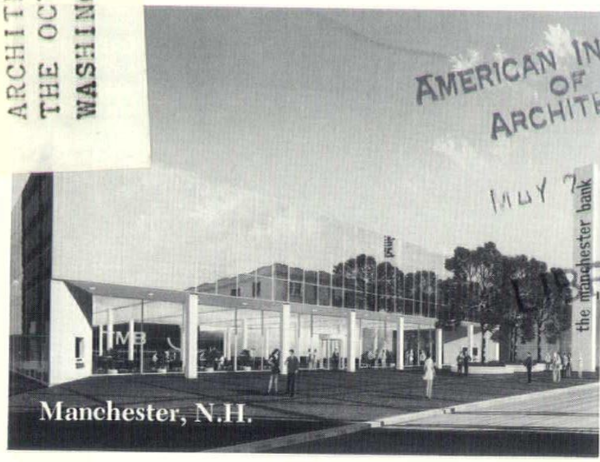
new england Architect

& NEW HAMPSHIRE ARCHITECTURAL REVIEW

April 1974



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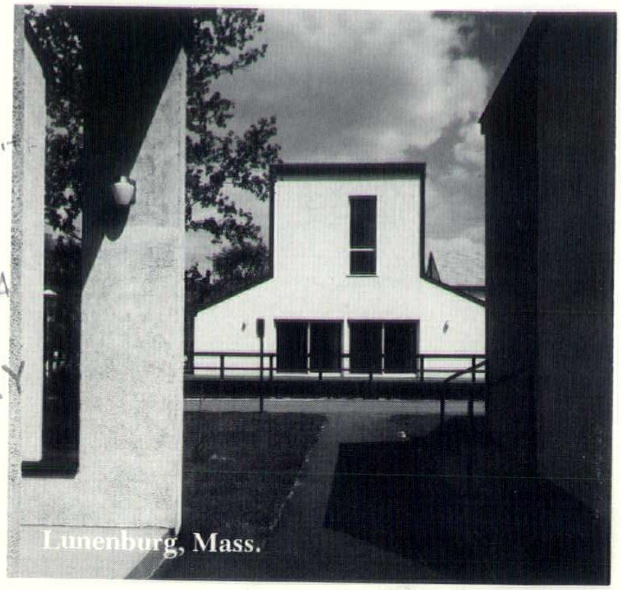
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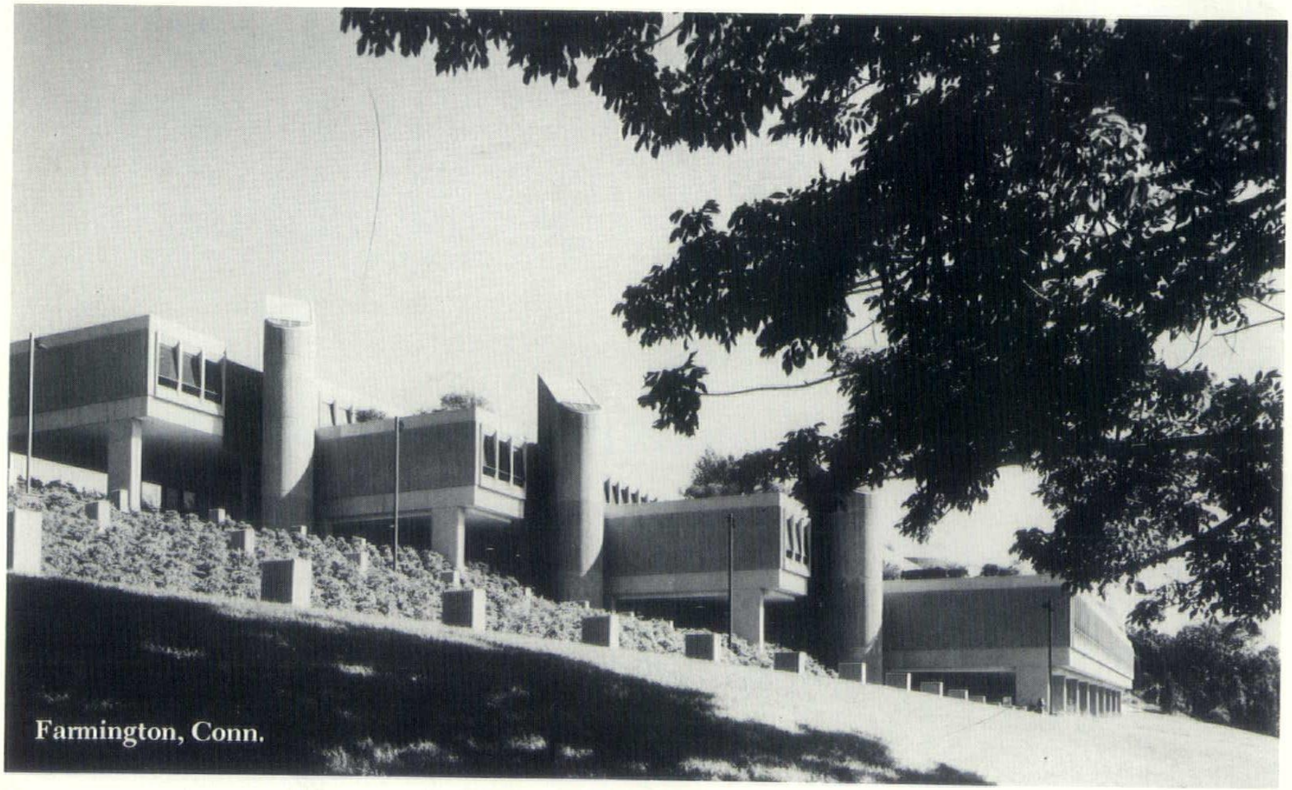
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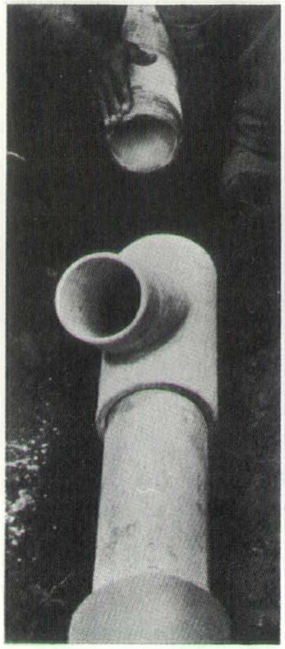

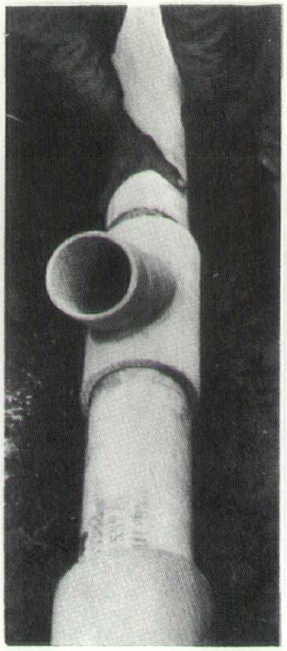

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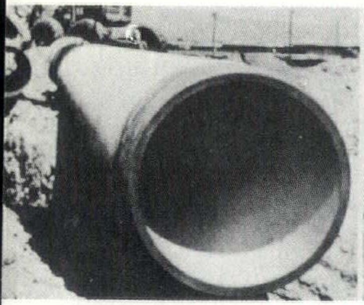

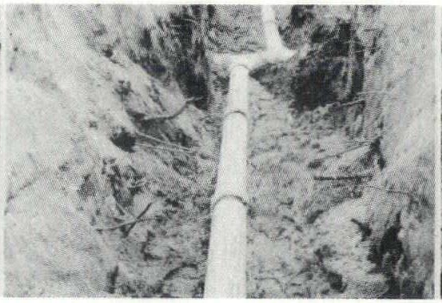

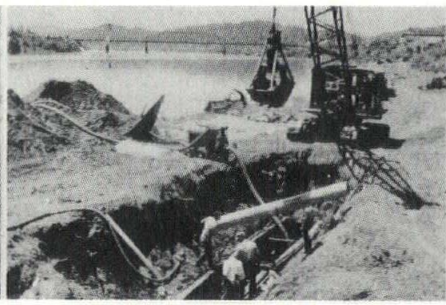

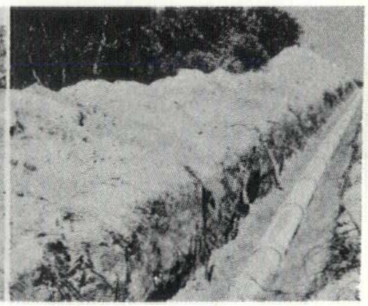

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NOTES & COMMENTS

Ritchie Opens Birmingham Office

THE Ritchie Organization, architects, engineers, and planners, has opened a new regional office at 236 Goodwin Crest, Birmingham, Alabama. Associate in charge is Erich R. Griebling, AIA.

"The expansion of our practice to service the growing south central and southeast regions is an important and major step for our firm," said Donald Ritchie, AIA, president of the 65-year-old firm which is based in Chestnut Hill, Mass. The new branch is a general practice office with a specialty in the planning and design of health care facilities. Full architectural, engineering and planning services are available for institutional, commercial and residential building types.

Birmingham's rapid growth within the past decade in both commerce and services was cited as a major determining factor in the firm's move to the city. Since the start of the '70's decade, nearly 100 new businesses have located in a 50-mile radius, attracted by fine land and water transportation facilities, low tax base and low construction costs. Total building awards (dollar value) jumped 218% in the 10-year period ending 1972.

The city is a major regional and national center for medical treatment, teaching, and research. Among the facilities providing the area a total of more than 5,200 beds is the Baptist Medical Centers, the largest hospital system owned by a religious group in the U.S. Currently, The Ritchie Organization is retained as project architects for the Baptist Medical Centers, Birmingham, and the Lakeshore Hospital, Homewood.

