Gaithersburg, MD

Builder: Trellis and Watkins, Inc., Columbia, MD

Designer: Trellis and Watkins, Inc., Columbia, MD

Solar Designer: Trellis and Watkins, Inc.

Price: $190,000

Net Heated Area: 2737 ft²

Heat Load: 91.2 x 10^6 BTU/yr

Degree Days: 4224

Solar Fraction: 27%

Auxiliary Heat: 5.72 BTU/DD/ft²

Passive Heating System(s): Direct gain, sun-tempering

Recognition Factors: Collector(s): South-facing glazing, atrium skylights, 449 ft² **Absorber(s):** Ceramic tile-covered concrete floor, masonry fireplace/planter **Storage:** Ceramic tile-covered concrete floor, masonry fireplace/planter—**capacity:** 9,518 BTU/°F **Distribution:** Radiation, natural and forced convection **Controls:** Registers, ducts, overhangs, shades

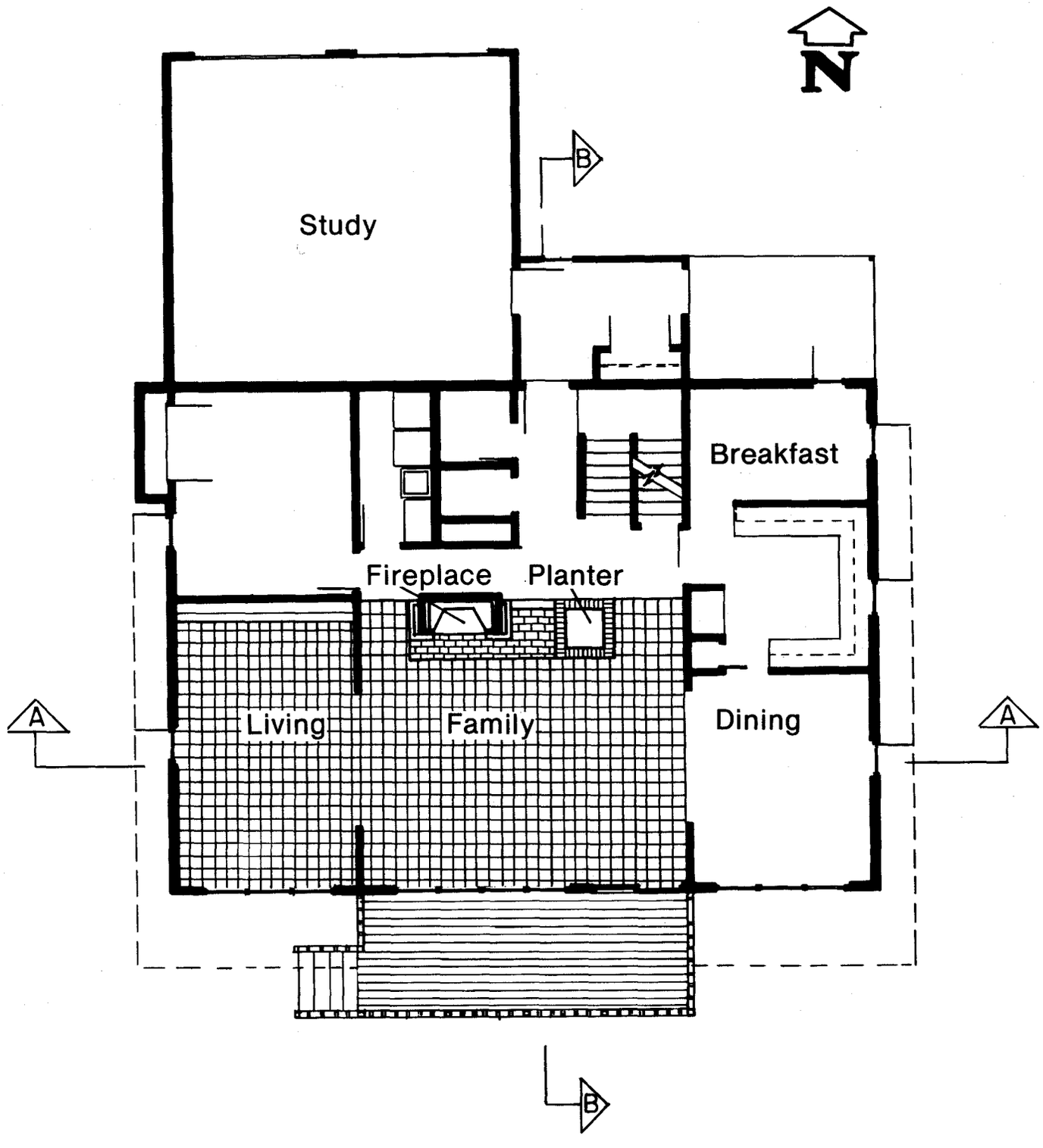
Back-up: Air-to-air heat pump (35,000 BTU/H)

