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The Byland House: A Solar Monticello

Fayette, Missouri

James McCullar

The design and construction of the Byland house, commissioned in 1977, took nearly three years and landscaping remains to be completed. Yet the house, now occupied for several years, seems to belong in the open countryside near the central Missouri town of Fayette.

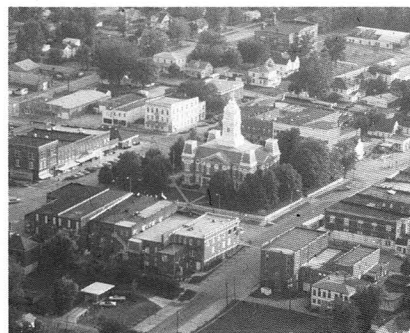
The scheme refers to a search for an elusive set of essential relationships between a building's function, form, image, and context. These relationships, once an intuitive part of architecture, have been obscured in the experience of the modern movement. The rejection of past forms and associations and the reliance on functional analysis for the creation of a new architecture has led to a proliferation of novel, discrete, and often inaccessible solutions that have little meaning other than shelter.¹ At the present time, when much of modern architecture is undergoing re-evaluation, the pattern of disassociation of images from their function and surroundings seems to remain. The relaxation of the prohibition against the past has released a rush of new images, but not necessarily in relation to function or context. A latent feeling of superficiality persists, suggesting style more than substance.

Modernist design has been influenced by the program, as in the dictate "form follows function," and occasionally by the



physical context.² The most evident relationship to both program and context is that of typology, which was rejected by modernism in the search for a new order, where a type may simultaneously express a function, be found within a context, and suggest cultural associations.³ The adaptation of a relevant typology can thus result in a building form that accommodates both programmatic expectations and its surroundings, with the inherent elasticity found in inclusive concepts. This suggests a superimposed relationship of function, typology, and context simultaneously expressed.

The design for the Byland house began with several trial and error schematics of a familiar nature which were soon discarded. Added to the program was a solar requirement which, while innocuous at first, soon became a primary basis for the design. The design took shape after a functional/solar analysis, which, with



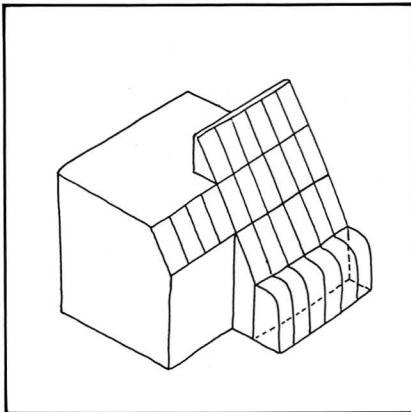
contextual references, suggested a typology—the eighteenth century villa—hence, a "Solar Monticello." Once established, the scheme underwent considerable adjustments influenced by technical requirements, the local context, and—perhaps the most difficult—a restricted budget. A brief discussion of the program, the Fayette context, and the systems outlined above—functional analysis, typology, and contextual references—delineates the evolution of the design.

The program stipulated by the owners, a professional couple with a teenage daughter, was very complete. They wanted a one-level, efficiently planned, passive and active solar house that would relate to its surroundings. They had researched available active systems and had selected the Thomason "Solaris" as the most cost effective. While not adverse to gadgetry, they wanted to avoid the typical high-tech image. The house would display their antique

Missouri furniture collection and be well organized into efficient living and bedroom zones. Particular attention was given to planning the kitchen, baths, and other service areas. As the budget was limited, materials had to be locally available. The site included four open acres sloping south to a lake located several miles from town. I was familiar with the Byland's living patterns, as I had visited them often in Fayette and had designed their dental office several years earlier.