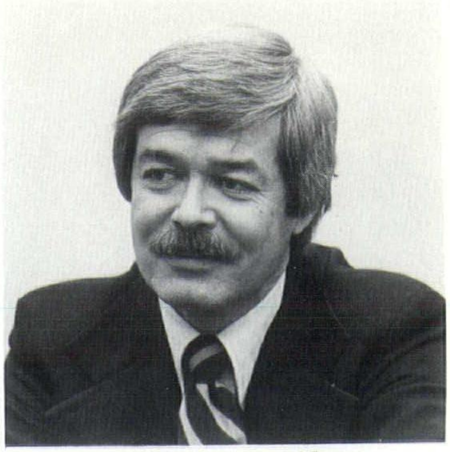
Supervising the coordination activities of the new Birmingham office with the main office is Lawrence Partridge, AIA. Both Mr. Partridge and Peter M. A. Moyes, AIA, Director of Development for Ritchie, have their offices in Chestnut Hill and make frequent trips

Erich R. Griebling

Donald Ritchie

side of Boston) and in the Ft. Lauderdale, Fla., and Birmingham regional offices.

DONALD RITCHIE, AIA, president of The Ritchie Organization, heads the architectural engineering and planning firm founded 65 years ago by his father, James H. Ritchie. Mr. Ritchie was educated at Harvard University and the Massachusetts Institute of Technology. He is a member of the American Institute



Lawrence Partridge

of Architects, the American Hospital Association, and the Birmingham Chamber of Commerce. He also directs the activities of the firm's Ft. Lauderdale, Fla. regional office.

ERICH R. GRIEBLING, AIA, associate in charge of the new office, joined the firm eight years ago after receiving his B. Arch. from Miami (O.) University. He has worked as a project designer in both the main office, and in the Ft. Lauderdale, Fla. regional office. Some of the projects for which he has served as designer are: South Miami (Fla.) Hospital; Mass. Mental Health Center, Boston; Read Memorial Hospital, Hancock, N. Y.; and Memorial Hospital, Sarasota. He is currently project designer for the Baptist Medical Centers, Birmingham, and Lakeshore Hospital, Homewood, Ala.

(Continued on page 25)

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April 1974 Volume 5 Number 9

features

departments

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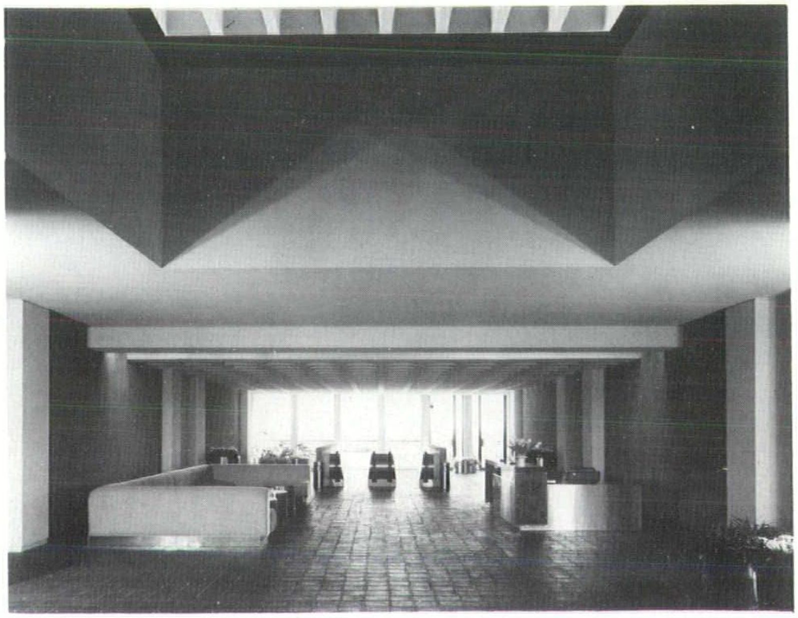
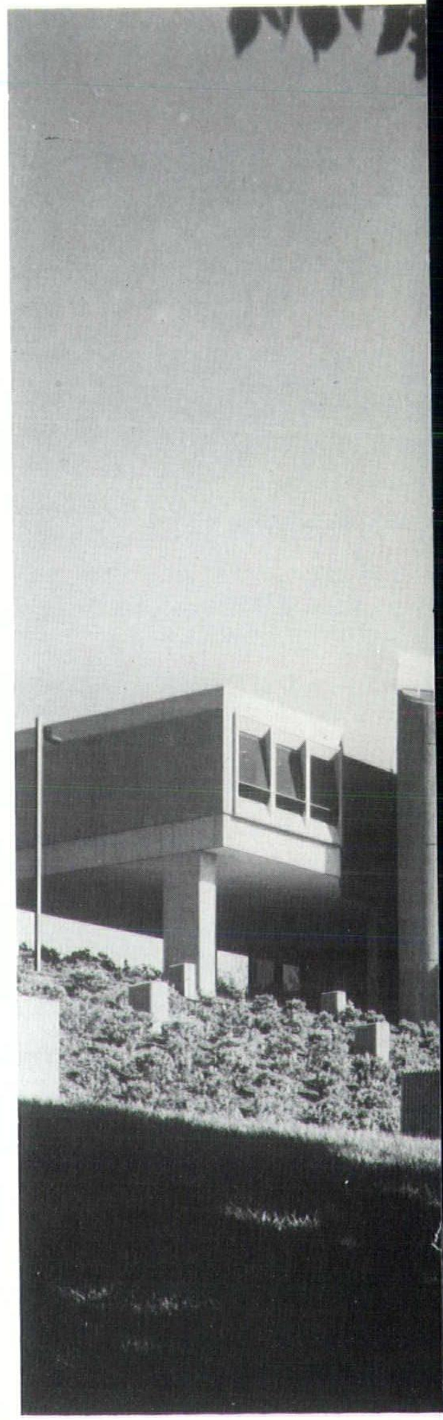
THE new Heublein corporate headquarters, designed by the West Hartford firm of Russell Gibson von Dohlen Inc., stands as dramatic proof of the architectural adage, "Site dictates solution."

Given a location on the same hill as another building, one of mammoth proportions, a busy Interstate highway as one of the boundaries,

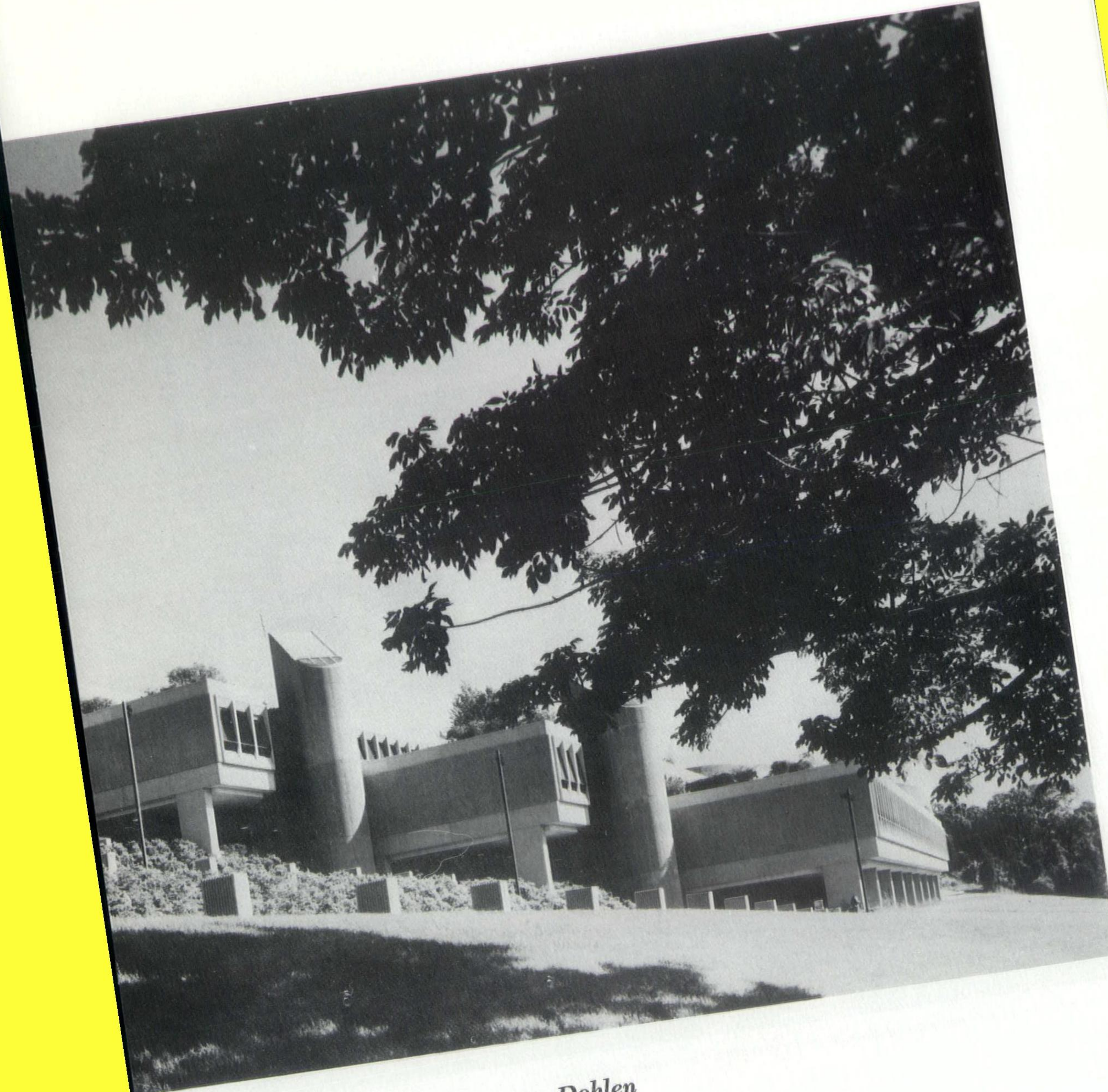


Main reception area.

