distribution:** Radiation, natural and forced convection **Controls:** Vents, awnings, thermostat

Back-up: Air-to-air heat pump (23,500 BTU/H), woodburning stove

Domestic Hot Water: Liquid flat-plate collectors (46 ft²), 42-gallon storage

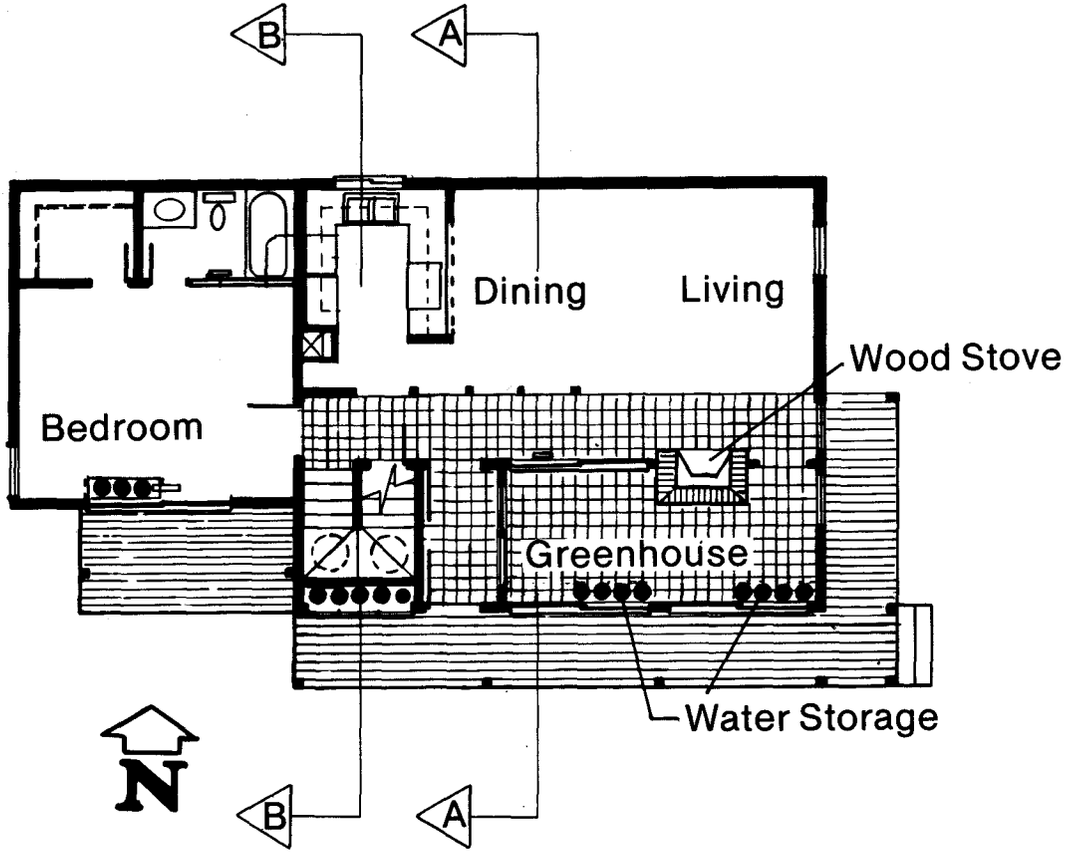
This contemporary house has been designed to compete in a very active speculative home market; the approach has been, therefore, to work largely within existing construction methods and materials to arrive at a design that is both energy efficient and economical. The lot on which this 2-story, wood-frame home is built slopes from north to south, affording it maximum exposure to the sun's path across the southern sky. Tall deciduous trees to the southwest have been left standing to deflect winter winds.

Collection of solar heat by the greenhouse at the southeast corner of the house occurs through four double-glazed sliding doors, and through a pair of Kalwall™ skylights (also double glazed) on the pitched roof. A vertical Kalwall™ **collector** is used to heat water tubes just west of the front entrance. Another pair of sliding glass doors **collects** direct solar radiation for storage in the lower-level master bedroom. Roof-mounted, active flat-plate collectors are used to preheat domestic water.

Solar radiation is **absorbed** and **stored** in the greenhouse by eight Kalwall™ water tubes, and the 1⅝-inch brick pavers of the floor.

Separating the lower greenhouse from the living and dining room behind it is a pair of sliding glass doors that allow solar heat into these areas. Water tubes are also used to **absorb** and **store** heat in the "solar battery™" within the central staircase. Three more water tubes **absorb** and **store** heat in the master bedroom.