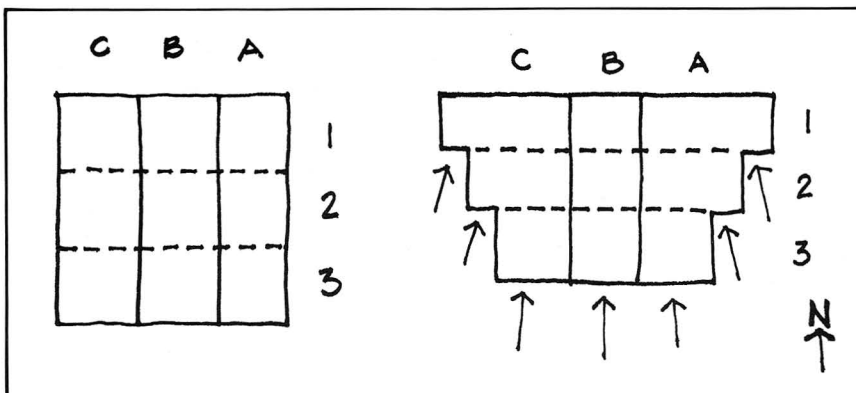
The context for the Byland house is an area along the Missouri River known as "Little Dixie" that retains a remarkable intact landscape of farms and small towns. The area was settled in the early- and mid-nineteenth century mostly by southerners, who brought with them a classically derived architectural tradition nurtured in Kentucky and other eastern states (Figure 1). Fayette, a small town of 3,000 people, is organized around a court house square whose nearly continuous commercial facades form a "false front" urban space behind which are relatively informal, modest neighborhoods of clapboard and occasionally brick houses that form a harmonious counterpoint to the surrounding farm area (Figure 2).

A functional analysis of the program began with a critique of typical solar designed houses (Figure 3). In active designs, col-



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1. House, Fayette, Missouri, mid-nineteenth century
2. Court house square, Fayette, Missouri, aerial view
3. Typical solar designed house, diagrammatic sketch
4. Byland house, diagrammatic analysis
5. Byland house, plan
6. Byland house model, front view
7. Byland house model, rear view



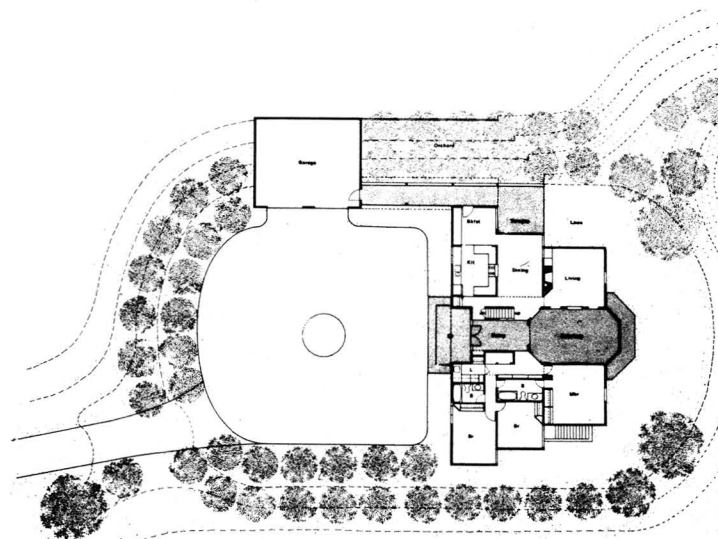
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lectors are usually placed over the south elevation, thereby blocking the relationship between interior and exterior, and preventing the opportunity for passive solar gain. In passive designs, the typical add-on greenhouse places an additional barrier between interior and exterior, is difficult to protect against heat loss, and is removed from the rear areas of the house. For the Byland house, it seemed practical to place the collectors at the north edge of the roof area in order to free the south elevation for passive collection, and to transform the greenhouse into an interior solarium. In this configuration, warmth gathered through the solarium can be transferred uniformly to the surrounding house.

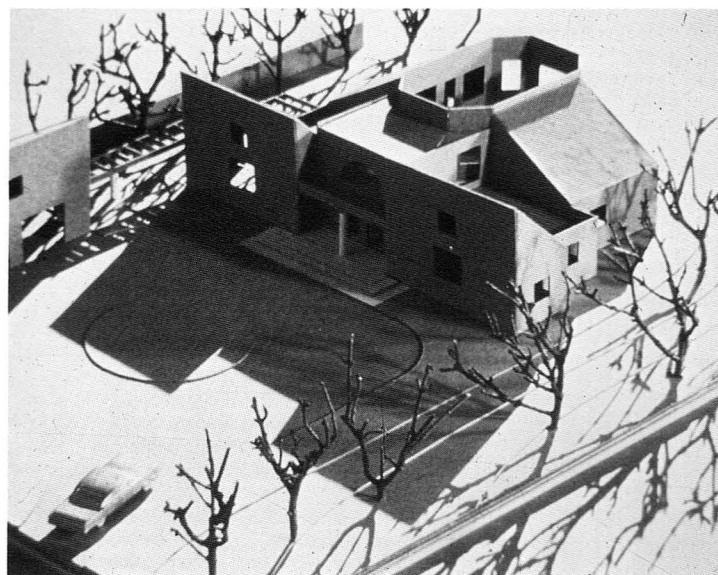
The programmatic requirements for a one-level house suggested the organization of distinct living and bedroom zones on each side of a solarium/circulation zone. This diagram was then subdivided