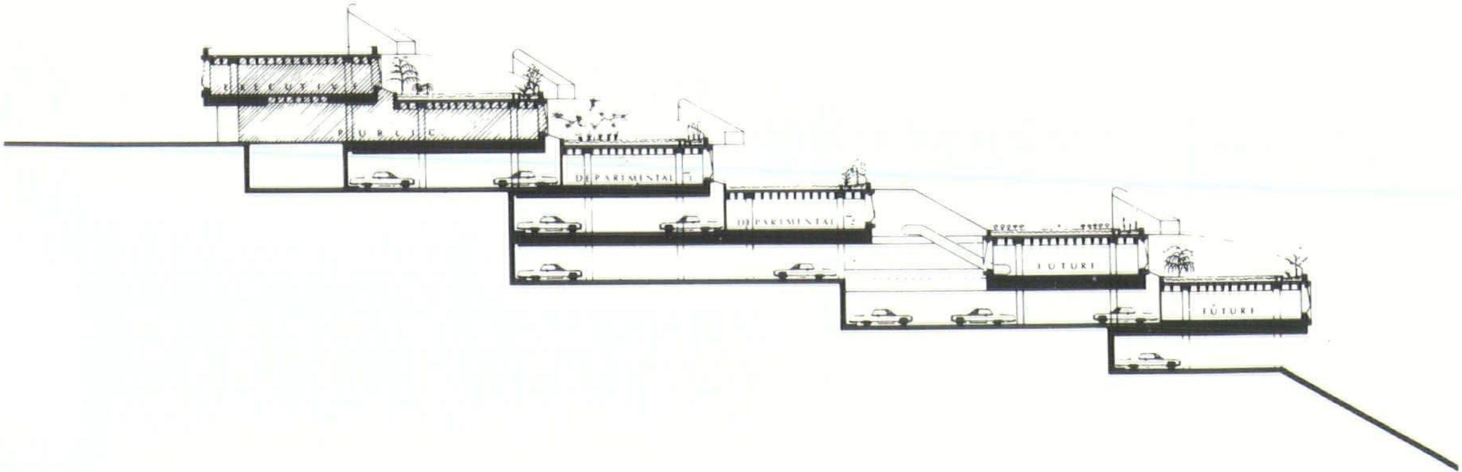


HEUBLEIN HEADQUARTERS BUILDING

FARMINGTON CONN.



Architects: Russell Gibson von Dohlen
West Hartford, Conn.



Most of the building's walls are of glass, as in the executive conference room (above).

and a magnificent view of Hartford some ten miles to the east, the architects had to come up with a design that would incorporate each of these elements and at the same time strongly suggest Heublein's corporate philosophy of "serving the world good food and drink."

The solution that evolved was based on the "Mirador" concept, which centers on a view from a hillside or balcony. It was decided to terrace the building into the slope of the hill, thus entirely avoiding the crest of the hill, which was so totally dominated by the massive University of Connecticut Medical Center. By utilizing this terraced effect, the architects were able to employ the Center as a kind of silent partner in the Heublein design concept — a contrapuntal backdrop to the much smaller-scaled new building.

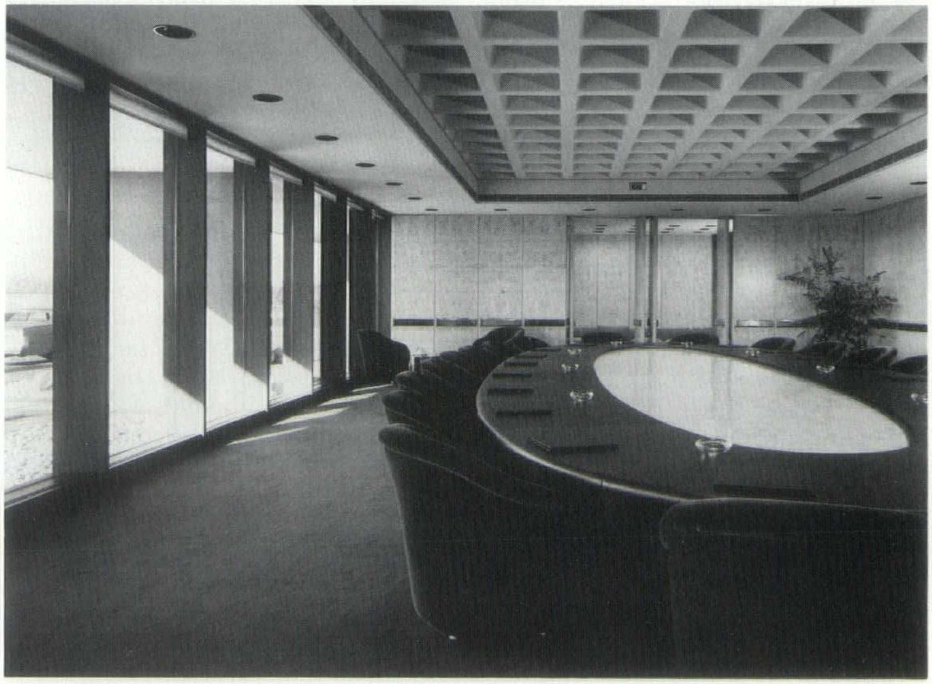
Having strong roots in Hartford, Heublein was anxious not to leave any impression of having "left" the city. With this thought in mind, Russell Gibson von Dohlen oriented the headquarters toward the east, where a splendid vista of the city presented itself beyond a low-wooded area on the site. In this symbolic placement of the building is the relationship between corporation and city continued.

The building itself is on four levels stepped into the hillside, in totality suggestive of a waterfall effect. High turret-like stair-tower columns "guard" each of the ends of the building, accentuating the low profile of the structure and, in a design sense, "holding it together." The three uppermost levels offer a variety of outdoor terraces. Roofs on three levels are fully exposed and also serve as an element of the overall design.

Access to Heublein is from the west, opposite I-84. The entrance drive branches into three service drives, each of which leads to a parking level beneath the building.

The dining area (above) has been designed with the intention of providing an entirely different environment than that in the work areas. Carpeting and furniture are unique to this part of the building.

Ceilings are coffer type waffle pattern (as in the Board of Directors Conference Room, (below), which also plays an important role in interior lighting. Because of the manner in which a great deal of the lighting is recessed into the coffers, the ceiling helps to diffuse and direct the light to the floor below, thus permitting a variety of lighting situations to be employed.



External structural material is precast and poured-in-place concrete, much of which is of rough-ribbed texture. The concrete, as well as the exposed aggregate finish stone, is of a substance natural to the area — a pattern followed throughout the building wherever practicable.

Ceilings are coffer type waffle pattern which also play an important role in interior lighting. Because of the manner in which a great deal of the lighting is recessed into the coffers, the ceiling helps to diffuse and direct the light to the floor below, thus permitting a variety of lighting situations to be employed. The coffer, in effect, becomes a part of the fixture.

At the entrance to the building, the ribbed concrete walls and red brick walks "flow" from that point through the lobby and out to the terrace, thereby creating a unified effect as well as giving the lobby a sort of breezeway identity. The need for a vestibule is eliminated by the use of a revolving door. The lobby itself is also used as a display area for art and sculpture.

Since the various levels do not stack directly above each other, escalators rather than elevators provide the basic inner transportation system. There is one elevator serving the fourth-floor executive offices from the public level.

The parking areas, located under the building, enable employees to enter their offices directly from their cars. Natural skylight lighting provides a light, airy feeling that is a pleasant relief from the oppressive atmosphere of the typical parking garage. Approximately 130 cars can be accommodated.

Because of the coffer waffle design of most of the ceilings, it was not possible to conceal mechanical ductwork within the ceiling spaces in a fashion customary with most office buildings. For this reason, much of the ductwork is under the floors. Linear diffusers are also used widely throughout the building; these are visible running along walls just below the ceiling level. A total air-conditioning system is installed, and each office has its own separate control for cooling and heating.

There are a number of different lighting systems throughout the building, each one chosen for its special effect. The main fixtures within the concrete coffers were custom designed to throw light down but give only a warm glow to the coffer sides. This fixture is used for general light level, night window lighting and all ceiling light patterns. There is also an adjustable fixture used to add light to work-levels as well as for accent lighting, art lighting and grow lighting for plantings. Other special systems are employed in the lobby, board room, audiovisual room and dining room.

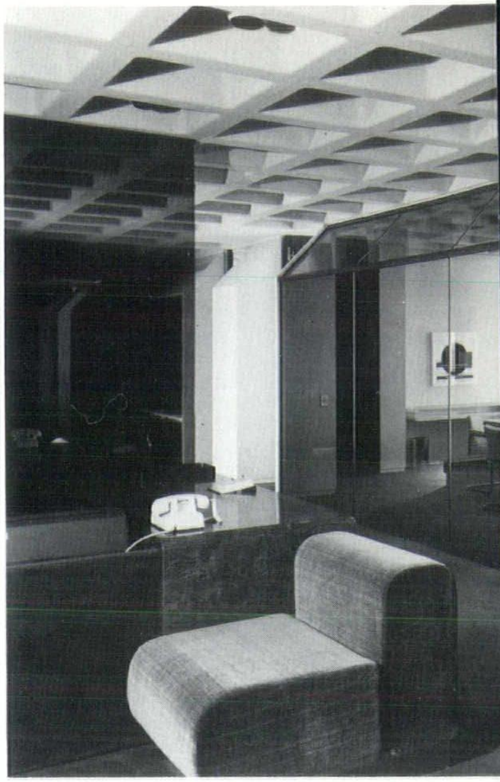
The decision was made to use superb paneling in limited amounts, rather than ordinary paneling on all walls, in offices. The rare African woods are carefully matched extending through doors and furniture. These woods are accented with stainless steel, either brushed or polished, in the form of panels, doors and chair rails.

The lobby stair is an open stair made from stainless steel; the treads are wrapped in carpet. The hand rail contains a cold-cathode light tube to create a continuous effect and to light the stair.

Glass partitions are used to keep an open feel to interior spaces without windows and to give some borrowed light to interior spaces having only direct window access.

The dining area has been designed with the intention of providing an entirely different environment from the work areas. Carpeting and furniture are unique to this part of the building. Diners have a pleasant view of one of the terraces, and plantings abound. Skylighting in the kitchen focuses on the food display areas and adds eye appeal to them.

Each of the three terraces has its own identity. The executive-level terrace has plantings which are mostly delicate evergreens. The public terrace outside the dining area has more fragrant plantings which complement the aroma of food eaten on the terrace. The first-level terrace is mostly water and is closed to traffic. Each terrace pool is filtered and chlorinated as if it were a swimming pool, even though the pools are only eight inches deep.