Passive Cooling Type: Natural and induced ventilation

A partially wooded lot that stretches along a north-south axis is the site for this custom house. The house is located at the north end of the site. From there, the land drops gradually to the south, bottoms out across a creek, and rises again on the opposite side. This location allows good exposure on the south side for maximum sunlight and summer breezes, as well as protection from winter winds which prevail from the northwest. The compact form of the house reduces exterior surface area, with the garage on the north side and the roof of the house providing one continuous surface that deflects the wind. Additional buffer spaces, such as closets, bathrooms, laundry, and stairs are located on the north side. There is also an enclosed, unheated air-lock entry connecting the house with the garage and the covered front porch. There are minimal windows on the north, east, and west elevations.

The house's centerpiece is a 2-story combination family room/atrium that opens onto all the other spaces. The kitchen and breakfast room are located to the east to receive morning sun while the living room is oriented for late afternoon sun on the west. On the second floor of the atrium, there is a balcony onto which all the bedrooms open.

The low, winter sun is **collected** through all the south windows and through three skylights in the roof of the atrium. Some of the solar energy heats the south-facing spaces directly, and the remainder is **absorbed** and **stored** by the ceramic tile-covered concrete floor and a masonry fireplace/planter. At night, heat **distribution** is by radiation back to the living spaces from the floor and planter. The warm floor also induces a convective flow that **distributes** heat to the second-floor spaces. The windows are triple