to form a nine square pattern, which, in turn, was transformed in shape to permit southern exposure to all the spaces along the east and west sides (Figure 4). Each of the nine plan segments represents a room with appropriate support spaces (Figure 5). Volumes are expressed in response to their relative importance and solar functions. For example, the solarium is two-stories high to permit maximum penetration of winter sun, and shed roofs facing south accommodate the solar collectors (Figures 6-7). In order to build a one-level house on the sloping site, it was necessary to create a flat area through cut and fill, which, due to topography, could be connected to the country road only at the northwest corner of the site.

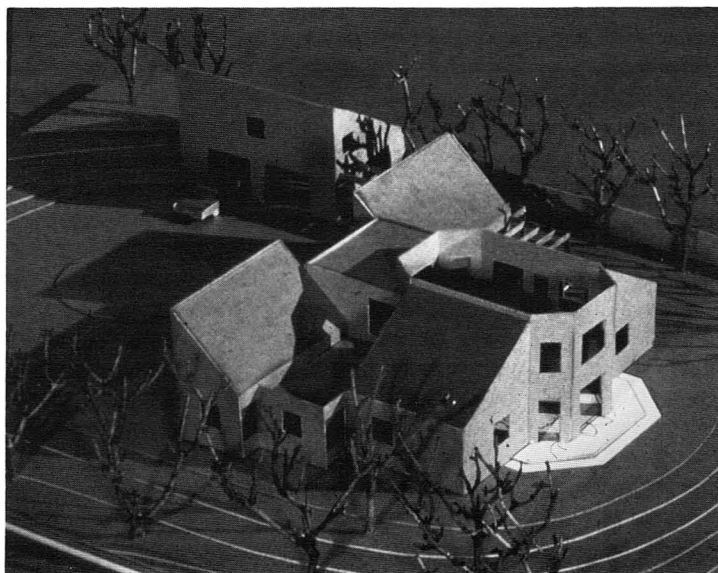
The initial diagram for the house suggested Borromini's cloister at San Carlo as a form for the solarium (Figures 8-9). The further development of the functional analysis led to the organization



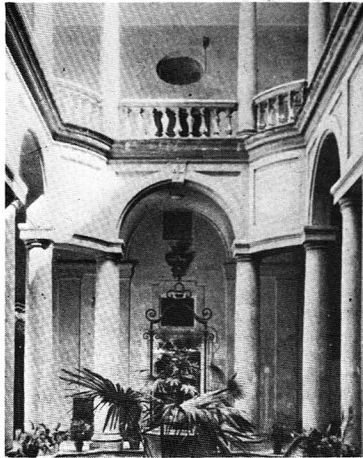
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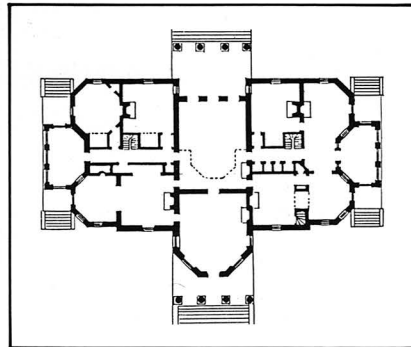
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of the villa derived from Vaux-le-Vicomte, and one used by Jefferson at Monticello, where the large principal rooms form a linear central core (Figure 10). The polygonal projection of Monticello's drawing room and the salon of the French plan type also seemed an appropriate form for the solarium. While the early Fayette houses are much reduced in scale due to the conditions of the remote frontier, they share a basic element of this type—axial organization around a central hall. The characteristics of eighteenth century French villas, such as Champs, moreover, suggested a scheme already evident in the preceding functional analysis for the Byland program (Figure 11):