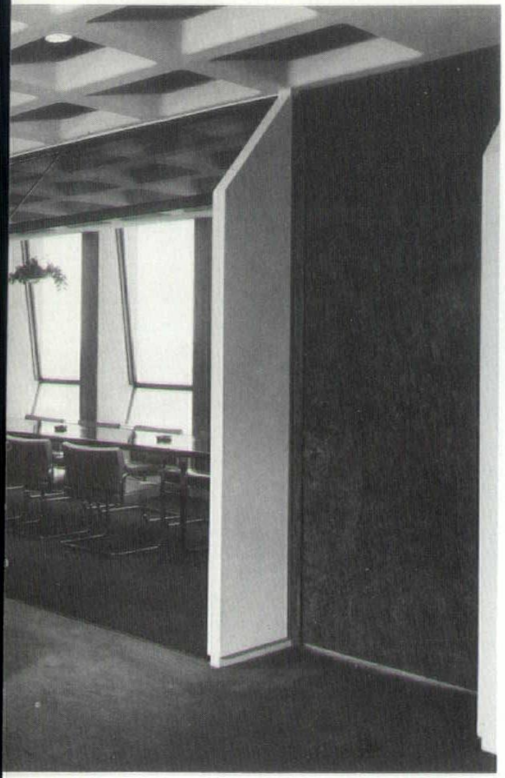


Flexibility plays a key role in office layout as it does throughout the building. There are three different office partition layouts within each thirty-foot bay, all on a module of five feet. Mechanical and electrical interchanges permit changes of floor layout or the moving of furniture within an office.

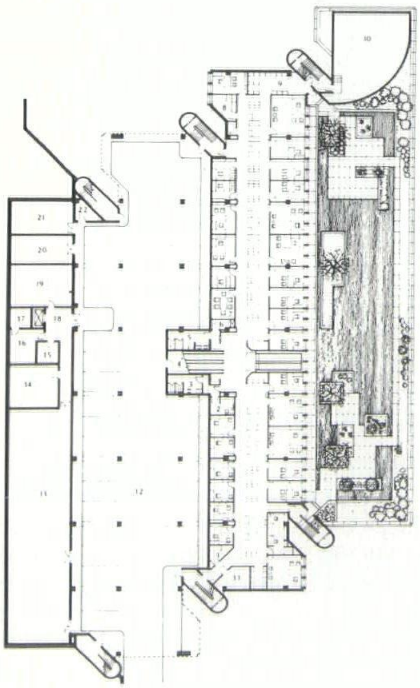
Special shades were developed to admit light and at the same time minimize glare. Special fabric and heavy-tension rollers were employed. All windows are fixed, contain anodized aluminum frames and feature bronze-tinted glass.

The building has a completed audiovisual system. Some rooms contain rear-projection screens for movies and slides. Background music in secretarial areas comes from concealed speakers. In all, there are four separate yet integrated systems.

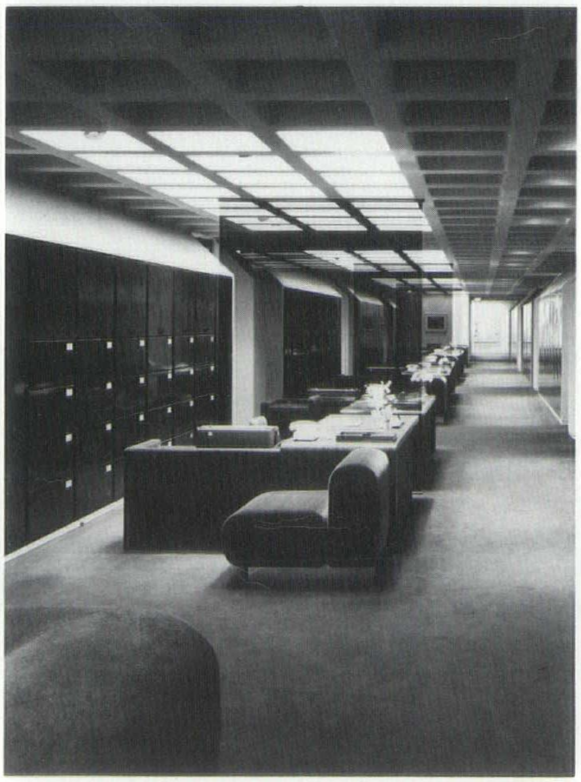
Russell Gibson von Dohlen architects believe that a kind of timelessness has been achieved by unity of design, and that the Heublein headquarters will remain modern many years from now.



Departmental offices.



Departmental level.



Secretarial area of management offices.

HOUSING

Architects:
Bastille - Neiley
Boston

AN unattractive abandoned gravel pit seemed a sorry beginning for the first public housing in a small town which wasn't really sure that it was ready to accept an apartment complex of any kind. However, all traces of the gravel pit were removed, and a small community of contemporary design emerged from the surroundings of woods and fields.

The imaginative design created

This state-aided housing project for the elderly was built on a six-acre site in an old gravel pit on the edge of a rural community. Six houses, each of which contains eight similar apartments are grouped around a central court, at one side of which is a Community Building for social gathering of the tenants and their guests.

FOR THE ELDERLY
LUNENBURG MASS.

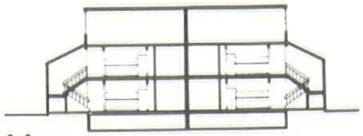
by the architect has neither the look nor the feel of public housing. Part of the field was left undisturbed, and vegetable gardens belonging to the tenants now flourish there. A small brook adds to the landscape, and a grove of pine trees provides pleasantly cool shade for just sitting in summer. The tenants have found that they have not had to abandon the habits of a lifetime in a small town in order to attain the advantages of apartment living.

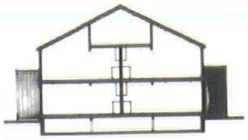
The centrally located Community Building remains the focal point of the community, and is the scene of constant activity — much of it organized and presided over by the tenants themselves — but mostly just as a place to find company when one is lonely.

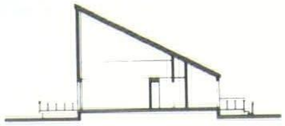
The town in general is very much pleased and even surprised that contemporary architecture can be at once so attractive and practical.

Six houses, each of which contains eight similar apartments, are grouped around a central court, at one side of which is a Community Building for social gathering of the tenants and their guests.

Each apartment includes a living-dining area and a sleeping area separated by a screen partition open at top and sides for a more spacious effect, with alcove kitchen, bath and storage facilities. Each first floor apartment has a small private terrace, above which is an open wood deck serving the second floor unit. The Community Building houses a large social hall with gen-

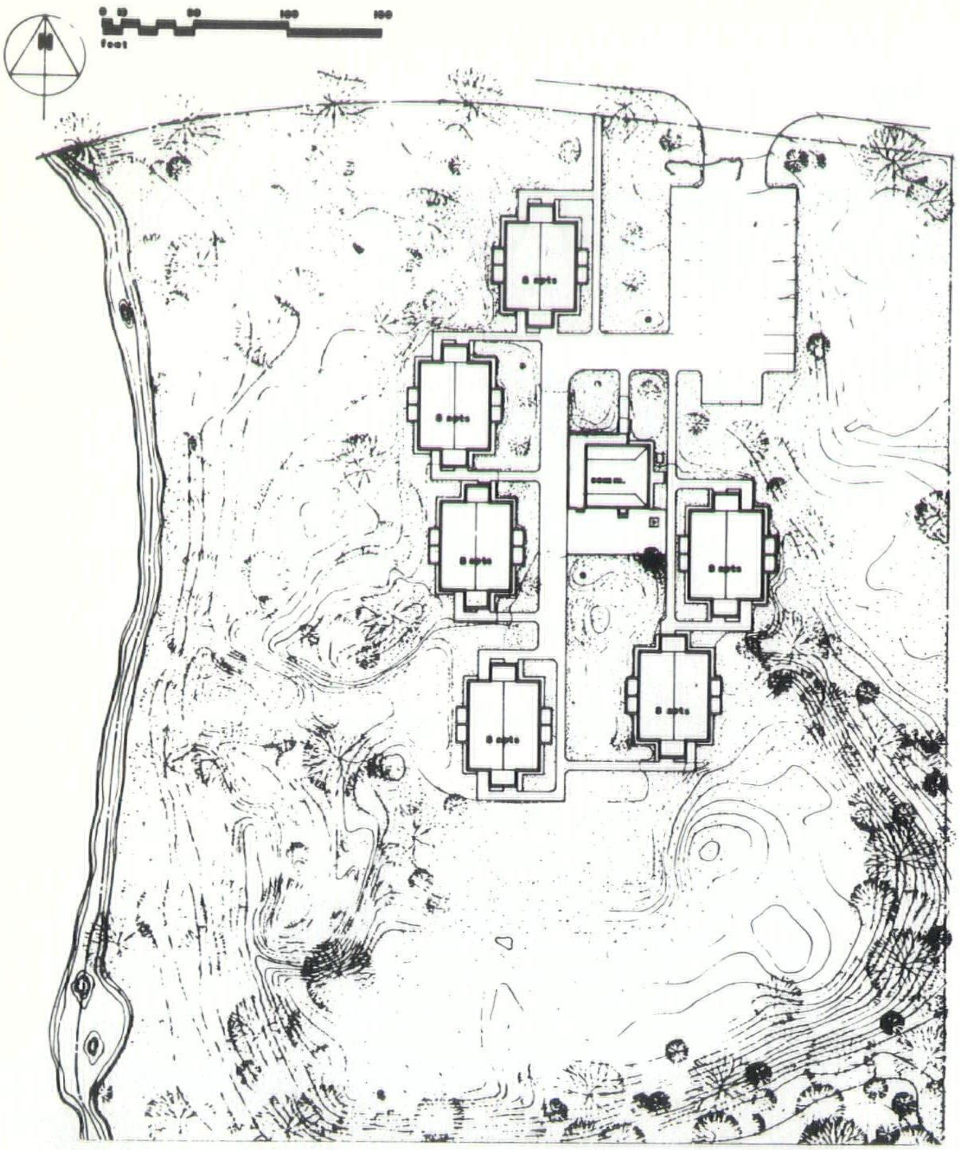






Construction is simple, with concrete foundation and wood frames. Rough textured white stucco was selected for exterior walls to avoid the maintenance problems of wood siding.

SITE PLAN



erous storage for coats, card tables and books, a kitchen, toilets, a central office and a utility and storage room. It is flanked on one side by a raised deck and on another by a broad brick terrace.