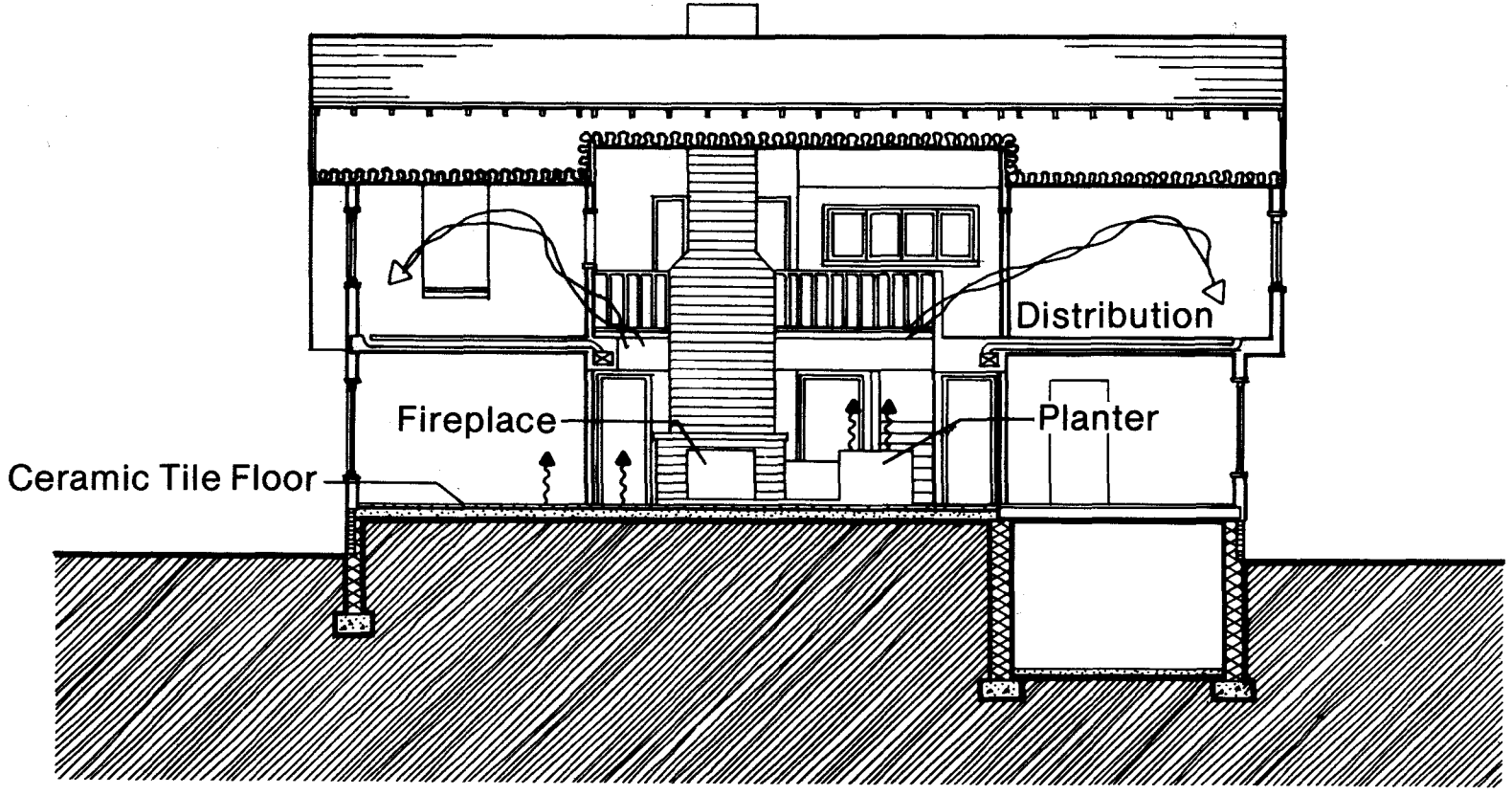

N
Study
B
Breakfast
Fireplace
Planter
A
Living
Family
Dining
A
B

glazed to **control** heat loss at night, and drapery space has been provided that will allow the homeowner an extra degree of protection. On very cold days, when the back-up heating system is in operation, the heat pump draws its return air from the top of the atrium space, thereby using and recycling the warm air that has stratified there.

A 4-foot wide deck, running the full length of the second floor, shades the first-floor glazing from midday sun between April and August. The second-floor glazing is shaded by a 2-foot overhang. In addition, these windows are protected by split bamboo drop shades that are manually controlled from the deck. The three skylights provide the only direct sunlight to the atrium space for a substantial portion of the summer. Because there are operable windows on all sides of the house, natural cross-ventilation will reduce the need for heat pump air conditioning on all but the hottest, most humid days of the year.