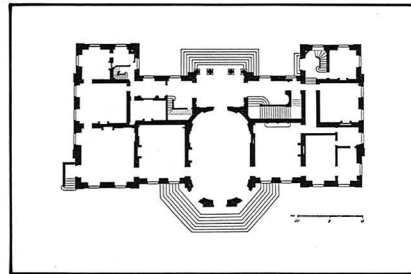
- emphasis on rational planning for domestic convenience, intimacy and comfort, often resulting in asymmetrical functional relationships within a symmetrical form;
- axial organization of the site plan to include sequentially an arrival courtyard, entry hall, salon, and private garden;
- octagonal or oval salon as the dominant space, with a direct relationship to the garden;
- expression of the plan, especially the salon, in the garden facades.

The second stage of the design development emerged from the adaptation of this plan type to the program. The transformation becomes evident in diagrams of the plan of Vaux-le-Vicomte where the central zone of entry and salon remain intact, but the wings are fragmented by the requirements of solar orientation of individual rooms (Figure 12). In the Byland house plan, the solarium and entry work perfectly in an organization similar to that of Champs, but the wings have evolved even further in response to specific functional requirements. As a consequence, the expression of the solarium on the south elevation refers more to later English and American houses than to either Monticello or Champs (Figures 13-15). Thus the adaptation of a typology produced a scheme comparable in function, but richer in other possibilities, than could have been achieved by a functional analysis alone.

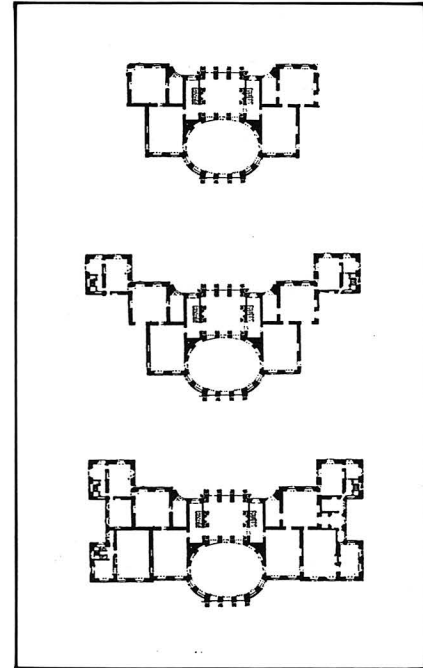
Contextual references reflecting the dualities of classical and gothic, and European and American imageries found in Fayette represent a third system in the design. These are evident in the expression of the plan discussed above. The axial organization of the entry/solarium, expressed as stuccoed volumes, forms a core of the house around which locally derived clapboard sheds and



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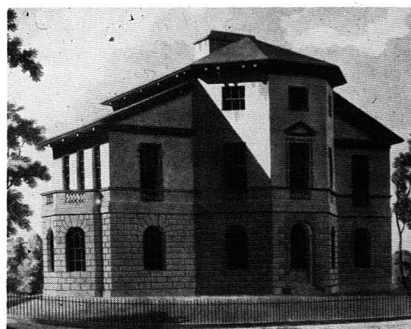
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8. Francesco Borromini, San Carlo alle Quattro Fontane, Rome, cloister, 1635-1636.
9. Byland house, solarium
10. Thomas Jefferson, Monticello, 1793-1809, plan

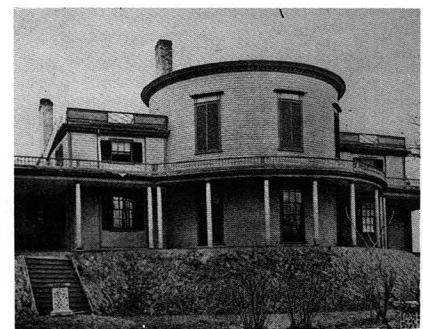
11. J. Bullet de Chamblain, Champs, 1703-1707, plan
12. Louis LeVau, Vaux-le-Vicomte, 1656-1661; transformations of the plan
13. Byland house, south elevation



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14. Sir Robert Taylor, Asgill House, 1758-1767