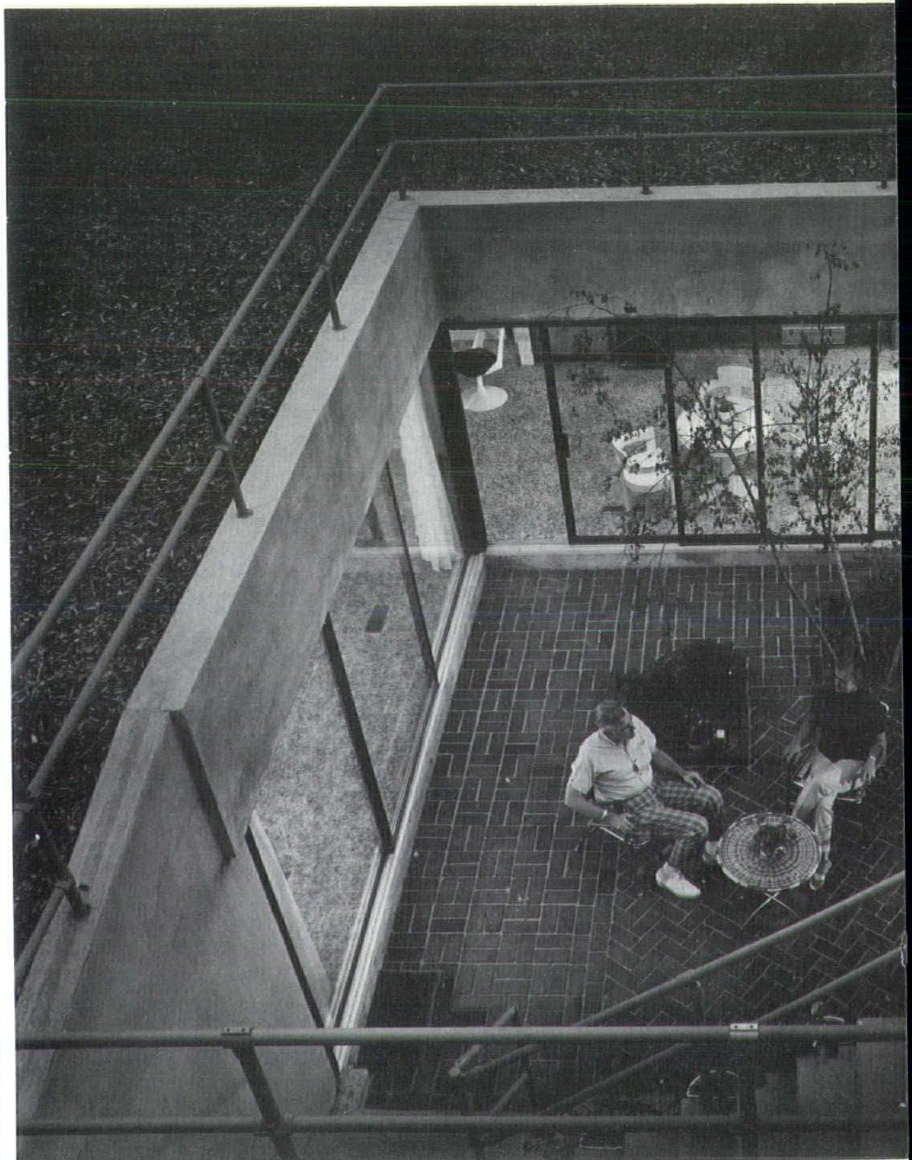
Construction is simple, with concrete foundation and wood frames. The dwelling unit floors are framed over crawl spaces, but the Community Building floor is a concrete slab on grade. Walls and ceilings are of painted sheetrock; floors are sheet vinyl in kitchens and bathrooms, and are carpeted elsewhere. Windows are vinyl-coated wood, and roofs are covered with asphalt shingles. Rough textured white stucco was selected for exterior walls, to avoid the maintenance problems of wood siding and the pretentiousness of brick in this setting. Exterior trim is stained dark green. There are no boiler rooms, since the project is all-electric. Water heaters are under the stairs, and exhaust fans in the attics.

The landscaping has been designed to provide year-round pleasure to the tenants, with roses, flowering trees and colorful foliage set against the existing fields and woods around the project. Individual garden plots are encouraged as well.

Consultants: Structural, Souza and True, Cambridge; Electrical, Bratiotis & MacConnell, Inc., Brookline; Heating and Ventilating, Owen-Merrill & Associates, Wellesley; Plumbing, McCarthy & Iannessa, Inc., Needham.

Contractor: Leominster Engineering Co., Inc., Leominster, Mass.

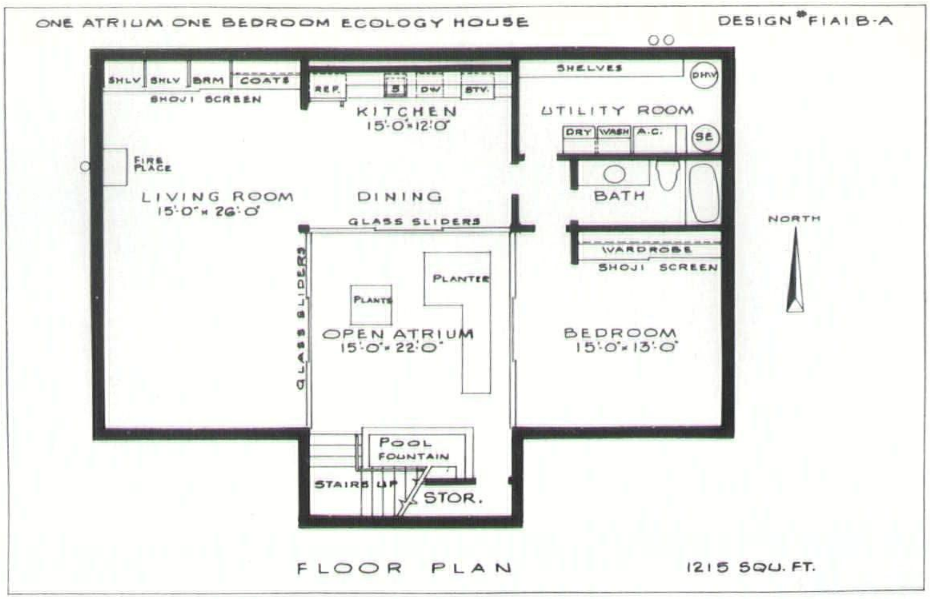
ECOLOGY HOUSE
MARSTON HILLS, MASS.

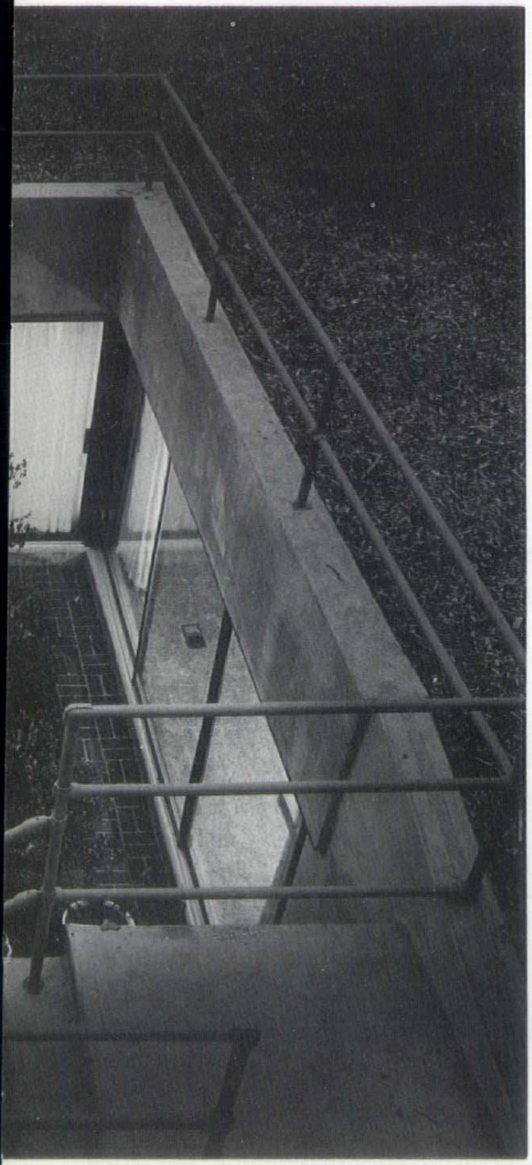


One enters the house by walking down stairs from ground level into an atrium, a brick-paved opening that offers a garden, a place to sun bathe or dine outdoors.

Architect:
John Barnard & Son
Osterville, Mass.

The basic floor plan of the house (right) was for the smallest unit the architect considered practical, but he has stock designs for two and three-bedroom models available and will custom design for any purpose.





THE Ecology House, built by R. Arthur Williams on Race Lane in Marston Hills, Mass., represents the culmination of one man's prolonged preoccupation with many social and environmental problems, including conservation of land in dense metropolitan areas, conservation of wood products, the needs for privacy and the need for low cost housing.

"Man has been probing outer space and investigating areas beneath the oceans for some time," architect John E. Barnard, Jr., has noted. "It's time we considered seriously the advantages of building homes and other facilities underground."

Barnard's Ecology House, which could be built on a 50 by 50 lot, provides 1200 square feet of living space. It could be most any size, but for test purposes, the architect felt a one-bedroom, bath, kitchen and generous living-dining room with fireplace was sufficient to prove his point. All rooms but the bathrooms are dominated by nine floor-to-ceiling glass panels to a 300-square-foot atrium.

One enters the house by walking downstairs from ground level into the atrium, a brick-paved opening that offers a garden, a place for sunbathing or outdoor dining. It could be covered with a plastic bubble in the winter for a year-long garden and Barnard is exploring that possibility.

Barnard's wife, Barbara, has decorated in bold splashes of blues and greens. She achieved a dramatic color effect by using two shoji screens, adapted from those used in Japanese homes, hung from ceiling tracks to form one long closet at the end of the living room, practical for storage and as an area to conceal a return air duct.

Barnard feels the effort to build a solar house was never fully exploited. One has no feeling of being underground as one looks toward the garden atrium. In fact, the view is more pleasing than the sights imposed on the average urban or suburban dweller: clotheslines, rubbish barrels, utility poles, traffic or commercialism.