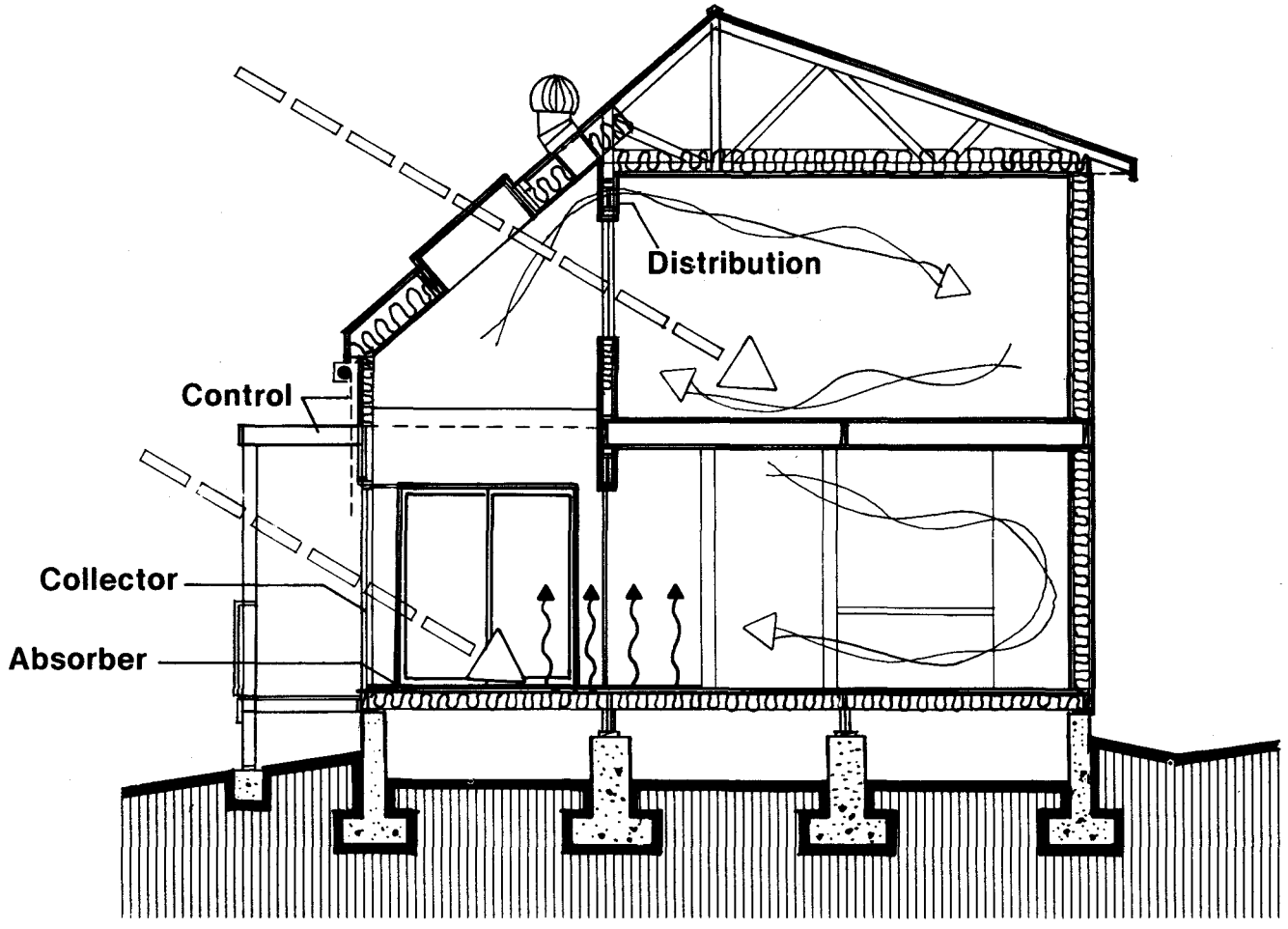
Distribution of heat is accomplished by radiation from storage masses as well as natural and forced convection. Heat that