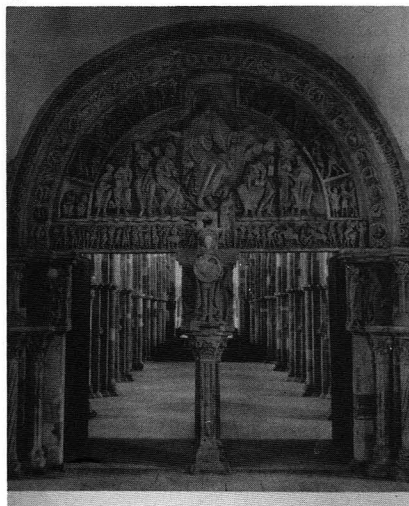
15. Charles Bulfinch, Swan House, Boston, circa 1796



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16. Byland house, north elevation
 17. False front commercial building, Fayette, Missouri, probably late nineteenth century
 18. Byland house, entry
 19. Benedictine Abbey, Church of La Madeleine, Vezelay, 1120-1140, portal
 20. Thomas Jefferson, University of Virginia, Pavillion IX, 1821



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flat roofed structures have been attached (Figure 16). The high courtyard facades formed by the backs of the solar collectors, with small windows, recall the American "false fronts" of local commercial buildings and create an implied enclosure around the gravel courtyard (Figure 17). Only the entry suggests the European sources of the solarium behind the facade. This duality is supported by the movement of light, as the sun touches the north facades only in spring and summer, while the spaces behind are filled with light the year around. From the south, the projecting solarium, recalling the brick bay windows of local houses and the octagonal bandshell on the court house square, suggests the idea of a ruined octagon to which later structures have been added.

The front entry, split by a column that symbolically supports the arched window above, is an image found in the upper windows of the Fayette court house (Figure 18). This element is also derived from Romanesque church portals and the facade of Pavillion IX at the University of Virginia (Figures 19-20). Thus the most authentic element in the house, a white tuscan column typical of those found in Fayette houses, is transformed into an unexpected role. The column also represents a vertical axis in solar geometry and is at the intersection of the north-south midday, and the east-west equinox, axis. To further express the equinox axis, a dark red moulding is set across the clapboard "false fronts" to accentuate their implied two dimensionality.

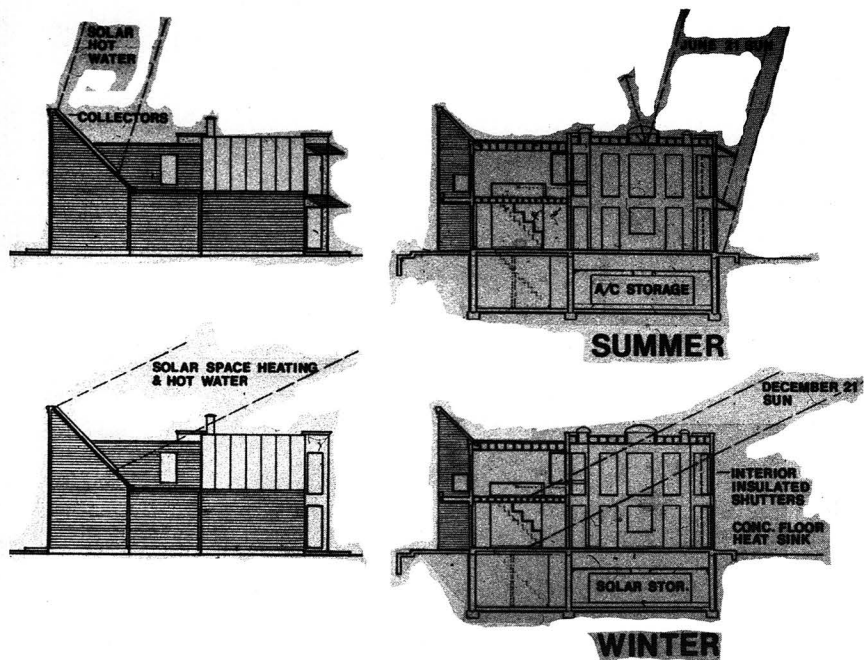


21. Byland house, solarium sunshades

With this development of images, the design reaches completion. Without the underlying order given by function and typology, this imagery would be only superficially applied without a necessary relationship to the function or substance of the house. And, conversely, the expression of function, or the program, also finds a relationship to the surrounding context.