The house is sited with the atrium facing the South. Thus every room

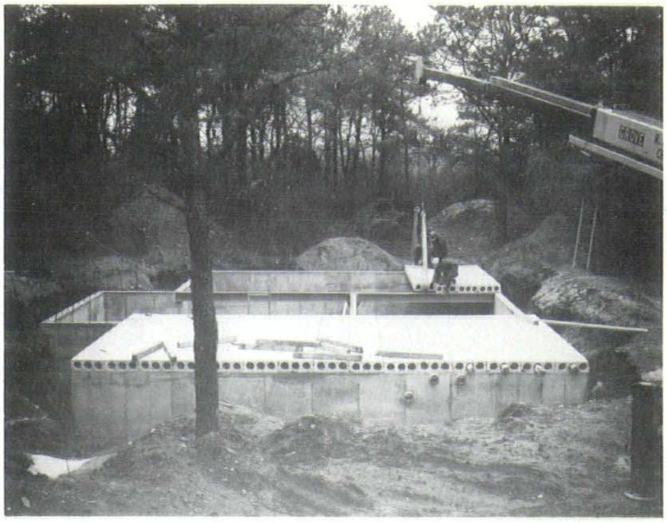
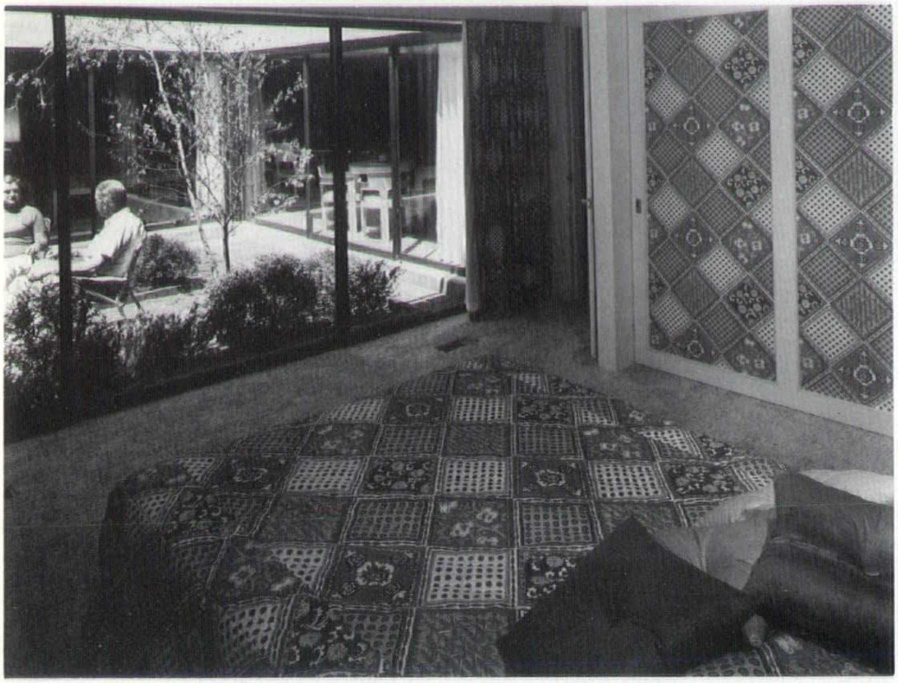


Photo taken during early stages of construction shows a precast concrete plank being lowered into position.

View from a corner of the living room towards the patio.



Every room is touched by the sun, especially during the winter when its rays reach even the pillows in the bedroom.

is touched by the sun and the lower the sun in the winter, the farther its rays until they touch the pillows in the bedroom.

Except for a plywood shield to cover a fountain pump in the atrium, there is no wood, consequently no maintenance. Walls are poured concrete reinforced with steel rods. Styrofoam insulation is placed outside and also applied over the roof which is composed of eight-inch pre-cast panels. The earth cover is at least 12 inches, and there is a three-ply pitch used instead of tar for waterproofing.

Mechanically, there is no exceptional or complicated equipment beyond air induction and air exhaust, an electronic air filter, dehumidifying gear, and air conditioning. Sewage treatment is handled differently, but not too unusually. Sewage goes into a sump and is then pumped up into a septic tank and finally into a leaching field as in the case of a conventional house not on a sewer line. Instead of a normal 40-pound roof load, the Ecology House roof was designed for a 250 pound per square inch load.

Although the house could be built on a 50 by 50 site, in Marston Mills it was sited to conform with local zoning. If it were not for signs, parking area, and a fence surrounding the atrium, you could drive by and see little change in the natural growth with the exception of a parked car or two.

"It's obvious," Barnard noted, "that a house of this type would have to be sited properly in relation to the water table and soil conditions, but it could be done on a sloping lot with the atrium opening to a grade, for example. A below ground garage could be part of the layout. It could be adapted for condominium ownership, office space and, of course, there are below grade shopping malls already. I read recently of an entire village in North China built underground."

The cost of the Ecology House, a one-bedroom model, was about $24,900, or just over $20 per square foot of living space. This compared favorably with the $30 per square foot cost of conventional housing. As more bedrooms are added, the unit cost actually decreases.

John Barnard's Ecology House is not the plastic dome, far out uninspiring type of shelter which, so far, has failed to capture enough interest to become marketable. John does plan to go into production of his below grade dwellings in the near future and his idea is no more preposterous than underground shopping centers, subways, and underground playrooms — all of which have been constructed already. Quite simply, living like this on a 50 by 50 lot is a pragmatic solution to the housing crisis which affects all of us. It is innovations like this, simple in concept and thorough in planning, that yield maximum results and positive change.

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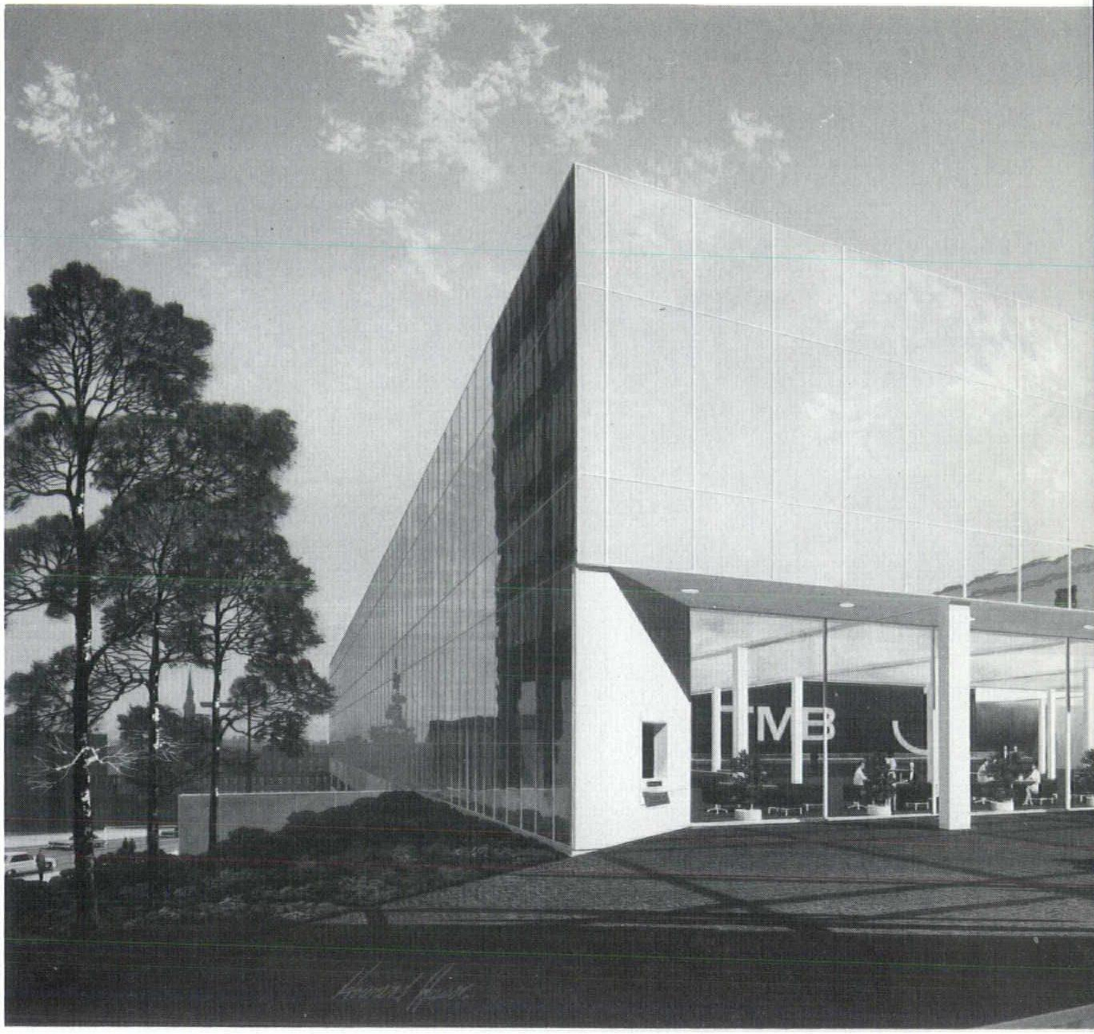
New Hampshire Architectural Review



THE MANCHESTER BANK

MANCHESTER, N.H.

Architects: Hugh Stubbins & Associates Cambridge

General Contractor:
Davison Construction Co.
Manchester, N.H.

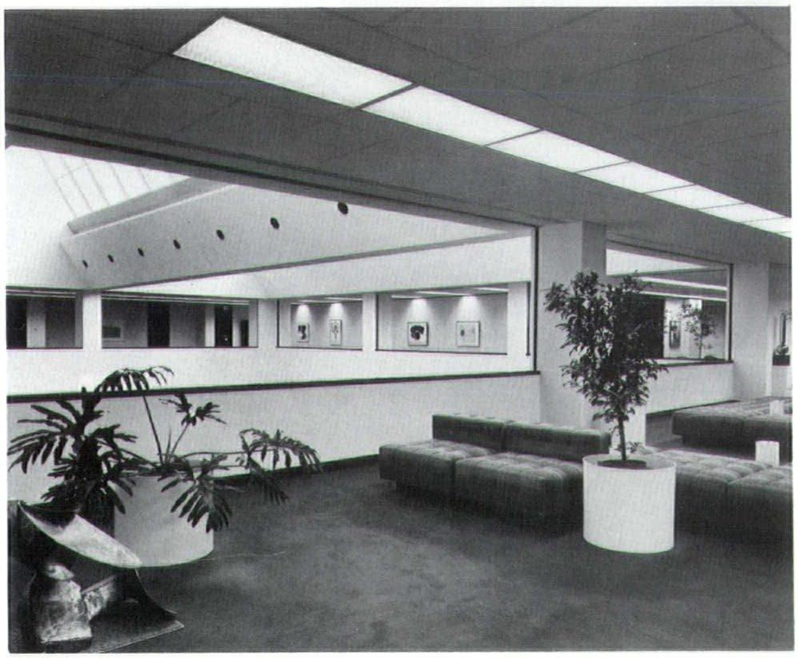
PHASE I of the Manchester Bank's expansion program was designed to double the size of the previous facility and offer full commercial banking services to the bank's Southern New Hampshire customers.