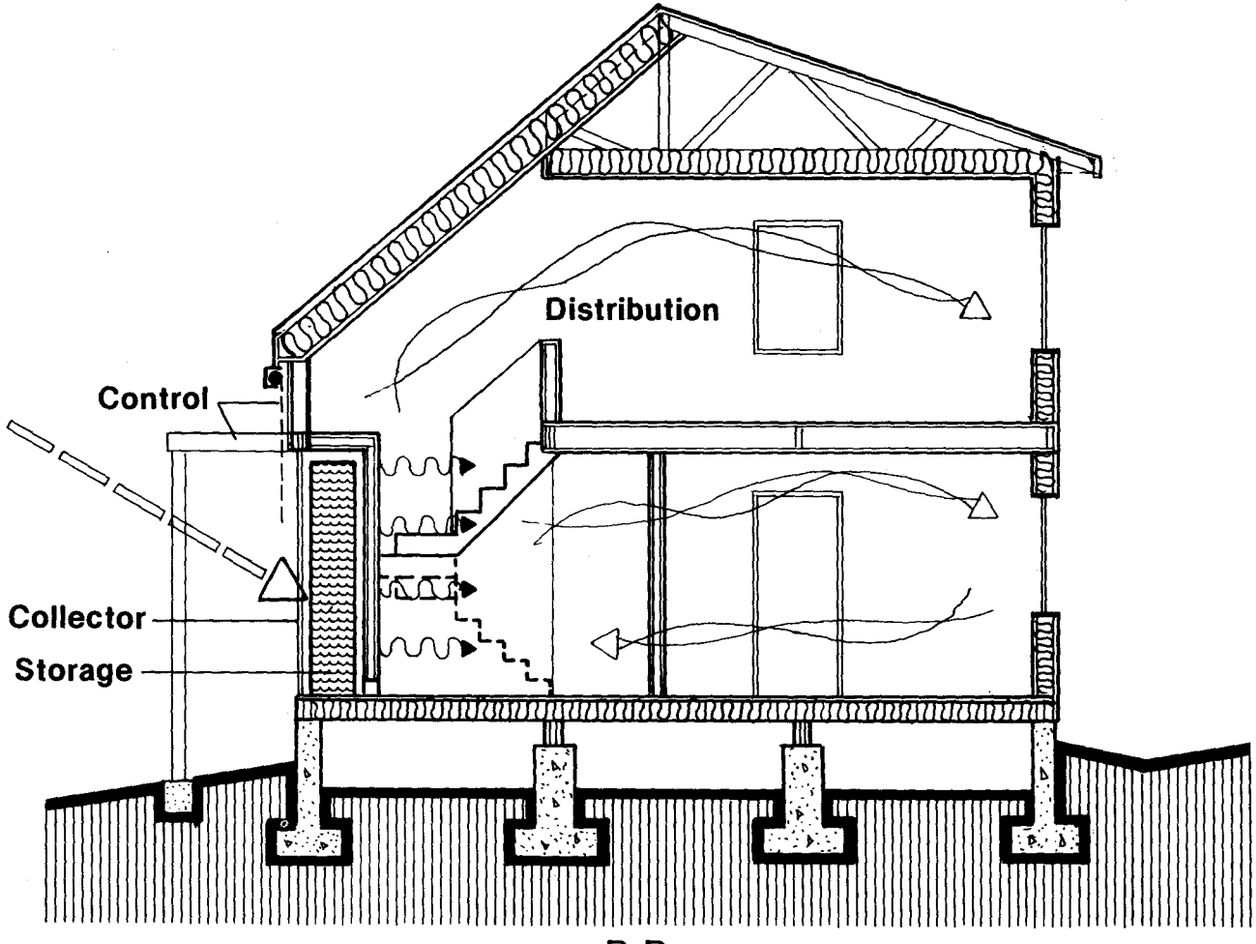
gathers near the greenhouse ceiling can either flow into upper-level living areas through a window and vents, or be drawn in by a thermostatically **controlled** through-wall fan. Heat from the water wall on the other side of the front entrance is distributed by a convective loop that pulls cool floor air into the water wall through vents, so that it can be heated and rise through hinged damper grilles at the top of the stairwell. From there it rises to the upper level. Another natural convective loop is set up when bedroom doors are left open so that the heated air can pass through north wall floor vents as it cools and loses buoyancy. At night when storage masses are supplying heat, a fan draws warm air that has risen to the ceiling of the utility area at the top of the stairs through a vent to the heat pump air handler. From there it is distributed to all rooms through ducts and floor registers. The master bedroom, too, is included in this network. When heat from storage masses is insufficient to meet the demands of the thermostat, the heat pump will turn on to make up the difference. The woodburning stove can be fired up to restrict use of the heat pump.

During summer, the storage masses are shaded by retractable awnings over all southern apertures. Heat that does gather in the greenhouses can be vented by opening ducts that connect to three 14-inch turbine fans on the roof. The turbines can be used to vent the entire house by opening the doors and windows to the greenhouse. Cross-ventilation is set up by opening east and north bedroom windows. A central air conditioning system also uses the central duct system.

Extensive caulking and weatherstripping, and a 6-mil vapor barrier throughout the entire energy envelope help to reduce infiltration. Floor insulation over the crawl space is rated at R-19, walls are R-11, and the roof is R-30.



A-A



B-B

This plan is from the book
"Passive Solar Homes – 91 new award-winning, energy-conserving single-family homes",
The U.S. Department of Housing and Urban Development, **1982**

The solar homes designs in this book were the winners of HUD's fifth (and final) cycle of demonstration solar homes. The 91 winning home plans in the book were selected from 550 applications from builders.

This was a time of great interest and activity in the passive solar home designs – many of the winning homes show a level of innovation not found in most of today's passive solar designs.