Passive and solar concepts for the Byland house contribute, often in unexpected ways, to the quality of the interior environment. Each room is oriented south to a lake view. The solarium is the principal light source for the interior. The concept of an indirect light

source is supported by the need to protect furnishings from direct exposure. The solarium is supported by an active collector system that provides space heating, domestic hot water, and assists in summer cooling. Summer cooling is achieved by a heatilator fireplace, ceiling and attic fans and by insulated (R-10) interior shutters, exterior sunshades, and well insulated walls (R-24) and ceilings (R-30) (Figure 21). The interior shutters function as apertures in the admission of light and in the control of heat gain and loss. Skylights and north facing clerestories provide daylighting and balance the intensity of south light.



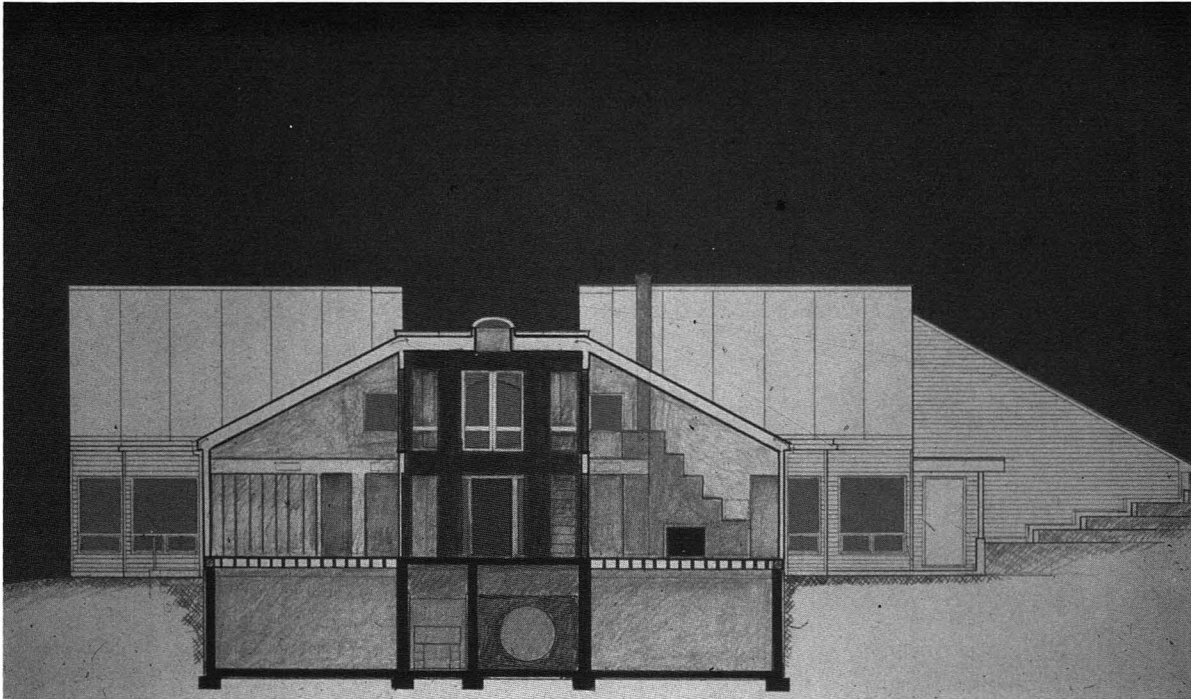
22. Byland house, solar diagrams

In winter, the sun penetrates the full length of the solarium and fills the house with light (Figure 22). The solarium's dark, polished concrete floor acts as a heat sink. In the evening or during cloudy days, the shutters can be closed to conserve energy. Low velocity air is distributed by an oversized duct system from the solar/rock storage directly below the solarium, which has a three to four day reserve capacity (Figures 23-24). Back up heating is provided by hot water fans in the duct supply from an oversized hot water heater and/or by the fireplace.