The site is located at the intersection of Elm and Spring Streets in the heart of the Central Business District of Manchester, New Hampshire, and is easily accessible by Interstate 93 and U.S. 3 from all major New England cities.

Phase I expansion work included the complete remodeling of an existing building at 1100 Elm Street to provide 30,000 square feet of flexible office space for banking func-

Executive Office Reception Area

View of tellers counter and "supergraphic" feature wall. Superimposed on the 16-by-48-foot aerial view of the central section of Manchester are 23 photos of people and activities from Manchester and surrounding areas.



Second floor lobby and gallery.

Public concourse.

View of public concourse and main entrance from behind the tellers counter.

tions and also the construction of a 32,000-square-foot addition to the West on two levels, matching the first and second floor heights of the existing building to provide a total area of 62,000 square feet for the projected needs of the Bank and its growing operations.

The foundations, superstructure and core facilities of the low-rise addition have been designed with the capability of constructing six (6) additional levels or 88,500 square feet at a future date. The lower-level of the addition is open to provide covered customer-parking spaces for 32 cars under the building. A Drive-In Teller facility with four (4) automobile positions accessible from Spring Street was also constructed.

Additional parking for customers and employees is provided on Bank property at Canal Street.

A landscaped plaza along Elm Street forms an integral part of the Bank design and its future development to the west. The exterior paving leads indoors into a two-story, skylighted, public circulation concourse for the Main Banking Tellers function. A "supergraphic" feature-wall, 28 feet high and 84 feet long, located behind the tellers' counter, forms the major focal-point within the interior space.

Applied to this feature-wall is a black and white photographic mural comprised of a 16 feet high by 48 feet long aerial photograph of Manchester including the Manchester Bank, the Central Business District, Merrimac River, Amoskeag Millyards, and other prominent landmarks. Superimposed over the aerial photograph are other black and white photographs of people and activities that underline the Manchester Bank's commitment as a people-oriented service facility.

The exterior design concept of the Bank utilizes a high performance, reflective and insulating glass. This silver mirror-like material ensures optimum performance values for the owners and users. From indoors the glass reduces solar-heat gain, sky-brightness and glare and increases visual comfort. From the exterior the reflective-skin brings high visibility, elegance and excitement to Elm Street. The mirrored facades, reflective by day, transparent by night, provide a variety of changing reflections and vistas, enhancing the street-level views of the Bank Building and adding a dynamic new element to Manchester's primary business area.

The entire structure is fully air-conditioned and utilizes an integrated air-light ceiling fixture system. Interior finishes include carpeted floors, teak and oak furniture, and the use of bright, high-keyed colors.

General Contractor: Davison Construction Co., Manchester, N.H.

Loan department reception area.

Ritchie (Cont'd from pg. 5)

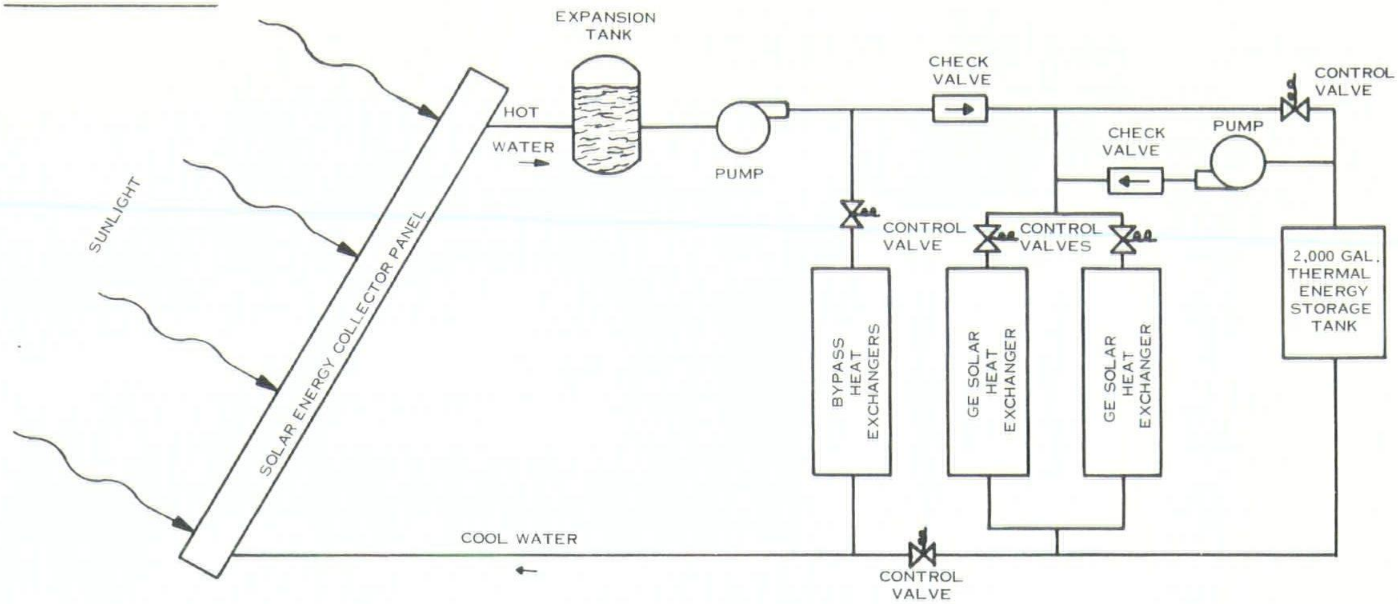
Peter M. A. Moyes

LAWRENCE PARTRIDGE, AIA, coordinator of the new office, joined the firm in 1962. He is a vice president and associate of The Ritchie Organization. He received his B. Arch. from the Catholic University of America, and an M. Arch. from the Massachusetts Institute of Technology. He is working from the Chestnut Hill office and making frequent trips to the new Birmingham branch. He also serves as project architect for the Baptist Medical Centers, Birmingham, and the Lakeshore Hospital, Homewood.

Other current architectural projects under his direction include the Springfield (Mass.) Hospital Medical Center; The Memorial Hospital, Pawtucket, R.I.; Lowell (Mass.) General Hospital; and the Bristol Hospital, Bristol, Conn.

PETER M. A. MOYES, AIA, who is a vice president and associate of the 65-year-old firm, is a member of the American Hospital Association, Construction Specifications Institute, Birmingham Chamber of Commerce, Rotary International, National Panel for the American Arbitration Association, and the International Hospital Federation. He received his civil engineering training at the University of Utah, and graduated from the U. S. Army Command and General Staff College. Some of Mr. Moyes recent projects include: the University of Massachusetts Medical School Teaching Hospital; Pondville Hospital, Walpole, Mass.; Overlook Hospital, Summit, N.J.; and the Hahnemann Hospital, Boston, where he also serves as trustee.

G.E. Constructs Experimental Solar Heating System For Use at Junior High School in Massachusetts



Solar energy will be more meaningful to students at Grover Cleveland Junior High School in Dorchester, Mass., now that a General Electric Company experimental solar heating system, funded by the National Science Foundation, is providing a portion of the school's heat.

Under a Research Applied to National Needs (RANN) contract from NSF, GE's Space Division, Valley Forge, Pa., has modified the school's conventional electrical heating system to accept supplementary solar heat. About 4,500 square feet of GE experimental solar heat collector panels have been installed on top of the school roof in three rectangular rows.

The system contains approximately 150 panels, each measuring four by eight feet. GE's solar panels consist of a black, heat-absorbing surface beneath two rigid sheets of clear Lexan plastic. A tubing network inside the black surface is filled with a water/anti-freeze solution. When energy from the sun passes through the plastic, it is absorbed by the dark surface and converted into heat, which in turn is transferred to the liquid. The hot liquid is then pumped through the tubing network to a pair of special solar heat exchangers that work in conjunction with two of the school's 10 conventional heating units. These solar heat exchangers then heat the air which warms a portion of the building as needed to maintain a comfortable temperature.

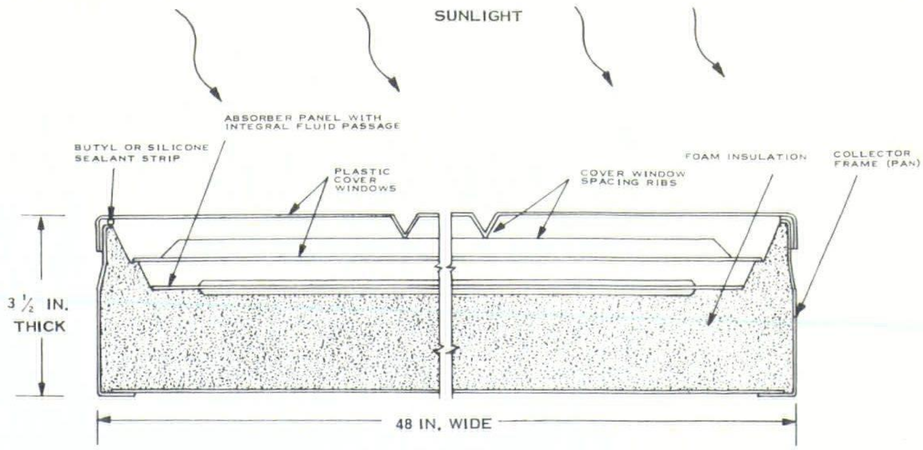
Whenever the system generates more heat than is required, surplus hot water will be stored in a 2,000-gallon heat storage tank. From here, the hot water can be pumped to the solar heat exchangers providing heat to the classrooms whenever clouds

obscure the sun and the solar panels are not absorbing heat.