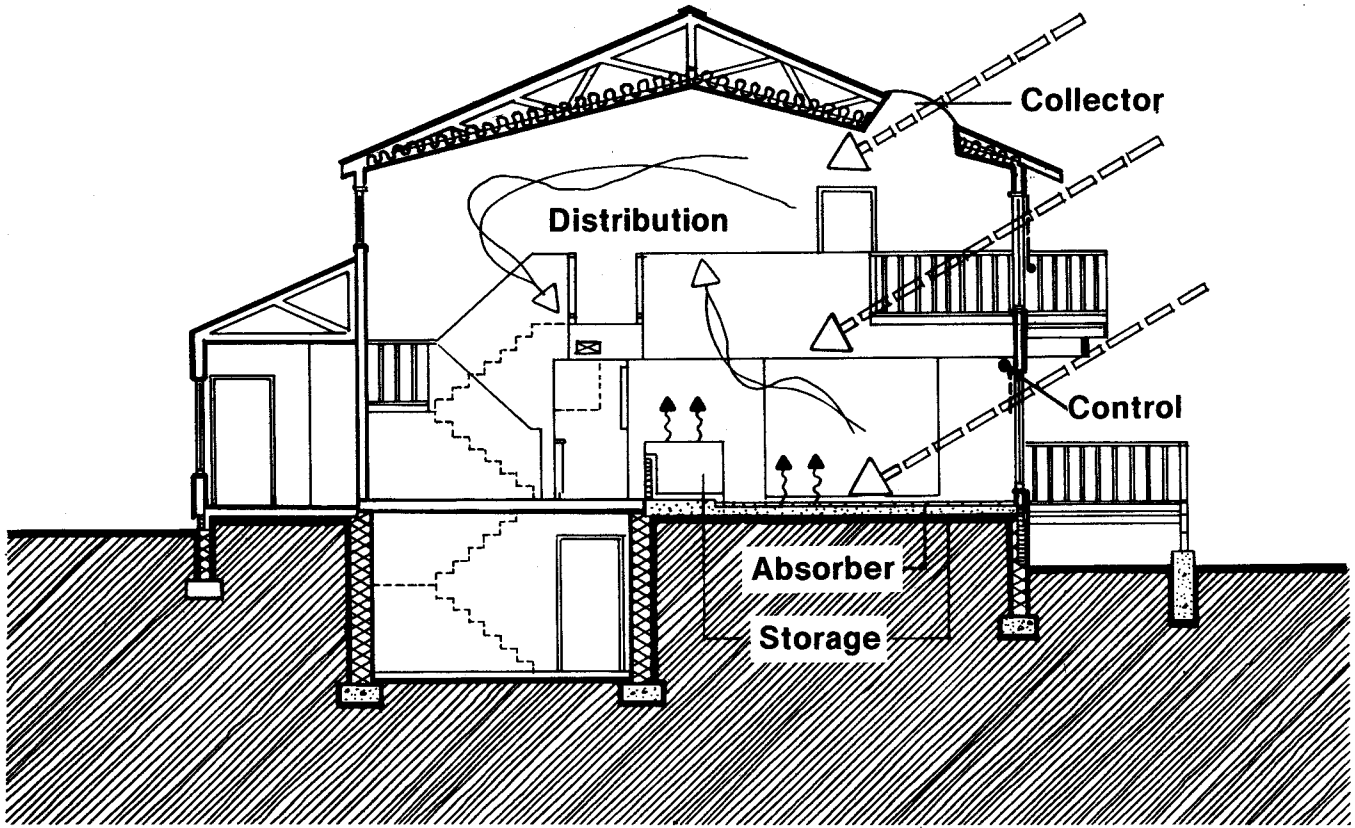
The building is well insulated for this climate; walls are 2- x 6-inch wood studs with full fiberglass batt insulation for a total insulating value, with sheathing and cedar siding, of R-23. Ceiling construction above the second floor includes 10 inches of fiberglass batts in the joists; the total roof value is R-31. Attic spaces are well ventilated with soffit and ridge vents. Where there are overhanging exterior soffits, as at the window recesses, 5½-inch batts are installed in the construction for a total value of R-24.

The floor over the unheated basement includes 3½-inch batts for a value of R-14.



A-A

Along the house perimeter, a 1-inch foamboard (R-5) is installed across the face of the first-floor slab and turns under the slab for 2 feet. Finally, all cracks around windows, doors, and exterior corners are hand-chinked prior to insulation to minimize air infiltration into the building envelope.



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.