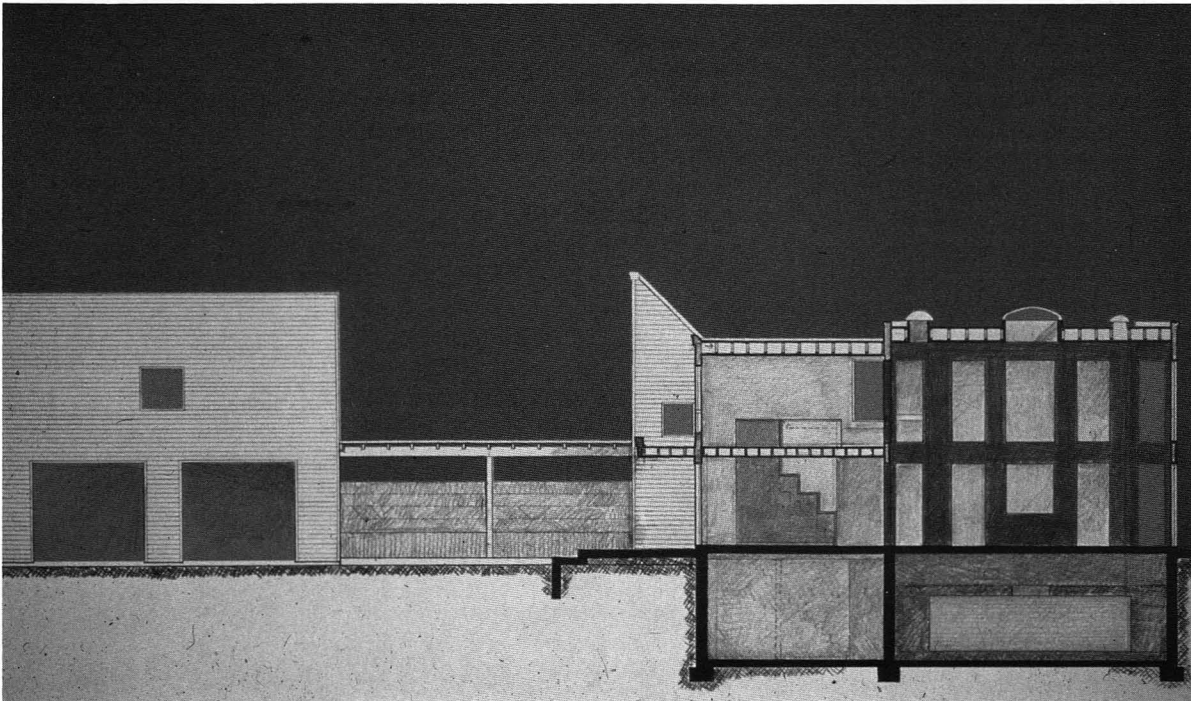
In summer, demountable redwood sunshades protect the south windows. Depending on the outside air temperature, the interior shutters form a second layer of protection. During a hot day, the skylights and clerestories provide sufficient daylighting to permit the windows to be shuttered, recalling the feeling of a traditional southern house. The most remarkable feature of the Thomason "Solaris" system is its assistance in cooling. In summer, when the collectors supply only

the domestic hot water preheat tank, the water/rock storage is used as a storage for cooled air at night when the A/C compressor and coil (located in the return air chamber) operate to take advantage of lower outside temperatures. The system operates from 10 p.m. to 6 a.m. and permits A/C components to be sized at forty percent of normal capacity. During a recent heat wave, inside temperatures, protected by sunshades and shutters, were consistently maintained in the low 70s.

The Byland house has gained a favorable acceptance in the Fayette community—perhaps a most difficult test for any design. Depending on the viewer, the house is considered as traditional, solar, or modern. The owners find it not only functional and economical in energy consumption, but also fun to live in. Perhaps most significantly, the owners have become intrigued with the various references of the design, to which they have come to refer as the "genealogy" of their house.



23. Byland house, cross section



24. Byland house, longitudinal section

NOTES

1. The interiors of modern hospitals, for example, are almost incomprehensible.
2. Graham Shane, "Contextualism," *Architectural Design*, vol. 46, no. 11.
3. Alan Calquhoun, "Typology & Design Methods," *Perspecta*, vol. 12. Not all twentieth century buildings have adhered to the dictum against typology: Frank Lloyd Wright's Guggenheim Museum is a modern reinterpretation of both the classical rotunda and the pre-modern museum typologies.