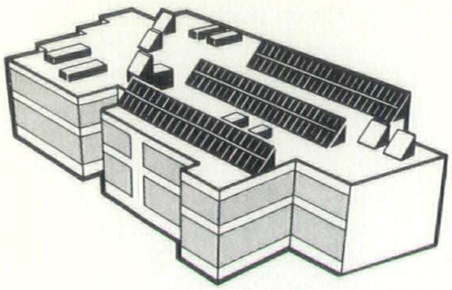
According to D.F. Huebner, General Manager of Energy Systems Programs at the Space Division, the experimental GE system is designed to provide up to 20 per cent of the heat required to warm the three-story school building. This percentage will vary according to such factors as outside temperature, cloudiness, relative humidity and time of day, Huebner indicated.

Grover Cleveland Junior High is one of four U.S. public schools that will be using solar energy as a supplemental heat source this year under the same National Science Foundation project. Other schools are: Timonium Elementary School, Baltimore, Md.; Fauquier County High School, Warrenton, Va., and North View Junior High School, Osseo, Minn. Major GE subcontractors on the Grover Cleveland project include the Ballinger Company, Architect Engineers, Philadelphia, Pa., and the Vappi Company, Cambridge, Mass.

Under another National Science Foundation RANN contract, the GE Space Division and the University of Pennsylvania are one of three industry/university teams conducting feasibility studies on using solar energy to provide heating, air conditioning and hot water for buildings. The primary objective of this multi-phase NSF program will be to stimulate and accelerate widespread use of solar energy wherever it is economically practical. According to an NSF estimate, about one fourth of the energy currently consumed in the U.S. is used for heating and cooling buildings. The Foundation believes that successful completion of its RANN solar energy problems will offer the country a practical, non-polluting and inexhaustible energy alternative.



As sunlight passes through a panel's clear plastic cover windows, the solar energy is retained by the windows, absorbed by a dark surface, and converted into heat. This heat is transferred to a liquid, which then is pumped through an integral fluid passage tubing network in the panels to a pair of special solar energy heat exchangers. The heat exchangers then provide the heat needed to maintain a comfortable temperature in a portion of the school building.



Prime Contractor: General Electric Company; Space Division, Valley Forge, Pa.

Major Subcontractors: Vappi Company, Cambridge, Mass., and Ballinger Company, Architect Engineers, Philadelphia, Pa.

Type of Installation: Experimental, roof-mounted, solar energy collector array.

Conventional School Heating System: All-electric, roof-mounted, forced hot air.

Size of Solar Energy Collector Array: Approximately 4,500 square feet.

Number of Solar Panels in System: About 150.

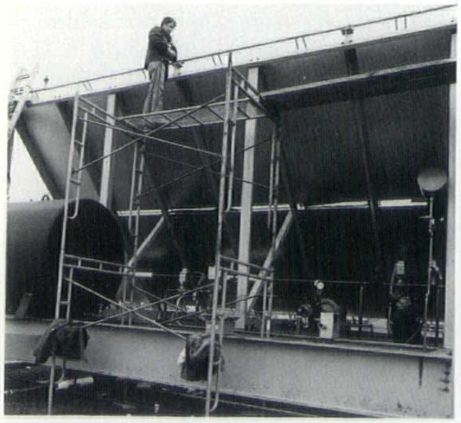
Individual Panel Dimensions and Weight: Length: 8 feet. Width: 4 feet. Thickness: 3½ inches. Area: 32 square feet. Weight: Approximately 100 pounds.

Capacity of Thermal Energy Storage Tank: 2,000 gallons.

Project Cost: $354,000.00.

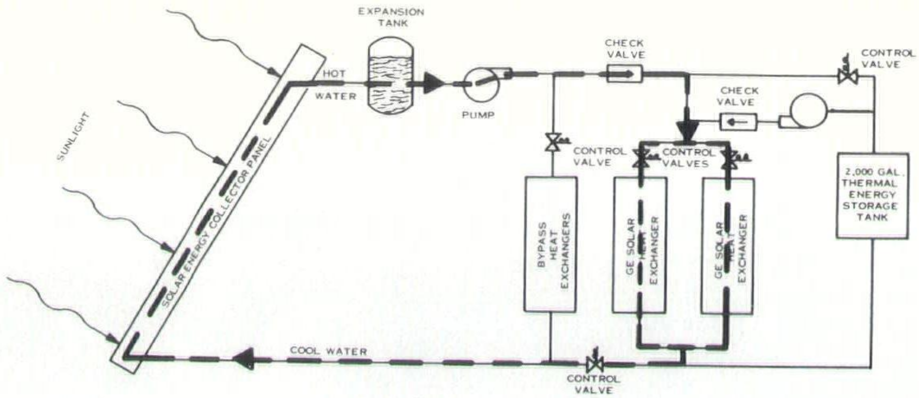
Panel Geographical Orientation: South facing.

Attitude of Panels: Installed at a 45 degree angle off horizontal.



The experimental roof-top solar heating system erected by General Electric and Vappi & Company is now providing up to 20 percent of the heat required to warm the three-story Grover Cleveland Junior High School in the Dorchester section of Boston. The $350,000 project was funded and managed by the National Science Foundation. Erection of the facility took only seven weeks and photo above shows it as it neared completion.

ENERGY FLOW IN VARIOUS MODES OF OPERATION:



Heating school rooms using energy provided by solar energy collector panels. This mode is used whenever the amount of heat collected by the panels equals the amount needed in the classrooms.

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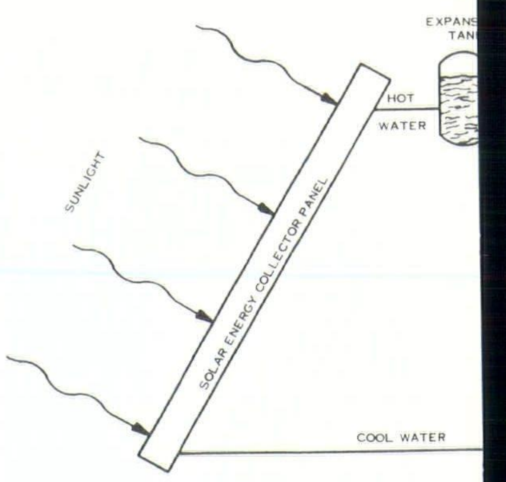
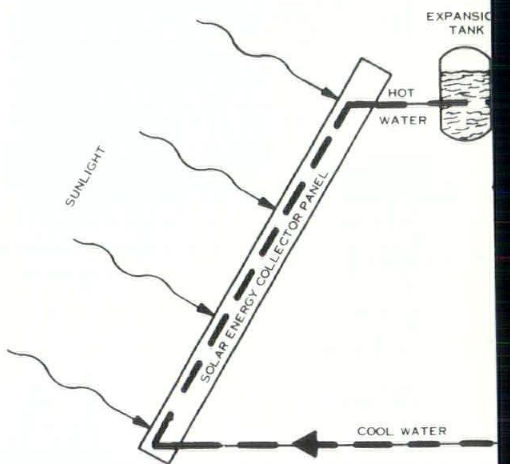
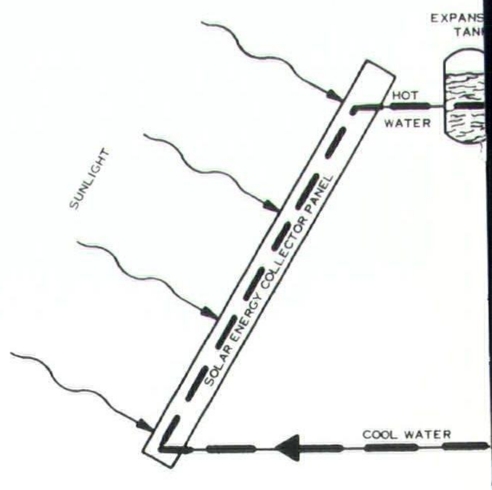
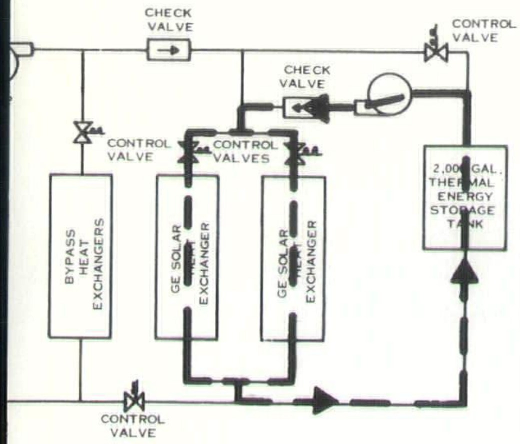
Energy Flow: (Con'td)



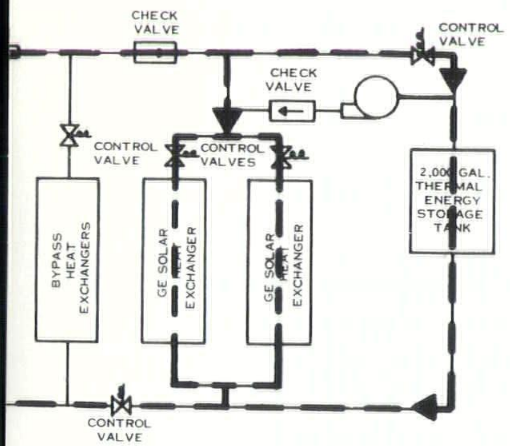


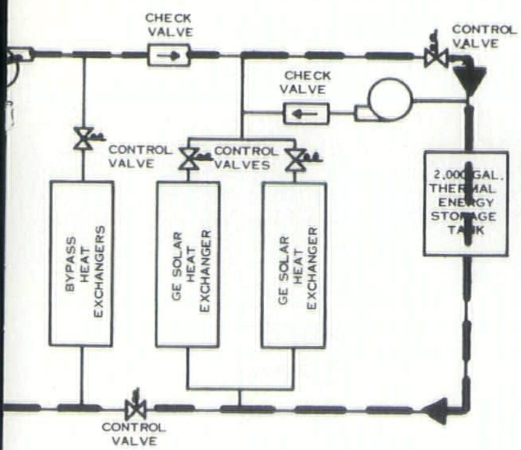
Heating school and also heating thermal energy storage tank. These two modes could be employed when more heat is being collected by solar panels than is required for heating classrooms.





Heating school rooms using stored energy. This mode could be used for operation during early morning, evening or night periods or during cloudy weather.





Heating thermal energy storage tank. This mode could be used when no heat is required in the classrooms.

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